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WASTE MANAGEMENT AND SUSTAINABLE DEVELOPMENT IN SOUTH AFRICA

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Abstract. Waste management is emerging as a key sector for sustainable development in South Africa with opportunities for enhancing investments in carbon credits that target reduction of methane from landfills and moveable assets in relation to environmentally sound equipment required for effective waste management. In the past, the waste management sector was dominated by private sector with selective operations in what makes business sense through recycling of saleable products. Materials mostly recycled included paper and hard board, plastics, glass, tinplate and aluminum. The rest of the waste materials estimated at 10.2 million tons of both general and hazardous end up in landfills. This trend is now getting reversed as development agencies such as Deutsche Gesellschaft für Technische Zusammenarbeit Gmbh (GTZ), Danish International Development Agency (DANIDA), Danish Co-operation for Environment and Development (DANCED) and Development Bank of Southern Africa (DBSA) are identifying opportunities in the sector for sustainable development purposes. Two key areas for investments include capturing methane emissions from landfills for trading in carbon markets and financing both physical and moveable assets to enhance sustainable development. However, the challenges for cost-effectiveness, efficiency and sustainability in the sector prevail in relation to lack of sound knowledge to design and implement integrated programmes that incorporate environment, development and sustainability. Also, inadequate capacity at municipal levels to administer waste management programmes and inability to collect rates and taxes for effective management of landfills constraint effectiveness and efficiency of the sector. Overall, financial resources are imperative to waste management and sustainable development as the sector requires capital investments for necessary infrastructure.

Key words: carbon credits, development, environment, investments, landfills, methane reduction and moveable assets, recycling, sustainability, waste management.

Abbreviations: BPEO: – Best Practical Environmental Option; CBO: – Community Based Organization; CDM: – Clean Development Mechanism; CER: – Certified Emissions Reduction; CSIR: – centre for Scientific International Research; DANIDA: – Danish International Development Agency; DANCED: – Danish Co-operation for Environment and Development; DBSA: – Development Bank of Southern Africa; DEAT: – Department of Environmental Affairs and Tourism; DWAF: – Department of Water Affairs; GHG: – Greenhouse Gas; GNI: – Gross National Income; GTZ: – Deutsche Gesellschaft für Technische Zusammenarbeit Gmbh; ICT: – Information Communication Technology; IWMP: – Integrated Waste Management Programme; LDV: – Light Delivery Vehicles; LFG: – Liquid Fuel Gas; NGO: – Non-governmental Organization; NWMS: – National Waste Management Strategy; PACSA: – Packaging Corporation of South Africa; PPP: – Public-Private cPartnerships; SADC: – Southern Africa Development Corporation; SMMEs: – Small and Medium Enterprises; UNFCCC: – United Nations Framework Convention on Climate Change; WSSD: – World Summit on Sustainable Development

1. Introduction

Waste Management is evolving as a key sector for environmental infrastructure financing. Financing of waste management eliminates negative effects of development impacts. Efficient and cost-effective production systems, use of resources and disposal of wastes are largely associated with management systems of good practices. In order to enhance an efficient and effective waste management system in South Africa, a series of baseline studies were commissioned in 1997. The studies provided a better understanding of the waste management situation in South Africa and served as a foundation for strategic guidance for the development of the National Waste Management Strategy (NWMS). For the strategy to be relevant to environment, development and sustainability, it is necessary to articulate an innovative process that facilitates:

- identifying and quantifying the main waste streams generated and how much ends up in streams, impact water quality and surrounding environment;
- understanding the reasons for poor community waste management, servicing and littering; and,
- classifying the status and capacity of landfills with particular reference to hazardous waste.

In the context of capturing methane for carbon credits and trading in carbon markets requires sound knowledge on how development financing can generate mutual benefits to local communities and global climate change. The complexity of carbon markets that target methane reduction from landfills within the waste management sector call for indepth situational analysis and specific recommendations.

