SECOND DRAFT

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National 3R Strategy for Waste Management

Department of Environment

Ministry of Environment and Forests
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ABBREVIATIONS

3R	Reduce, Reuse, Recycle
ADB	Asian Development Bank
BCSIR	Bangladesh Council of Scientific & Industrial Research
BOO	Built Operate and Own
BOT	Built Operate and Transfer
BOOT	Built Operate and Own and Transfer
CBOs	Community Based Organizations
CDM	Clean Development Mechanism
CERs	Certified Emission Reduction
CP	Cleaner Production
DCC	Dhaka City Corporation
DoE	Department of Environment
ECA	Environmental Conservation Act
ECR	Environmental Conservation Rules
EMS	Environmental Management System
EPR	Extended Producers Responsibility
E-waste	Electronic/electrical waste(s)
FAO	Food and Agriculture Organization
GoB	Government of Bangladesh
GDP	Gross Domestic Product
GHG	Green House Gas
GO	Government Organization
IDCOL	Infrastructure Development Company Limited
IFRD	Institute of Fuel Research & Development
JICA	Japan International Cooperation Agency
LGD	Local Government Division
LGED	Local Government and Engineering Department
LIFE	Local Initiative Facility for Environment
LPUPAP	Local Partnership for Urban Poverty Alleviation Project
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forest
MoLRD&C	Ministry of Local Government Rural Development & Cooperatives
NEMAP	National Environmental Management Action Plan
NDBMP	National Domestic Biogas and Manure Program
PRSP	Poverty Reduction Strategy Paper
PPP	Polluters Pay Principal
PPP	Public Private Partnership
SBSUAP	Support for Basic Service in Urban Area Project
SEMP	Sustainable Environmental Management Program
SME	Small and Medium Enterprise
SPFS	Special Programme of Food Security
SWM	Solid Waste Management
Tk.	Taka
TSDFs	Treatment, Storage and Disposal Facilities
ULAB	Used Lead Acid Battery
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
VER	Verified Emission Reduction

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CONTEXT

1.1 Introduction

Rapid urbanization has made solid waste management a serious problem today. The perception of the people has always been that it is a responsibility of the local government bodies. Local authorities are bound to keep their area clean. For some time now, many municipalities, city corporations and industries have been experimenting with several innovative and participatory methods of Reduce, Reuse and Recycle waste. Over the past few years, Bangladesh has been engaged in experimenting with new technical options and administrative processes to find innovative methods to address waste management more effectively. There are more than 522 towns and cities, which are hubs of rapid economic development and population growth, generate thousand of tons of waste from domestic, industrial, commercial, health care facilities and agricultural sources that must be managed daily. Low collection coverage, unavailable transport services, and lack of suitable treatment, recycling and disposal facilities are responsible for unsatisfactory waste management, leading to water, land and air pollution, and for putting people and the environment at risk.

A shift in thinking about the definition of waste is essential for a transition to more resource-efficient societies. Waste is traditionally thought of as having no value. Moreover, waste is widely assumed to be inevitable. This leads top economic and management practices that actually tend to promote the generation of waste. Thus, in a resource- efficient economy and society, the term “waste” would refer only to those residual materials that have no economic value. Under this definition, traditionally “valueless” streams of waste can be considered resources for a new tier of the economy. They can be recovered (or prevented from being lost) through greater efficiency and management at every stage of production and consumption.

Figures 1.1and 1.2 illustrate the changes in the flow of resources as different resource- saving measures are applied to an economy, from resource extraction and production to consumption and final disposal. The first diagram show’s a “one- way” economy in which little effort is made to either reduce the amount of materials consumed in production (and thereby the wastes produced) or to reuse or recycle those wastes. Both the materials embodied in the production and the wastes produced make a one- way trip from extraction to the landfill, with that portion of the materials captured in the products only being delayed in completing the journey. The second diagram illustrates the achievement of greater resource efficiency by reducing consumption and waste of materials, as well as by reusing and recycling by- products. By implementing measures on both the production and consumption sides, countries may be able to reduce (per unit of product) both the quantity of the residual materials flow (Lower right) that ultimately reaches disposal sites.

At the far end of the resource efficiency spectrum is the “closed cycle”, where any output either becomes an input to another manufacturing process or is returned to natural systems as a benign emission rather than a pollutant causing environmental stress. For example, a closed cycle processing plant takes in fresh water and does not discharge any liquid effluents. Rather the water is constantly recycled and possibly utilized in the final product itself.

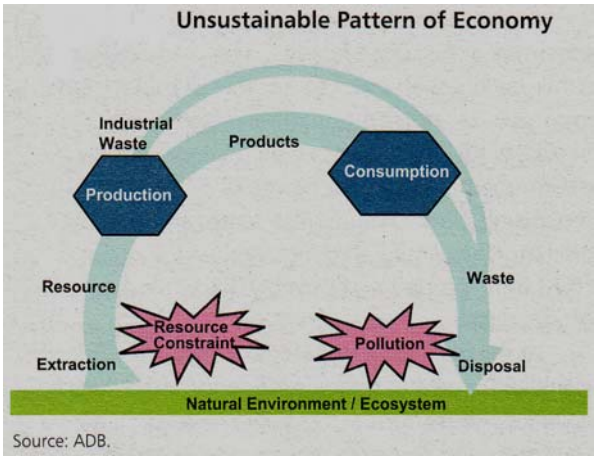

Figure 1.1 Unsustainable Pattern of Economy

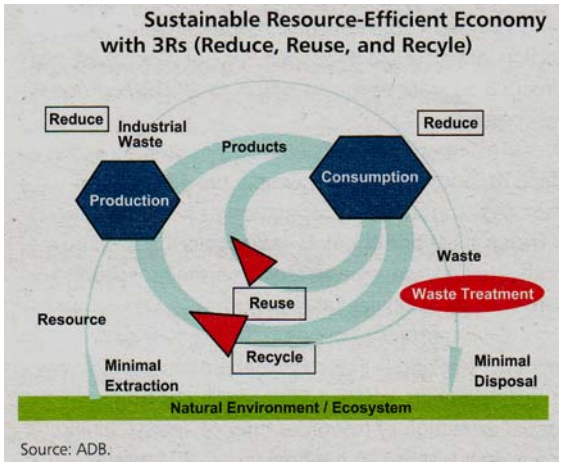

Figure 1.2 Sustainable Resource-Efficient Economy with 3Rs (Reduce, Reuse and Recycling)

Development and implementation of a national strategy for waste management is essential in order to reduce environmental, social and economical problems associated with the present disposal practices. In the past more attention had been given to waste disposal system as an end of the pipe solution with little attention to overall solid waste management. The proposed strategy is focused on the entire aspect of waste management from generation to final disposal site.

1.2 What is 3R?

The principle of reducing waste, reusing and recycling resources and products is often called the "3Rs."

- *Reducing* means choosing to use items with care to reduce the amount of waste generated.
- *Reusing* involves the repeated use of items or parts of items which still have usable aspects.
- *Recycling* means the use of waste itself as resources.

Waste minimization can be achieved in an efficient way by focusing primarily on the first of the 3Rs, "reduce," followed by "reuse" and then "recycle." The waste hierarchy refers to the "3Rs" i.e., reduce, reuse and recycle, which classify waste management strategies according to their desirability. The 3Rs are meant to be a hierarchy, in order of importance. The waste hierarchy has taken many forms over the past decade, but the basic concept has remained the cornerstone of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste.