2. Situational analysis

South Africa is the most economically developed country in African continent with Gross National Income (GNI) per capita of US$2750 in 2003, energy use per capita in Kilogram (kg) of oil equivalent of 2,502 and electricity use per capita of 3860 kWh (Kilo Watt Hour) in the year 2002 (World Bank, 2005). Emissions per capita in 1999 were estimated at 7.8 metric tons of Carbon Dioxide (CO_2) equivalent and volumes of waste generated in 1992 and 1997 both general and hazardous accumulated to about 500 million tons (Department of Water Affairs, 1998). Given this state of development the country has a diverse waste stream, the management of which varies in approach, efficiency and complexity depending on the responsibility of local authority. Waste generation rates for the different market segments are shown in Table I. Table I shows a major overall increase compared with a previous study carried out in 1992. The table shows that mining was the largest contributor to this increase followed by industrial, power, land use, domestic and trade and sewage. In 1997, the trend in the table shows that mining was still the leading in waste

TABLE I. Waste generation rates in South Africa in 1992 and 1997.[a]

Waste stream	1992 (CSIR study)	1997
Mining	378.0	468.2
Industrial	23.0	16.3
Power generation	20.0	20.6
Agriculture and forestry	20.0	20.0[b]
Domestic and trade	15.0	8.2
Sewage sludge	12.0	0.3
Total	468.0	533.6

[a]This table provides information extracted from a study on waste generation rates in million tons per year in South Africa in 1992 and 1997. The study was conducted by Center for Scientific International Research (CSIR).

generation while a decline was realized in industrial, domestic and trade and sewage. This trend could be as a result of international standards that impact directly on waste generation.

Estimates put the national average waste generation rate at 0.8 kg/capita/day for more developed areas and 0.3 kg/capita/day for less developed areas of South Africa. Service coverage estimates are around 80% for urban kerbside coverage (100% in more formally developed areas and 65% in less formally developed areas). Coverage in rural areas is almost non-existent, one estimate putting it at 35%. Collection and transfer efficiency is low compared to developed countries' standards. Waste disposal in South Africa is mostly in landfills, but it is estimated that only 10% of landfills are managed in accordance with the Minimum Requirements (Department of Water Affairs, 1998). Analysis of 9 provinces of South Africa indicates that waste generation will increase to about 12 million tons per year by the year 2010. This will realize an increase of about 2 million tons in a period of less than 10 years.

From the summary Table II, Gauteng province that constitutes Johannesburg a metropolitan city is the largest generator of waste followed by Western Cape, Mpumalanga and Kwa-Zulu-Natal provinces consisting of major cities such as Cape

TABLE II. Summary of provincial general waste generation predicted for the year 2010.

Province	Predicted total waste	
	m^3/year	*t*/year
Eastern Cape	3 105 989	802 090
Free State	3 877 380	745 535
Gauteng	26 085 304	4 207 608
Kwa-Zulu-Natal	5 749 959	1 437 762
Mpumalanga	11 200 387	1 783 766
Northern Cape	956 369	191 669
Northern Province	2 374 864	623 678
North West	2 296 489	542 135
Western Cape	12 979 785	2 129 647
Totals	68 626 526	12 463 890

Town and Durban respectively. These cities are also with well managed landfills as well as recycling programmes. Recycling activities in South Africa are mostly private sector initiatives run by packaging manufacturers through buy-back facilities. At grassroots level there are *ad hoc* initiatives through Non-Governmental Organizations (NGOs) and Community Based Organizations (CBOs) that encourage waste separation and recycling to create employment and generate income for poverty alleviation besides managing and sustaining the environment. Recycling for packaging companies has shown a positive increase over the years since 1990. The demand for packaging products made of recycled materials provides direct incentives for the entities involved. But difficulties arise when separation of waste is not enhanced at source. Mixed waste costs more resources for separation (sorting) and cleaning.

This Table III shows data comparison for recycling of paper and board, plastics, glass, tinplate and aluminium for 1990 and 1996. There have been efforts in South Africa to establish recycling plants to separate mixed waste collected in urban areas. However most of the large-scale operations have not proved viable, and subsequently closed, mainly due to economic reasons and the difficulty of processing unsorted waste streams. Although, packaging recycled from aluminuim in 1990 and 1998 as shown in Table III is about 100% showing high demand for aluminium packaged products.