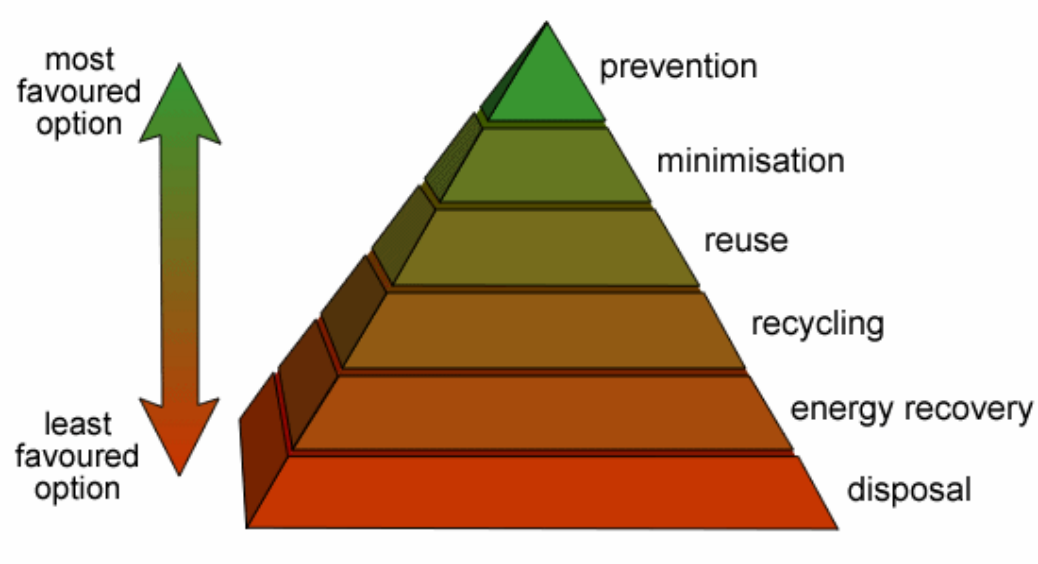

Figure: 1.3 Waste Hierarchy

The concept of minimizing waste impacts in terms of quantity or ill-effects, by reducing quantity of wastes, reusing the waste products with simple treatments and recycling the wastes by using it as resources to produce same or modified products is usually referred to as “3R”. Purchasing and using resources with care can reduce the pace of consumption of resources and further connected energy and resources. Ultimately reducing wastes multifold for waste streams. When long lasting goods are reused time and again, it offsets harvesting of new similar or same products. This saves fresh resources exploitation and waste generation quantity. Some waste products can be consumed as resources for production of different goods or the same product, meaning recycling the same resource. This too saves fresh resources and offsets waste generation. All in all, the 3Rs individually or collectively saves fresh resources exploitation, add value to the already exploited resources and very importantly minimizes the waste quantity and its ill effects. Waste minimization efficiency is stated to be better achieved applying 3Rs in a hierarchical order- Reduce, Reuse and Recycle.

1.3 Baseline Information on Selected Sectors of Waste

It is estimated that approximately 13,332 tons of waste is produced per day in the urban areas of Bangladesh, which is over 4.86 million tons annually. It is projected that this amount will grow up to 47,000 tons/day and close to 17.2 million tons per year by 2025, due to growth both in population and the increase in per capita waste generation. Waste collection rate ranges from 44.30% to 76.47% in major cities. Based on the present total urban population, per capita waste generation rate is found at 0.41 kg/capita/day in urban area.

Existing infrastructure for waste management shows that waste collection efficiency in different urban areas varies from 37% to 77% with an average of 55%. The overall waste collection situation is not very satisfactory. Huge amount of uncollected waste, (a high proportion of which is organic), creates nuisance and pollutes the local environment quickly. Therefore, frequent removal is absolutely necessary for avoiding unsightly and unhygienic surroundings.

Table 1.1 Current Situation of Wastes in Bangladesh – at a Glance

Category	Statistics	Data Source
TOTAL VOLUME OF WASTES (tons/year)		
Total volume of municipal solid wastes in urban areas	4,866,505 (2005) = 13,332.89tons/day x 365 3,000 tons/day in Dhaka (2005)	Waste Concern (2005) JICA (2005)
Agricultural Waste	65 million metric ton per year	Waste Concern and Swiss Contact 2007
Industrial waste (hazardous) from seven selected sectors*	109.47 million/cubic meter/year (waste water) 0.113 million ton/year (sludge) and 26, 884 tons/year (solid waste)	Waste Concern and ADB (2008)
Hazardous Medical Waste	12,271 metric ton per year (2007)	Waste Concern and ADB (2008)
WASTE PER CAPITA (kg/per/day)		
	Urban: 0.41 (2005) Dhaka City: 0.56 (2005) Agricultural:1.68 (based on 2008 rural population)	Waste Concern (2008) JICA (2005)
FUTURE WASTE PROJECTIONS (Total Waste Generation)		
By 2025 (solid waste) 2012 (hazardous waste)	17,155,000 tons/year = 47,000tons/day x 365 0.60 kg/per/day in Urban Areas 2472.07 million/cubic meter/year (waste water), 2.81 million metric ton/year (sludge) and 53,874 metric ton/year (solid waste)	UMP (1999), as cited by Waste Concern (2008) Waste Concern and ADB (2008)
SOLID WASTE MANAGEMENT		
Collection of waste (% of waste generated)	44.30% - 76.47% in major urban cities 43.5% for Dhaka City	Waste Concern (2005) JICA (2005)
Solid waste disposal facilities	Mainly uncontrolled land-filling (except for the sanitary landfill at Matuail site in Dhaka, supported by JICA). No site or facility for treatment, recycling and disposal of hazardous waste.	Dhaka City Corporation and JICA (2007)
E-WASTES		
Use of electronic goods in year 2006	Mobile phones: 22,000,000 Personal computers: 600,000 Televisions: 1,252,000	Waste Concern (2008)
RECYCLE		
Informal Sector	120,000 urban poor from the informal sector are involved in the recycling trade chain of Dhaka City.15% of the total generated waste in Dhaka (mainly inorganic) amounting to 475 tons/day are recycled daily.	Waste Concern (2005)

*These are textile, hospital clinics, tannery, pesticides, fertilizer, oil refinery and paper and pulp)

In the midst of limited capacity of municipal authorities to manage the waste, informal sector is playing a vital role by recycling a certain quantity of wastes - mainly the inorganic portions. Around 4 to 15% of the total generated waste is being recycled by the informal sector. It is estimated in the study that every year Tk. 10,706 million is being saved through recycling. In Dhaka alone, approximately 120,000 urban poor are involved in the recycling trade chain. It is also found that the average rate of recycling varies with the size of the city, e.g. in the city corporations it is around twice as much as in the pourashavas and other urban centers.

Ultimate disposal of all types of waste is done crudely in open dumps, lowlands or water bodies in an unsanitary manner. As a result, the surrounding environment of the dumpsites is barely hygienic. The increasing demand for landfill is also a big problem for the authority to find suitable lands for dumping wastes. At current waste generation rate the total land required for municipal

solid waste per year with existing collection efficiency and 100% collection efficiency will be 141 acres and 273 acres respectively with a depth of 4 meters.

1.4 Key Issues Related to Waste Management

Several major issues affecting waste management in Bangladesh include:

1.4.1 Inadequate National Policy and Support

Coercion without assistance: Present national policy and rules are not adequately harmonized with the needs and capabilities of the local governments and industries. Coercion without assistance will not help deliver the goods. The local authorities are handicapped by an array of problems, which are insurmountable in the short term without adequate financial and technical support from the national governments.

Lack of landfill site: Local government bodies have been struggling to find suitable land for sanitary land filling. Due to high population density in a highly urbanized region, finding large extents of land away from main habitations is difficult. A large part of the country consists of low-lying areas which are generally active flood plains. As a result suitable landfill sites are not available within the city.

Lack of hazardous waste disposal facility: At present there is no secured landfill site available in the country for disposal of hazardous industrial waste. Apart from secured landfill site there is no facility in the country for treatment and recycling of hazardous waste. Industrial units are facing problems with off-site management of waste.

Lack of guideline for efficient use of agricultural waste: Of 65 million tons of agricultural waste generated in the country, 90% used as domestic fuel in an inefficient manner. There is no clear government policy or guideline on efficient use of agricultural waste for production of energy or fertilizer.

Lack of rules for management of municipal solid waste: At present there is no guideline or rules available for management of solid waste in the country.

Lack of Incentives for Environmental Management System (EMS) and Cleaner Production (CP): No incentive or support is available from government to promote and support cleaner production practices amongst the industries. To manage industrial waste, EMS and CP are the important tools.

1.4.2 Absence of a Strategy

The absence of waste management strategy: The country does not have a waste management strategy. As a result, waste management is viewed solely as an engineering responsibility for collection and disposal. Waste management is no more a technical issue. It needs social, fiscal and administrative solutions as well.

Conventional approach: Most of the cities current approach to waste management system is conventional i.e. end of pipe solution. Its stress is on collection and disposal and not on reuse and reduction. ‘We dump – They collect’ is the general attitude that had been cultivated among the residents, institutions as well as industries by this approach over a long period. Waste management is not their concern. It is a municipal responsibility.

Non-recognition of the role of informal service sector: The informal sector service providers such as the waste pickers remove a considerable quantum of daily waste from the city streets

and dustbins. Together, they make an enormous contribution to urban solid waste management in the city, which is not well recognized or appreciated.

1.4.3 Lack of institutional capacity

Lack of Resources: The City Corporations/Pourashavas claims that it lacks financial and human resources to address waste issues effectively. Undoubtedly, a human resource issue is affecting the efficiency and effectiveness of the waste management team of the City Corporations and Pourashavas. Under the present circumstances, they have had very little opportunity to expand their knowledge horizons and enhance the technical know-how. They need exposure to modern waste management applications.

Lack of database and record keeping: Most of the cities do not have a functional record keeping method to asses the ward-wise and street-wise volumes of waste handled. Stress is that, without adequate record keeping and realistic databases it is difficult to improve the quality of planning and delivery of basic services in the cities. Industries also do not have data base and records of amount of waste generated or treated.

Slow pace of new initiatives: As a local authority, City Corporation and Pourashavas stand out in its efforts to address the waste problem. Moving away from depending solely on conventional approaches, it has experimented with several new technical options to address the issue. Composting, bio-gas generation, separation at source and promotion of collection centers are some these initiatives. However, the Pourashavas neither has funds nor the partnerships to take the allied administrative risks to make the required city-wide quantum jump to ensure that these solutions are universally replicated.

Lack of partnerships: City Corporations and Pourashavas have engaged the services of some private sector to assist it in waste collection and disposal. It appears to be working well. Nevertheless, for better results, more partnerships must be built.

Modal defects in privatization: Privatization is a tool to strengthen municipal services but private monopolies can defeat this purpose by taking city authorities to ransom through flash strikes and work-halts as is experienced in some of the other privatized sectors of the country. Moreover, the payment mode currently agreed with the private sector partner appears to contradict the 3R principle. Because they are paid for the volume of garbage collected, the private sector partners are not inclined to play a constructive role in promoting waste reduction and separation at the point of origin.

1.4.4 Lack of Public Cooperation

Negative public perception: The average resident as well as industrialist views waste management as a City Corporation's or Pourashava's responsibility. The public carries a negative perception of the role played by the local body mainly because of the conspicuous quantities of waste lying uncollected on city roads for days. At the same time, there is widespread resistance to the call for separation of waste at household level. The City Corporation or Pourashava to shy away from one of its customary responsibilities and hand over the same as a responsibility of the households views it as a move. This lack of civic awareness and public cooperation has always plagued the City Corporation or Pourashava efforts to keep the city clean.

Absence of participatory mechanisms: The city administration does not have adequate institutional mechanisms to engage the residents, public organizations, NGO and other stakeholders on a regular basis to assist in decision making and programme implementation. The role that these stakeholders can play in educating the masses and mobilizing their communities has not been adequately recognized.

1.4.5 Financing and Cost Recovery

The fact is proper management of waste requires an elaborate waste management infrastructure such as waste bins, construction cost of primary and secondary waste collection points, sanitary landfills, fleets of trucks for collection of wastes, waste treatment and recycling facilities, etc. All this costs money. No explicit strategy for mobilizing the necessary investment is in place. Absence of collection cost for cost recovery makes funding drive unreal.

Any future strategy to streamline 3R principles for waste management in the city will be effective only if it can directly address these drawbacks. The strategy proposed here is an attempt in that direction.

1.5 National 3R Goal

The national 3R goal for waste management is achieve higher levels of waste reduction, reuse, and recycling and minimize waste disposal on open dumps, rivers, flood plains and landfills by 2015.

1.6 Objectives of the National 3R Strategy

The main objective of this 3R strategy is to delineate ways and means of achieving national 3R goals through providing a uniform guideline for all stakeholders. Specific objectives of this strategy are to:

- address the key issues of waste management;
- define the roles of various actors; and
- guide the creation of enabling conditions for success.

1.7 Priority Sectors for 3R

Following sectors are identified by the government as priority sectors:

Municipal solid waste, industrial waste, biomedical waste, institutional and commercial waste and agricultural waste.

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GUIDING PRINCIPLES

The following principles are the core of the National 3R Strategy. The principles are based on well established urban environmental management and service rendering norms and in line with key strategies and policies of Bangladesh such as PRSP, National Sanitation Policy and Strategy, Industrial Policy, Agricultural Policy, Renewable Energy Policy as well CDM Strategy.

2.1 Waste is a Resource

Waste traditionally has been seen having no value. In a resource efficient economy and society, the term 'waste' would refer only to those residual materials that have absolutely no potential to be utilized and, therefore, economic value. Under this definition, traditionally 'valueless' streams of waste can be considered resources for a new tier of the economy. They can be recovered (or prevented from being lost) through greater efficiency and management at every stage of production and consumption. Even some hazardous or toxic materials may be recycled or re-refined for reuse.

2.2 Source Separation of Waste

Separation of waste at source is of paramount importance in 3Rs initiative. Municipal waste by virtue of its diverse sources will have mixture of materials. However, recently it is observed that recyclables with economic value such as wastepaper, plastic, broken glass, metal etc., is not segregated and is thrown on the streets by people along with domestic/trade/institutional waste. By throwing such recyclable materials on the streets or into a common dustbin, the quality of recyclable materials deteriorates as it gets soiled by wet waste which is often contains even contaminated and hazardous waste. Without waste separation the composition of wastes will not be known and planning, designing and implementation of waste management systems is not possible. Waste separation therefore is a key activity in any successful 3R initiative. In general, the wastes can be separated at three levels; 1) household and community level, 2) in the process of collection and transportation by municipal workers, and 3) at the waste disposal site by the workers and waste pickers from informal sector. It is also important to note that in absence of recycling industries or buyers for the segregated wastes, the sorted wastes end up discarded and mixed with unsorted wastes in open spaces or at disposal sites. At least 10-15% of the total waste can conveniently be segregated at source for recycling, which now goes waste in the absence of the practice of segregation of waste at source. The quality and efficiency of the recycling plants highly depend on the quality of the segregated wastes. Especially the composting of organic wastes purely depends on quality of waste separation.

2.3 Selection of Appropriate and Affordable Technology

Development and transfer of environmentally sound technologies for waste management and the 3Rs that are applicable in the context of prevailing socio-economic and climatic condition of the country through collaboration among stakeholders such as national governments, local governments, private sectors (including inter-industrial collaboration), consumers, manufactures, informal sectors and research bodies should promoted. Waste intensive industries may be given special attention in this context. Collaboration with

materials industry is a key for technical capacity development for the 3Rs-related technologies and industries. The markets for recycled materials should be stimulated through measures such as standards, incentives, green procurement etc.

2.4 Technology should be Emission Reducing

Inefficient and dirty technology should be avoided and replaced by efficient and less Green House Gas (GHG) emitting technologies. A carbon project refers to a business initiative that receives funding because of the cut emission of GHGs (green house gases) that will result. They have become increasingly important since the advent of the Clean Development Mechanism (CDM) under Phase I of the Kyoto Protocol-the international protocol of the Framework Convention of Climate Change toward reducing GHGs. Under CDM activity a developing country can harness foreign Direct Investment from annexed developed countries in those projects where GHG emission can be mitigated. CDM can promote technological improvement by encouraging energy conservation, adaptation of renewable energy, and recovery and utilization of methane from landfill, thus contributing to sustainable development in the developing countries. It can also help improve the energy supply mix, source energy supply, reduce local pollution, and help reduce GHG emissions.

2.5 Cleaner Production

Cleaner production is the continual effort to prevent pollution; reduce the use of energy, water and material resources; and minimize waste in the production process. It involves rethinking products, product components and production processes to achieve sustainable production. Cleaner production is about considering the entire life cycle of products, including: product design, selection of raw materials, production and assembly of the final product, consumer use, managing all used products at the end of their life. Cleaner Production will have following benefits:

- leads to improve products and processes
- saves on raw materials and energy, reducing production costs
- increases competitiveness through the use of new and improved technologies
- reduces the need for more environmental regulation
- reduces risk from on- and off-site treatment, storage and disposal of toxic wastes
- improves the health and safety of employees
- reduces the cost of increasingly expensive end-of-pipe solutions

2.6 Product-Life Extension

The concepts of product–life extension and the service economy go beyond all other industrial ecology approaches to closing the loop in industrial or consumer systems. Companies can realize cost savings in materials, energy, transportation, consumables, and the need to manage the eventual disposal and/or recycling of physical product through various strategies. Product-life extension implies a fundamental shift from selling products themselves to selling the use of products, the customer value they yield. The change in the source of economic value to firms depends on enhancing product life through design strategies**.**

2.7 Substance, Product, or Technology Bans

To address resource efficiency not only overarching legislation, but also separate laws to specific products needed. For each of these laws, it is necessary to set recycling targets, as well as roles and cost sharing among relevant parties. A number of these laws include Design for Environment considerations, which involve reducing environmental impact and resource consumption by improving product design. Design for Environment is a key component of integrated product policy, which is a policy concept to minimize environmental impacts at all phases of a product's life cycle.