The volume of plastics (HDPE, LDPE, PS, PET, PP and PVC) recycled each year in South Africa represents approximately 27% of the use of these polymers. Most plastic that is recycled is recovered from the general waste stream, and is clearly marked to identify the polymer used. The economics of plastics recycling are determined by labour costs for collection, sorting and processing, as well as transport costs and electricity and water consumption costs for washing and processing of the recovered materials. The selling prices for recycled polymer are limited to about 60–70% of the virgin polymer prices, which are in turn subject to the normal supply/demand scenario.

TABLE III. Comparison of recyclable materials.

	Paper and board		Plastics		Glass		Tinplate		Aluminium	
	1990	1996	1990	1994	1990	1996	1990	1996	1990	1996
Total available for consumption (thousand tons)	1870	1885	625	740				316	128	118
Total converted into packaging (thousand tons)	850	818	240	355	459	350	269	261	21	31
Amount recycled (thousand tons)	340	673	70	135	64	79	56	129	34	37
Percentage packaging recycled	40%	82%	29%	38%	14%	23%	21%	49%	100%	100%
Percentage recycled (relative to total production)	18%	36%	11%	18%	–	–	–	43%	27%	31%

Data for the total amount of waste recycled is not available. The latest data from the packaging industry, however, shows the following percentages of recycled materials shown in Table IV.

In most cases issues pertaining to waste are associated with scattered garbage and poor management as shown in Figure 1. This situation is a common practice in rural areas of Africa, Asia and Latin America and has achieved global attention. Since the 1972 Stockholm conference on Environment and Human Settlements, global concern about growing pollution has escalated, particularly in the last decade. This is evident in the many international protocols and conventions that have arisen, and countless reports and conferences from significant bodies including the 1992 Rio conference on environment, where delegates agreed on Agenda 21 as a blueprint for sustainable development and the Johannesburg report of the 2002 World Summit on Sustainable Development (WSSD).

TABLE IV. Percentage of recycled materials 1990–2002.

Category	% Recycled by year					
	1990	1992	1994	1996	2000	2002
Paper	29.0	28.4	38.0	38.0	40.0	51.9
Metals	21.0	26.3	29.9	51.0	40.8	63.5
Plastic	11.0	14.8	17.0	17.0	11.9	25.5
Glass	14.0	22.4	19.4	17.6	19.5	28.9

Source: Packaging Corporation of South Africa (PACSA) 2005.

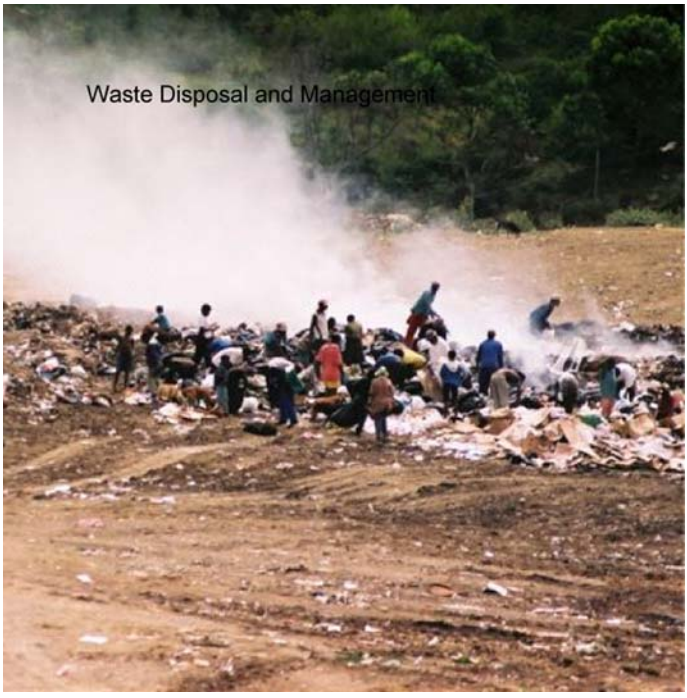

Figure 1. Waste disposal in open land fills.