2.8 Industrial Symbiosis and By-Product Exchange

The concept of industrial symbiosis, a key field of study and practice of industrial ecology, is based on this process of exchange and collaboration between or among firms, where one facility's waste (energy, water or materials) becomes another facility's feedstock. Inherent to industrial symbiosis is a cooperative approach to competitive advantage among traditionally unrelated firms. The keys to industrial symbiosis are collaboration and synergistic possibilities offered by geographic proximity.

A by-product exchange is especially useful when managers in a plant reach the limits of cleaner production and still have major unusable wastes. The concept of industrial symbiosis broadens the mission of such a network to sharing other resources, as well as by-products, especially energy, water and a wide range of services.

2.9 Polluters Pay Principle and Take-Back Provisions

Promote the polluter pays principle to make the party responsible for producing pollution responsible for paying for the damage done to the natural environment. The Polluter Pays Principle (PPP) is an environmental policy principle, which requires that the costs of pollution be borne by those who cause it. Its immediate goal is that of internalizing the environmental externalities of economic activities, so that the prices of goods and services fully reflect the costs of production. The PPP will economically promote efficiency; legally, it will promote justice; it will promote harmonization of international environmental policies. Polluter pays is also known as Extended Producers Responsibility (EPR). EPR is a concept where manufacturers and importers of products should bear a significant degree of responsibility for the environmental impacts of their products throughout the product life-cycle, including upstream impacts inherent in the selection of materials for the products, impacts from manufacturers' production process itself, and downstream impacts from the use and disposal of the products.

Take-back provisions require producers of products to make easier steps to take back their products for recycling. This motivates the producer to design the product with recyclability of the materials in mind and especially to reduce the content of toxic materials that may be difficult to dispose.

2.10 Green Purchasing

The selection and acquisition of such products and services that most effectively minimize negative environmental impacts over their life cycle. It is required to promote of procurement of Eco-Friendly Goods and services by the state and other Entities. It also requires manufacturers or service providers to provide information on the environmental impacts of items they offer for sale.

Objectives of the Green Procurement are to:

- Promote the culture of making environmentally-informed decisions in the government, especially in the purchases and use of different products;
- Include environmental criteria in public tenders, whenever possible and practicable;
- Establish the specifications and requirements for products of services to be considered environmentally advantageous; and
- Develop incentive programs for suppliers of environmentally sound products and services.

2.11 Environmental Management System (EMS)

Resource efficiency in a business or company can be significantly improved by establishing an Environmental Management System (EMS) with challenging and comprehensive objectives, effective indicators, and structures assuring rapid learning and response. Managers should see ISO 14001 or any other EMS structure as the outline in which the team defines significant objectives and strategies relevant for the industry and its social and environmental setting. ISO 14001 is increasingly important in international trade. Government also has a potential role in promoting EMS, by linking EMS adaptation with permit requirements, introducing related flexible penalty systems, and/or ensuring that future updates of EMS standards have an increased emphasis on resource efficiency and enhanced environmental performance.

2.12 Supporting Informal Sector

In Bangladesh large number of waste pickers earns their livelihood from waste picking from the streets, dust bins and waste dumps. It is estimated that these waste pickers pick up a large amount of recyclables with economic value in the urban areas and pass it on to the recycling industries through 2-4 levels of intermediaries. Thus though the informal sector operations comprising the feriwallahs, waste pickers, buyers and manufactures of informal actors are crucial to the waste management chain in urban areas of Bangladesh yet the services provided by this sector is poorly understood or acknowledged and it ends up being projected as illegal and illicit and being looked down upon. So, policy should not overlook informal sector already involved in the existing recycling trade chain. So, solid waste management for the cities and towns of Bangladesh should integrate both the formal and informal operations towards achieving the objective of 3Rs.

2.13 Gender Sensitive Approach

A gender-sensitive approach and a clear commitment to gender equity and the empowerment of women are critical in the support of new initiatives in urban services and environmental protection; attention to gender can increase management effectiveness, avoid costly mistakes, and ensure equitable access to livelihoods, resources or benefits which makes available. In particular, the frequently subordinate status of women may affect their general access to and control of resources, so that the “waste” materials or waste related activities may be the only ones which are available to them. So, a gender perspective should be integrated in assessment studies, planning, implementation and monitoring of waste management projects. This should include a gender-specific analysis of how available waste and resources are valued and used.

2.14 Public-Private Partnership

Collaboration between public bodies, such as local authorities or central government, and private companies referred to a Public-Private Partnership (PPP). Because of the increasing cost of service and deteriorating standard of service rendered by the official work force for various reasons, the element of public-private partnership is being introduced as recommended by numerous studies of the problem. Private-Public Partnerships is the best way to secure the improvements in public services. Private companies are often more efficient and better run than bureaucratic public bodies. In trying to bring the public and private sector together, the government hopes that the management skills and financial acumen of the business community will create better value for money for taxpayers.

2.15 Correspondence between Service Received and Payment Made

For most urban services, citizens receive, there are direct correspondence between service received and payment made for it. Unfortunately, such correspondence is absent in the case of waste collection and disposal. This has created the perpetual shortage of fund for providing these essential urban services. Mobilization of financial resources from private sources- domestic or foreign - is also constrained for absence of cost recovery mechanism. Thus, establishes this essential correspondence by charging a service fee is essential for making the necessary investment for improving waste management in major cities of Bangladesh.

3

3R RELATED POLICY GUIDELINES

Major policies, acts, rules, and other regulatory documents on waste management are listed in Table 2. There is no specific policy for waste management in Bangladesh. However, several rules and policies are being drafted for specific types of wastes. The following documents have been taken into consideration in preparation of the national 3R strategy.

Table 3.1 Main Policies, Laws and Regulations related to Waste Management and 3R in Bangladesh

Date	Title
Policy	
2006	**Draft National Urban Policy** ・ CDM and Recycling has been emphasized in this policy.
2008	**National Renewable Energy Policy** This policy is promoting production of biogas and other green energy from waste and also providing incentives such CDM to promote green energy projects.
1999	**National Agriculture Policy** According to this policy the government will promote use compost/organic fertilizer amongst the farmers to improve the soil productivity and food security
2005	**National Industrial Policy** This policy is recommended use of EMS and Cleaner Production practices amongst the industries
1998	**National Policy for Water Supply and Sanitation** ・According to this policy the government shall take measures for recycling of waste as much as possible and use organic waste materials for compost and bio-gas production.
1998	**Urban Management Policy Statement** Recommend the municipalities for privatization of services as well as giving priority to facilities for slum dwellers including provisions of water supply, sanitation and solid waste disposal.
Act	
2006	**Fertilizer Act** Under this act compost has been promoted and standard of compost has been set by the government on 2008.
1995	**Bangladesh Environmental Conservation Act (ECA)** Recommends standards for disposal of different types of waste.
Rules	
2008	**Biomedical Waste Management Rules** This rule recommends source separation of hospital waste as well as separate collection, transportation and treatment and disposal of all kinds of hospital and clinical waste.
2006	**Lead Acid Battery Recycling and Management Rules** Under this rules collection and recycling has been improved.
2005	**Draft National Solid Waste Management Handling Rule** 3R principle has been used.
1997	**Bangladesh Environmental Conservation Rules (ECR)** Recommends waste disposal standards for mainly industrial wastes.
Strategy	
2005	**National CDM Strategy** This strategy is promoting pro-poor CDM projects on waste sector by harnessing carbon financing
2005	**Poverty Reduction Strategy Paper (PRSP)** Here EMS has been promoted. To improve the solid waste management situation, special focus is given to segregation of waste at source along with the promotion of recycle, reduce and reuse of industrial and other solid waste etc.

2005	**National Sanitation Strategy** Its goal is to achieve 100% sanitation coverage by 2010. Here emphasis on resource recovery and recycling has been given as top priority to improve urban sanitation situation instead of disposal.
Action Plan	
2005	**Dhaka Environment Management Plan** Waste recycling has been promoted, less land filling encouraged, EMS promoted among industries.
2005	**Solid Waste Management Action Plan for Eight Secondary Towns in Bangladesh** Under the Secondary Towns Integrated Flood Protection (Phase-2) Project of Local Government Engineering Department, GoB. This action plan is based on 4 R principle i.e. reduce, reuse, recycle and recover of the waste.
1995	**National Environmental Management Action Plan (NEMAP)** This is a plan of the Government of Bangladesh (GoB), prepared by the Ministry of Environment and Forest (MoEF) in consultation with people from all walks of life. 3R is being promoted under the Sustainable Environment Management Programme (SEMP) of NEMAP.
Other	
2008	**Circular to Promote Compost by the Ministry of Agriculture (MoA)**, on 23 April 2008 Ministry of agriculture issued a circular to promote use of compost amongst the farmers to reduce the burden on the
2004	**Private Sector Infrastructure Guideline** This guideline of the GOB has recommended private sector investment in waste management sector which includes all types of waste. It has also identified waste sector as one of the priority sector for private investment.
2005	**Private Sector Housing Development Guideline** This guideline recommends to space in new housing areas for waste recycling specially composting and bio gas generation.
2004	**Dhaka Declaration on Waste Management by SAARC** countries during 10–12 October 2004 SAARC countries agree to encourage NGOs and private companies to establish community based composting, segregation of waste at source, separate collection and resource recovery from wastes with particular focus on composting.

Source: Waste Concern (2008)

4

EXISTING EXAMPLES OF GOOD PRACTICES AND LESSONS LEARNED

While the national 3R goal for waste management is to achieve higher levels of waste reduction, reuse, and recycling and minimizing waste disposal on open dumps, rivers, flood plains and landfills by 2015 may seem ambitious and the challenges ahead may be multifaceted , there have been number of positive experiences in the recent past which provides useful lessons to build upon. Some of the examples related to 3R projects in Bangladesh are briefly described below:

4.1 Existing Examples of Good Practices

4.1.1 Source Separation of Waste at Uttara Model Town (Sector 5)

A pilot project on source separation of waste was initiated in Sector 5 of the Uttara Model Town of Dhaka city. In the year 2006 the population of this area was estimated to be 105,913 and every day 51.16 tons of waste was generated from the area. Waste Concern took this initiative in partnership with Swisscontact-KATALYST in the year 2007. The objectives of this project was to promote source separation of municipal waste at household level which can lead to availability of better quality of recyclables which subsequently enables people to fetch higher price for recyclables, reduce frequency of injury of the waste collector/recyclers, assist in promoting recycling of inorganic waste, reduce the use of virgin materials in production process of new products, and at the same time reduce waste transportation as well as disposal cost of private sector and Dhaka City Corporation. Study shows that with effective 3R practice the community two truck full loads of recyclables can be minimized in Uttar Model Town as a result can save estimated at Taka 9,490,000 per year.

4.1.2 Community Based Urban Solid Waste Management in Bangladesh

Composting is a means of recapturing value from waste through the utilization of natural biodegradation process to convert organic materials into soil additives. It has the potential to reduce the cost of waste disposal, minimize large scale public health risk, produce a clean and readily marketable finished product and help to increase the recovery rate of recyclable materials.

In 1998, with the support from UNDP, Waste Concern in partnership with the Ministry of Environment and Forest (MoEF) of the government of Bangladesh initiated the "Community Based Urban Solid Waste Management in Dhaka" under a project entitled Sustainable Environment Management Programme (SEMP). The prime goal of this project is to explore technical and commercial feasibility of labour intensive aerobic composting technique and to promote the principal of 4R's (Reduce, Re-use, Recycle and Recovery of waste) in the urban areas of Bangladesh. The main objectives and the guiding force of the proposed project are as follows:

i. Improve the solid waste related problems by promoting community based solid waste recycling activities in the community level of 5 (five) identified communities of Dhaka city.

ii. Create job opportunity for the neglected (especially woman) poor of the cities from solid waste recycling activities.
iii. Conduct study, research, documentation and experiments on solid waste recycling, clinical waste management, and organic farming
iv. Develop a community, private-sector and municipal partnerships to improve the overall environment

4.1.3 Composting of Waste in Slums

Municipal services are already overburdened in the cities and towns of Bangladesh, and simply can not provide services to the slum dwellers, leaving the residents to their own devices for sanitation and other basic services, resulting unhygienic and filthy living conditions. A recent study estimates that nearly one-third of Dhaka's population i.e. 3 million live in slum and squatter settlements. In an attempt to search for an alternative low-cost and sustainable solid waste management facility for slums, in 1998 a pilot `Barrel Type Composting' program was initiated in Dhaka with the support from Local Initiative Facility for Environment (LIFE) Program of UNDP. A specially designed 200 liter perforated green barrel with a lid was supplied to the slum. One green barrel is provided to a group of six households and placed on a raised base with concrete ring. Slum dwellers using the Compost Barrels are imparted training and motivated to dispose their kitchen waste into the green barrel. Waste decomposed aerobically into compost in three months time period. Cost of barrel can be recovered within a 4 (four) years time period from the sale of compost produced from the barrel.

4.1.4 School Composting Program of American International School Dhaka (AISD)

American International School Dhaka at Baridhara is promoting 3R at their campus and installing an in-house rooftop compost plant for effective organic waste management as part of their commitment to become an environment friendly institution. In 1998, an initiative by AISD shows how 3R can be promoted, how institutional waste can be segregated and recycled within the campus with the active participation of students, teachers and staffs. From a baseline study it was found every day... tons of waste generates in the school and a major portion of this waste is organic. With the technical assistance from Waste Concern, the school authority established a compost plant on the roof of the school successfully, where organic waste from class rooms, offices, dining hall and kitchen is coming to the compost plant. The recyclables are kept in the separate bins and later sold to dealers.

4.1.5 Medium Scale Commercial Composting

So far, 47 replications of this model has been carried by others (GO, NGOs and private sectors) in 26 Towns of Bangladesh. From 2001 to 2006, organic waste recycled by these replications is 1,24,400 tons. These plants produced 31,100 tons of compost during this period. Having beneficiaries about 2.9 million. Created jobs for 986 urban poor, saved landfill area of 33.12 acres of 1 meter depth land. Production of compost involves two types of costs, fixed cost involved in composting plant and operational cost for running the plant. There are three major incomes from a compost plant, such as, proceedings from compost sale, recyclables and house-to-house collection fee. An efficient compost plant has a pay back period at 48 months.

4.1.6 Large Scale Commercial Composting Using CDM

Waste Concern initiated its composting activity with small decentralized community based approach. Later using this experience Waste Concern took small scale composting activity into larger scale using Clean Development Mechanism (CDM) approach. Using CDM, Waste Concern

initiated 700-tons per day capacity composting project for Dhaka City Corporation area. This project is expected to produce compost 50,000 tons every year, creating job for 800 urban poor, saving municipal waste management cost, improve the environment and reduce 89,259 tons of CO_2e/ Year. This Certified Emission Reduction (CER) from composting organic waste has created a new source of revenue for a composting initiative. For example converting one ton of organic waste into compost (using aerobic process) can reduce half ton of CO_2e emission. This has created a new source of funding opportunity for poor and cash strapped cities and towns to bring investment both locally and internationally in waste based projects.

4.1.7 Plastic Waste Recycling in Dhaka by Informal Sector

The potentials of recycling of plastic waste have made it a growing business worldwide, both from economic and environmental point of view. In Bangladesh, especially in Dhaka, plastic waste recycling is based on rudimentary technology and dominated by informal sector. In Dhaka City Corporation (DCC) area 3315 tons of solid waste was generated per day during 2005, of which 4.15% is composed of plastic materials. As such, 50,214 tons of plastic waste is disposed in the city at the rate of 137.57 tons/day. Although 51% of total plastic waste is recycled in DCC area, health safety and environmental issues are not properly looked after. This needs an urgent attention. The amount of plastic consumption is growing with the GDP growth of Bangladesh. A study shows that during 2005, 45% of the plastic waste is recycled in the country by informal sector which is resulting a savings of US$ 350 million in the year 2005 by avoiding export of virgin resin.

4.1.8 Lead Acid Battery Recycling by Formal and Informal Sector

Use of lead acid battery (ULAB) has been on steep rise as vehicle use has been increasing sharply in the country with the growth of GDP. A study conducted by Waste Concern shows that in 2006, Bangladesh saved minimum of US$ 4.73 million by recovering lead from used lead acid battery by recovering 3420 tons of recycled lead per year. To encourage environment friendly recycling of ULAB, in the year 2006, the government of Bangladesh has recently enacted an order on Used Lead Acid Battery Recycling and Management, under this order environment friendly collection and recycling ULAB has been encouraged.