Certain international agreements, such as the United Nations Framework Convention on Climate Change (UNFCCC), dealing with emissions of greenhouse gases, and the Basel Convention, which addresses trans-boundary movements of hazardous waste, impose specific requirements for waste management and promote sustainable development that is pollution free.

South Africa's reintegration into the global economy and the southern African political arena necessitates an improved pollution and waste management system. The country's economic and industrial policy has also turned towards export promotion as a pillar of South Africa's economic development. Therefore, the country has growing obligations to meet international commitments and to be a globally responsible country. The government therefore promotes an integrated approach to pollution and waste management as a key factor in achieving sustainable development.

Some of the international treaties to which South Africa is party relate specifically to the pollution of water, air and land environments; others are of a cross-cutting nature and impact on all three environmental media. To date, more than 26 international agreements pertain to integrated pollution and waste management, 19 of which have been acceded to or ratified by South Africa. Of relevance to waste management include:

- Prevention and Combating of Pollution of the Sea by Oil Act (No 6 of 1981) and regulations
- International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties Act (No 64 of 1987)
- Dumping at Sea Control Act (No 73 of 1980)
- Prevention of Pollution from Ships Act (No 2 of 1986) and regulations
- Conservation of Agricultural Resources Act (No 43 of 1983)
- Nature Conservation Ordinances of the various provinces
- Antarctic Treaty Act (No 60 of 1996)
- Nuclear Energy Act (No 113 of 1994)
- National Water Act (No 36 of 1998)
- Environmental Conservation Act (No 73 of 1989)
- National Environmental Management Act (No 107 of 1998).

In addition, the Environmental Management Policy for South Africa sets a number of objectives for integrated pollution control and waste management system. The objectives include:

- Promoting cleaner production and establishing mechanisms to ensure continuous improvements in best practices in all areas of environmental management.
- Preventing or reducing and managing pollution of any part of the environment due to all forms of human activity, and in particular from radioactive, toxic and other hazardous substances.

- Setting targets to minimize waste generation and pollution at source and promoting a hierarchy of waste management practices, namely reduction of waste at source, reuse and recycling with safe disposal as the last resort.
- Regulating and monitoring waste production, enforce waste control measures, and coordinating administration of integrated pollution and waste management through a single government department.
- Setting up information systems on chemical hazards and toxic releases and ensuring the introduction of a system to track the transport of hazardous materials.
- Ensuring the protection and proactive management of human health problems related to the environment in all forms of economic activity.

The integrated pollution and waste management policy is driven by a vision of environmentally sustainable economic development. This vision promotes a clean, healthy environment, and a strong, stable economy. By preventing, minimizing, controlling and mitigating pollution and waste, the environment is protected from degradation by enhancing sustainable development. By increasing the use of cleaner production technologies, avoiding accidental and operational releases and reducing the non-productive costs of treatment, disposal and clean-up, a more efficient and competitive economy and a healthier environment will be established. The South African government is committed to a programme of sustainable development that will deliver basic environmental, social and economic services to all, without threatening the viability of natural, built and social systems upon which these services depend.

3. Waste management practices in other countries

A review of waste management trends and practices in other similar developing countries indicates that many of them are looking towards innovative solutions to the problems of inadequate and inefficient services provided by government authorities. Numerous examples of the involvement of the private sector in service delivery, the informal sector in waste recovery and private individuals in recycling and composting initiatives, points to the realization that an effective service can be provided at reasonable cost whilst at the same time providing job creation opportunities and alleviating poverty.

Importantly, reference must be made to basic waste management systems, the Waste Management Hierarchy, appropriate priorities and sustainability of the services rendered, the Principles of ''Proximity'' and ''Regional Self Sufficiency'', and the ''Best Practical Environmental Option'' (BPEO). In order to ensure the sustainability of waste storage, collection and disposal services, the Integrated waste Management Programme (IWMP) must recognize local needs and prioritize accordingly, and ensure the use of appropriate technology, which ties in with the BPEO approach. In addition, the IWMP must always make provision for the

development of waste minimization, resource recovery and treatment, and job creation, when and where appropriate.