4.1.9 Battery Buy Back for Recycling by Rahimafrooz

Rahimafrooz Batteries Ltd. (RBL), one of the largest lead acid battery producing company of Bangladesh, encouraged by government's policy to promote environment friendly took the initiative of a smelting plant to recycle used batteries in environment friendly manner. In this plant, annually 660,000 no batteries will be recycled that will contribute in preventing environmental pollution from used batteries. In addition, out of this recycling, yearly 3,300 ton hard lead will be reclaimed from used batteries, (one third of the yearly consumption of RBL) which will result in resource conservation by reducing consumption of fresh lead.

4.1.10 Agricultural Waste Composting in Chok Singha by Village

Deterioration of soil health due to reduced use of organic manure, high cropping intensity, less crop rotation, high unbalanced application of chemical fertilizer and pesticides has become an issue of great concern in the rural areas of Bangladesh. In this backdrop, the Special Programme of Food Security (SPFS) Project in Chak Singa, Bagha, Rajshahi, of Food and Agriculture Organization (FAO) took an initiative to replicate Waste Concern's composting technique in its project areas to promote sustainable agriculture and food security for Bangladesh under project entitled, `Capacity Building for Composting Activities under Special Program For Food Security

[GCSP/BGD/033/ JPN- SPFS] Project FAO of United Nations during October 2005 to June 2006. Today, after the intervention field visit shows that the model of Waste Concern to covert organic waste into compost has become popular in the Chak Singha village. About 261 family of this village formed an association to use compost in their crops. They are getting significantly good results from the use of this compost. A number of families from adjoining areas are replicating the project and some have scaled-up their production capacity into commercial scale.

4.1.11 Agricultural Waste Used for Biogas Generation and Improved Cook Stoves

Biogas, which is mainly composed of methane (60-70%) and carbon dioxide (30-40%) is a combustible gas produced by anaerobic fermentation of organic materials by the action of methanogenic bacteria. Methane is odorless gas and burns with a clear blue flame without smoke. It produces more heat than kerosene, fuel wood, charcoal and dung-cakes. When biogas is used in suitable designed burners, it gives a clean, smokeless, blue flame, which is ideal for cooking. If biogas is used in specially designed lamp it gives a light similar to the kerosene pressure lamps. Biogas can be used for other purposes such as electricity generation, refrigeration, space heating and running engines but higher amount gas will be required for these purposes. Family size biogas plant is appropriate only for the domestic use such as cooking and lighting. Infrastructure Development Company Limited (IDCOL) is implementing National Domestic Biogas and Manure Program (NDBMP) with support from GoB, SNV Netherlands and Kfw. Under the project, a total of 60,000 domestic sized biogas plants will be financed during the period 2006-2009. The Institute of Fuel Research & Development (IFRD) of Bangladesh Council of Scientific & Industrial Research (BCSIR) has been pursuing R&D activities on “Stove Technology” to suit the need in respect of bio-mass fuel, shape of the cooking pot and cooking habit of the users. Grameen Shakti started its biogas program in 2005 and Improved Cook Stoves Program in 2006. Grameen Shakti’s biogas program is the first market based program in Bangladesh. Grameen Shakti’s so far constructed 16000 cook stoves through 1000 nos. technicians cum entrepreneurs. Both programs have become popular with the rural people and show an accelerating trend.

4.1.12 Biomass Used for Commercial Power Generation

With an intention to generate electric power and supply to the rural areas, Dream’s Power Ltd, a Kapasia, Gazipur based private company with the financial assistance of World Bank and technical expertise from India installed a power plant at Kapasia, Gazipur at the end of 2007. The main purpose of the project is to generate electricity where REB or PDB power supply are absent and rice-husks are abundant and under-used or un-utilized, to serve the rural & make profit.

The main features of the power plant are two bio-gas generating units and three diesel or gas-based power generators (100KV, 110KV and 80KV). Rice-husks are being used as input to the bio-gas generation. The capital investment of the power plant including generators and gas-producing unit is Tk.2.5 crore. Power is sold at 5Tk/unit (1 unit=1 KW-hr); for each connection to households/shops monthly fixed charge is TK.100. In addition a service charge of 5% of the total bill is there. 3 bags of rice husks per hours are used for generation of 35-40 KW of power; there is a seasonal variation in the price of rice-husks which is related to the production of paddy in the area. Price of rice-husks varies between 20-40tk/bag. For 24 hrs of operation under full capacity of the plant (300KW) there is a demand of rice-husks of 9 ton/day and 3300ton/year. At present about 500 households/shops are the beneficiaries of the project.

4.1.13 Biomedical Waste Collection and Disposal

At present health care facilities are growing in a rapid pace in Bangladesh and improper management of waste from these facilities has become serious threat to our health and

environment. Poorly managed health care waste (HCW) exposes health-care workers, waste handlers, and the community to diseases like hepatitis and AIDS (HIV), infections, and may damage the environment. For example PRISM, a local NGO has initiated Biomedical Waste Collection and Disposal service to 75 private clinics including government hospitals in Dhaka city. The objectives of hospital waste management services are to:

- Motivate and organize small private clinics and government hospitals to improve their internal environment.
- Raise awareness and skill among hospital and clinical staff on safe waste management.
- Reduce occupational health hazards among hospital and clinic staff especially wastes handlers.
- Reduce urban environmental pollution covering hospital and clinical waste as an integral part of waste management.
- Reduce public health risk covered by mismanagement of hospital and clinical waste

4.1.14 Environmental Management System (EMS) Practices in Several Industries

Experience in Bangladesh shows that introduction of EMS can benefit industries economically, environmentally and socially. An EMS is a systematic approach to dealing with the environmental aspects of an organization. It is “tool” that enables an organization of any size or type to control the impact of its activities, products, or services on environment. Application of an Environmental Management System (EMS) to ISO 14001 will show practical business results in terms of increased efficiency and reduced costs as well as environmental benefits. Past few years, a number of plastic industries adopted EMS and saved significant amount of their production cost annually. Study shows that many of these manufacturing industries saved 30% of its water consumption, reduced 20% chemical waste consumption, reduced 30% Green House Gas emission.

4.1.15 Use of Biomass in Boiler- Example of a Private Furniture Manufacturer

Hatil Complex Ltd. (HCL) a large furniture producing manufacture, is located at Kashimpur in Jirani Bazar of Gazipur district. HCL replaced its diesel run boiler with biomass run boiler for the seasoning its wood inputs. In order to run a 2.5 ton capacity boiler 150,000 liters of diesel was required which was worth Tk. 52.5 lacs per annum. It was found that, wastage wood generated from the production line of its factory is 9,26,950 kg/year. So, from a study the total amount of wood waste required to run the 2.5 ton boiler was found to be 3,13,947.30 kg /year. Simply using a biomass based boiler today HCL has 5,52,002 kg/ year excess wood with significant economic value and by replacing diesel to run the boiler HCL can save Tk. 52.5 lacs per year.

4.1.16 Recycling Training Center in Katchpur, Narayangang

Waste Concern has its own recycling training center. Waste Concern established a Recycling Training Center (RTC) in 2005, with the support from UNDP under the Sustainable Environment Management Program (SEMP) implemented by the Ministry of Environment and Forest (MoEF) for technology demonstration and hands-on training on waste recycling and energy conservation for the officials, staffs, students, researchers from both the Government and private sectors. Training Center can accommodate 30 participants/ batch.

4.2 Lessons Learned

- Clear-cut policy package, incentives, guidelines needs to be promoted for 3R in Bangladesh.
- Appropriate Technologies are expensive, which should be subsidized by rich developed countries (for example technology transfer in CDM projects).
- Easy financial support should be promoted by bank/ financial organizations and incentives should be extended to 3R projects.
- Capacity building training programs and research on 3R required for both public and private sector
- Role of Media needs be promoted to inform people and raise mass awareness on 3R.
- Public-Private-Community Partnership needs to be promoted to bring in investment in 3R projects.
- Informal sector should to be given special attention in 3R initiatives.

5

STRATEGIS FOR PROMOTION OF 3R

The main features of the National Strategy promoting 3R are:

- Prioritizing waste avoidance/reduction over recycling, and recycling over all other forms environmentally sound disposal;
- Reusing non-avoidable waste as far as possible;
- Maintaining content of hazardous content in the waste at the lowest possible level;
- Guaranteeing an environmentally sound residual waste treatment and disposal as basic prerequisite for human existence and environmental protection.

Based on the guiding principles and the key issues identified earlier, following strategies are recommended to promote 3R in waste sector:

5.1 General Strategies

5.1.1 Raising Public Awareness Through Information, Education and Demonstration Projects

The most important strategy for promotion of 3R is to raise public awareness for changing our behavior and practices towards waste disposal. Implementation of 3R practices largely depends upon behavioral factors. Media has a huge impact on changing human behavior and practices. The following strategies must be adopted to maximize the benefit of media (both electronic and print) campaign for promotion of 3R:

- 3R concept of waste must find space in the media;
- Regular information on source separation, promotion of waste reduction at source;
- Reporting on best practices and success stories on waste minimization and recycling;
- Reporting on financial and environmental benefits of 3R;

For lasting and long-term improvements, environmental management must be brought about through educational programs, which will result in systematic capacity building through the formal education system. Specific tools would include development of teaching materials for schools. Development of training courses for tertiary educational institutions will need to be developed as part of the implementation of the strategy. The DoE have to actively involved with the Ministry of Education and with schools to introduce environmental education into the school system. The school project will be planned and implemented in parallel and in close co-operation with the capacity building components of the National 3R Strategy.

Demonstration projects on different technologies and best practices on 3R should be also established in the short and medium terms for domestic, institutional waste, commercial, agricultural, hazardous and industrial waste. Research institutions, universities as well as environmental NGOs must be engaged to implement such projects.

5.1.2 Engaging an Affordable Mix of Appropriate Technical Options to Reduce, Reuse, Recycle Waste

A number of technological barriers have to be overcome to achieve the national 3R goals. The strategies to be adopted are:

- Low cost technological option instead of capital intensive sophisticated technological solutions for waste recycling.
- Waste treatment technologies with greater emphasis on resource recovery and recycling. Emphasis will be on less energy consuming technologies in order to capture carbon credits and lower the carbon foot prints as well as technologies which can create job.
- Technology advisory group will be formed at the Ministry of Environment and Forests to assess the technology for promotion of 3R. Unproven technology and commercially not tested will not be promoted.
- Multiple technology options will be considered for waste treatment and recycling in a city rather than a single technology as well as for industries.
- Decentralized technologies should be preferred over centralized technologies of waste treatment/recycling.
- Since major portion of municipal waste is organic, technologies that can convert organic waste into organic fertilizer or biogas (which may then be used for electricity generation) should be encouraged.

5.1.3 Strategies for Sustainability

Following strategies will be followed for sustainability of 3R programmes

Establishing National 3R Focal Point

A well organized institutional set-up is a prerequisite for implementation of 3R and its sustainability. *3R Wing* at the Ministry of Environment and Forests is to be established to guide the promotion and implementation of 3R strategies in the country. Apart from 3R wing, an inter-ministerial committee will be formed for coordination amongst different line ministries.

A 3R Secretariat will be constituted within DoE to monitor progress in the implementation of 3R strategies and also for multi-level communication. The institutional arrangement for the waste management defined in the National Policy for Safe Drinking Water and Sanitation 1998 will be followed.

Involving All Stakeholders

The successful promotion and implementation of the 3R strategy require that all stakeholders be involved from development stage of the strategy through implementation to monitoring and evaluation stages. Community participation in the implementation of 3R related projects will be a priority.

Multi-sectoral Approach

3R is essentially multi-sectoral. Local Government, agriculture, education, finance, commerce, information and energy sectors must work hand in hand for promotion of 3R and implementation of 3R strategies at the ground level. Apart from government agencies involvement of trade bodies such as relevant chamber of commerce and industries will be ensured.

Appropriate and Affordable Technological Options

Choice of different technological options must be available for people considering to practice the 3R principles considering social especially gender related issues, economical, cultural acceptance and environmental friendliness. For waste recycling at slums and squatter settlements especial emphasis will be given on technologies which are simple and affordable.

Building Partnership with NGOs and Civil Societies

NGOs have strong technical and community mobilization skills that can be utilized for promotion and implementation of the strategy. Government at all level should build partnership with the NGOs and civil society organizations

Private Sector Participation

Enabling environment shall be created for increased private sector participation in treatment and recycling activities/projects. Soft loan, tax holiday as well as provision of land for establishment of treatment/recycling facilities will be provided by the government to encourage private sector participation. Private sector participation will be encouraged by BOO, BOOT and public-private partnership projects.

Rules and Guideline

Appropriate rules and guidelines for promotion of 3R shall be enacted. Source separation of waste will be made mandatory along with industries will be made to pay more for generation of waste beyond certain limit along with incentives for generation of less waste as well as recycling.

Capacity Building

Capacity building programs for local government bodies as well as industries on different approaches of 3R, EMS and Cleaner Production will be organized by 3R Secretariat on a regular basis.

Research and Development (R&D)

Promoting R&D is central to supporting investment in the environment and energy industries for resource efficiency and sustainable waste management. Most new technologies originate in the more developed countries, although some adaptations of these technologies or indigenous technologies are also produced in developing countries like us. R&D may be carried out by educational and research institutions, by industry institutes, and by the companies themselves. Government can encourage R&D by providing grants through nonprofit institutions such as universities and by offering tax credits or similar incentives to firms for R&D expenditure, so long as a result will be publicly available. Developing green industrial parks can also help centralize research and extension services by providing a home for new and expanding business, along

with business associations, incubator services, and a research base to improve the success of investment in various sectors.

Government should emphasize the development of economically viable products and processes that require fewer reagents, fewer solvent, and less energy than conventional processes. Green chemistry R&D searches for new solutions in several basic areas, including changes in chemical process design (e.g. alternative catalysts and regents for chemical production processes); changes in manufacturing process (e.g. getting more output per unit of chemical input); and new products that replace polluting chemicals (e.g. benign petrochemical products, biomaterials and bio-fuels).

5.1.4. Strategies for Financing

Public Funding

The government funding for waste management especially focusing on 3R will be arranged. Decision making for the use of public fund should be left to the local government bodies, Ministry of Finance, Ministry of Industry and other relevant bodies.

Donor Funding

Donor Agency funding has been declining over the years. In view of environmental, health, poverty reduction as well as green house gas mitigation potentials donor funding must be substantially increased. However, for donor funded projects, coordination will be done amongst the donors to avoid duplication and overlapping of projects.

Private Funding Through CDM

There is huge scope to attract private financing for waste treatment and recycling projects both for industries and municipal authorities since reuse and recycling of waste reduces green house gas emissions which is eligible for carbon financing through CERs and VERs. Government will encourage implementation of waste treatment and recycling projects based on carbon financing.

Cost Recovery

For sustainability of financing mechanism and attracting required investment, whatever is the source, it is important to levy service fee for waste collection, transportation, treatment, recycling and disposal.

5.2 Sector Specific Strategies for Promotion of 3R

5.2.1 Domestic Waste

- Public awareness campaigns will promote separation at source for domestic waste. The DoE with City Corporations and Pouroshavas will develop a programme for source separation of domestic wastes.

- Segregation of waste at the point of origin i.e., house, office, school or institution, will be a non-negotiable and critical element of the strategy. City Corporations/ Pouroshavas will direct the households, shops and institutions not to mix recyclable waste with biodegradable waste and will encourage them to keep the bio degradable and non-biodegradable, recyclable and non-recyclable waste in separate containers or bags for collection by the informal sector recyclers or by the approved DoE.

- Directions will be given to the households to compost the kitchen waste preferable at household or neighborhood and if not possible at neighborhood level then at ward or city level and if not available and to separate the non-compostibles for municipal collection or direct sale.

- The City Corporations/Pouroshavas will take suitable steps to encourage the households to store their household hazardous waste (batteries, aerosol cans, razor blades and tube lights, e-waste) separately for discharge on publicized days in different areas of the city.

- Regular education and public awareness sessions will be organized in each locality with the help of residents' associations and other NGOs. Through such sessions, 'No separation-No collection' policy must be communicated and adopted using participatory techniques.

- All households will be encouraged to purchase and use compost bins available in the market. As part of the strategy, the City Corporations/ Pouroshavas will provide market information; negotiate with the suppliers and arrange for higher purchase systems; and also develop appropriate subsidies for the poorer sections to obtain the bins

- The City Corporations/Pourashavas will engage private sector to establish recycling plants for organic waste such as biogas or composting plant. Moreover for recycling of inorganic waste such as plastic, glass, metal incentive will be provided by the local authorities to recycle the waste as much as possible.

- For establishment of treatment and recycling facilities, local government bodies will arrange land and also ensure supply of right quality of waste for private entrepreneurs.

- All kinds of recycling activities can contribute towards green house gas mitigation; as such linking recycling projects with Clean Development Mechanisms (CDM) will be encouraged.

- Domestic waste which can not be recycled will be used for sanitary land filling. The site for land filling will be selected after EIA and public consultation.

5.2.2 Hazardous Waste from Manufacturing Industry

- **Inventory of hazardous waste generation**

Since industries change their products, processes and capacity of production, and new industries get established periodic, updating of inventories is required. It should be made mandatory on the part of industries to report changes/additions in hazardous waste generation and steps taken to reduce generation of waste per unit of production. Industries will be required to store hazardous waste for a period not exceeding 90 days and shall maintain a record of sale, transfer, storage, recycling and reprocessing of such wastes unless agreed by DoE. The waste could either be recycled /reused or disposed of in captive or common Treatment, Storage and Disposed Facilities (TSDF) available in the country, or be incinerated. Inventories of 'end of life' consumer products such as e-waste are also required to be made.

- **Waste avoidance and waste minimization at source**

In the hierarchy of waste management, waste avoidance and waste minimization have to be attempted first, for which dissemination of information on technological options should be a

continuing exercise. Promote implementation of recovery of resources such as solvents, other reagents and by-products as well as re-generation of spent catalysts in a time frame manner.

- **Reuse, recovery and recycling of hazardous waste**

Industrial associations/industries should explore options/ opportunities of reusing, recovery and recycling of hazardous waste in an environmentally sound manner.

Establishment of 'Waste Exchange Banks/ Centers' should be encouraged to provide information on wastes and promote reuse, recovery and recycling technologies which upscale the quality of resource recovery.

Introduce payback scheme as part of extended corporate responsibility in case of lead-acid batteries.

Develop a system for channel sing of wastes containing toxic metals for recovery, such as mercury from thermometers and fluorescent tube lights, cadmium from batteries etc.

- **E-waste**

The recycling of e-waste is required to be regulated due to presence of hazardous constituents in the components of waste electrical and electronic assemblies. Governments should encourage e-waste recycling projects under public-private partnership mode.

- **Encourage cleaner production and eco-design practice**

Encourage cleaner production and eco-design practice within each manufacturing sector: This is a process which minimizes environmental impact across the product life cycle, whilst producing a high quality, cost-effective product

- **Encourage the use of Environmental Product Labeling**

Encourage the use of Environmental Product Labeling on products to enable consumers to make informed choices about the products they buy

- **Encourage the implementation of Environmental Management Systems (EMS),**

Encourage the implementation of Environmental Management Systems (EMS), which can result in better resource efficiency and increased awareness of waste prevention and recycling practices throughout staff, the DoE, will promote the implementation of EMS through the provision of guidance, advice and leading by example

- **Safe disposal of hazardous waste**

For the waste which cannot be recycled/ reused, safe and environmentally sound disposal should be adopted depending upon waste category. Design and operation norms of disposal facilities should be strictly adhered to as per the guidelines to be framed by DoE. Supervision

of such facilities by DoE during construction stage is required to ensure quality of construction as per guidelines, including post closure monitoring.

- **Setting up of Common Treatment, Storage and Disposal Facilities (TSDFs)**

Setting-up of TSDFs should be considered within industrial estates/ EPZs. The Government may consider providing financial support for establishing such treatment facilities. The TSDFs shall cater to meticulously delineated hazardous waste catchments areas taking into consideration their distance from the generators and availability of wastes. DoE shall ensure that in a given hazardous waste catchments area, there are no multiple operating TSDFs. Private sector will be encouraged to establish TSDFs.

- **Transportation of hazardous waste**

DoE will develop on-line tracking system for movement of hazardous waste from generation to the disposal/ recovery/ recycle stage. Industries have to pay for collection and transportation of waste for treatment and disposal out side the industries own premises,

- **Use of cement kilns for hazardous waste incineration**

Use of hazardous wastes (such as ETP sludge from dyes & dye intermediates, tyre chips, paint sludge, Toluene-Die-Isocynate tar residue and refinery sludge) as supplementary fuels in cement kilns need to be promoted.

- **Illegal dump sites and remediation**

To take care of illegal dumping, surveillance both by enforcement agencies and industry associations needs to be stepped up. The approach for site remediation of dump sites would vary from site to site depending on nature of pollutants, future damage potential and remedial cost. The remediation strategy should focus on the 'Polluter Pays Principle' which needs to be strictly enforced. In such a case, the polluter has to reinstate or restore the damaged or destroyed elements of the environment at his cost. To take care of cases of remediation wherein polluters are not traceable, a dedicated fund needs to be created by MoEF.

- **Strengthening the infrastructure of regulatory bodies**

For effective enforcement of regulations, DoE has to be strengthened in terms of manpower, equipment, instruments and other infrastructure facilities. The Government may support DoE by adequate funding, training and awareness programmes, periodically.

- **Disposal of date expired drugs & pesticides:**

In order to deal with such hazardous wastes, as well as disposal in a facility as per following options should be permitted:

- To have these processed wherever possible by the industry.

- To appropriately incinerate either through dedicated incinerators of individual industry or through incinerators available with common facilities.

- **Handling and management of hazardous waste during ship dismantling:**

Adequate safety systems and procedures need to be adopted during dismantling of ships and handling of hazardous wastes/ materials (such as used oil, waste oil, asbestos containing panels/ tiles, damaged asbestos containing material, paint chips, and used chemicals like acids etc.) This activity is required to be regulated through DoE and Shipping Department.

5.2.3 Waste from Agriculture

Recycling of pesticide waste is not viable due to product quality requirements and the environmental risks involved. However, government will promote technologies such as efficient stoves to minimize the use of agricultural waste as domestic fuel source and encourage surplus biomass for production compost or energy.

5.4 Medical Waste

Recycling of medical waste is not viable due to the potential health risks. Capacity building and waste management education programmes need to be implemented before medical waste can be managed in an environmentally sound manner. The strategy to promote source separation and waste management include:

- Producers of bio-medical and other hazardous waste that can threaten public health will be made primarily responsible for disposing such waste under the supervision and care of the concerned authorities. For this, special guidelines will be issued by the government following the norms issued for the same by the Ministry of Health and the Ministry of Environment.

- Biomedical and pathological waste including body parts of humans will be disposed of through methods that conform to safety standards stipulated by the government and will be incinerated by the producer under City Corporations/Pouroshavas supervision.

- The City Corporations/Pouroshavas will insist on placing special containers at sorting stations, recyclables collecting centers or other public places for the deposit of hazardous waste.

6

ROLE OF RELEVANT STAKEHOLDERS

Implementation of the 3R strategy will involve active participation by major stakeholders in stakeholders. Their respective roles include:

6.1 Government

- Develop policies, guidelines and rules and regulations,
- Facilitate local authorities as well as industries to provide infrastructure facilities;
- Arrange required financial mechanisms to implement the strategy, and
- Accommodate the role of informal sector in the strategy.

6.2 Citizens and Industrialists

- Sorting of waste at household as well as factory/commercial and institutional level to:
- Reduce
- Reuse
- Recycle and
- Environmentally Sound Final disposal

6.3 Private Sector

- Involvement in recycling activities
- Investment in 3R related projects
- Participate in the development of infrastructure facilities in collection, transportation and recycling of waste
- Provide 3R related infrastructure at industry level
- General awareness creation

6.4 NGOs

- Community mobilization in the implementation of the strategy
- Awareness creation to secure community participation

6.5 Informal Sector

- Play supportive role to promote separation and collection of waste at primary level.
- Use practical experience and local knowledge to improve waste management and recycling system.
- Work in partnership with community, government, NGOs, CBOs and private sector.
- Improve the working conditions to reduce health hazards.

6.6 Small and Medium Enterprises (SMEs)

- SMEs using recyclables as raw material work closely with informal sector and create demand for fresh recyclables in the market;
- Produce environment friendly products;
- Adopt cleaner technology and improve the health and safety for its workers; and
- Attract investment and appropriate technology to recycle more waste and produce new products for a sustainable business.

6.7 Media

- Coverage of 3R activities.
- Mass awareness raising campaigns.
- Publicity of good example of 3R practices.

7

DEVELOPING ACTION PLANS

The National 3R Strategy broadly guides the relevant institutions e.g. local government bodies, industries, NGOs, trade bodies such as chamber of commerce and industries agencies to develop their own action plans for achieving National 3R goal in their respective areas. The following broad actions from the government will help develop individual action plans:

- Identification of priority sub-sectors for 3R in waste sector;
- Setting-up of quantifiable targets for 3R within the priority sub-sectors
- Review and updating of the priority sub-sectors and targets
- Assessment of sub-sectors and sectoral progress

7.1 Cost of Implementation

Cost of implementation will be determined by the respective institutions e.g. local government bodies and agencies, NGOs, industries and government organizations at local level considering local context, particularly addressing socio-economic as well as cultural needs.