In addition to implementing basic waste management systems, as shown in Figure 2, there is a need to develop appropriate philosophies and ethics in the evolution of waste management practices. These logically address the reduction of waste generation by prevention and minimization, through efficient production methods and use of resources. The waste stream is also reduced through resource recovery. Finally, hazardous wastes are treated prior to final disposal to reduce the associated risks. All these elements are included in the internationally recognized Waste Management Hierarchy.

Integrated Waste Management can be considered to be a different concept to the Hierarchy of Waste Management as it evaluates the mix of technologies that are appropriate to the waste stream that is being examined. In fact Life Cycle Assessment approaches are more and more being considered as they tend to lead to the development of more sustainable waste management policies, appropriate and achievable goals.

Key principles, actions and suggested tools for public-private type partnerships in waste management are available from similar countries that can be readily adapted to the South African situation (Figure 3).

4. Waste management practices in SADC

In terms of the Bank's area of operations and its sub-regional and regional context within Southern Africa development Corporation (SADC), various country reports were reviewed to determine the current waste management situation with SADC. It was found that a number of initiatives have, at various times in the past 5 years, been

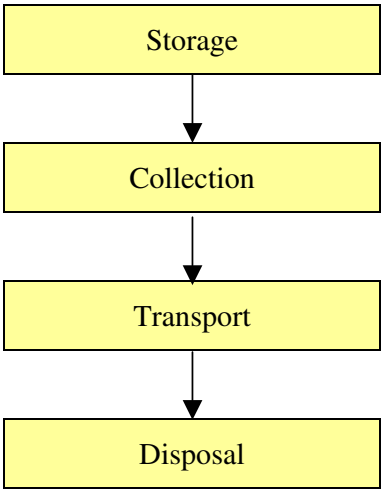

Figure 2. The elements of a basic waste management system.

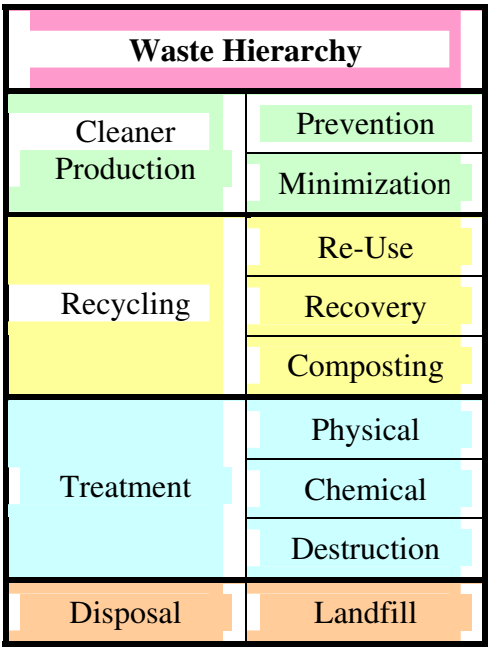

Figure 3. Hierarchy of waste.

put in place to facilitate the development of waste management plans and improved services. These primarily include for the upgrading of collection systems and waste disposal sites. Various initiatives also included composting and recycling with a view to job creation and poverty alleviation.

Most of these initiatives have been funded or managed by external donor funding agencies such as GTZ, Danced and Danida. A broad review of the various SADC countries shows that in most cases the development of Waste Management Plans has not been successful due to issues of sustainability arising from the lack of capacity and financial resources. There also appears to be a lack of political willpower, in most cases, to drive these initiatives and to ensure the successful outcome of related projects.

Analysis of waste generation in SADC countries including South Africa, shows that understanding the continuum of waste from source to final stage is critical to process and product innovations. For example, the role of waste segment generators is shown within the concept of ''cradle to grave'' from initial product conception through to final disposal (Department of water Affairs, 2001a b c d). This enables planners and decision makers to strategically establish relevant mechanisms for efficiency, effectiveness and sustainability (Figure 4).

The schematic presentation of the full waste cycle shown above (product conception, generation, transportation and dissemination, pre-treatment, disposal) indicates potential opportunities for DBSA investment in environmental infra-structure. This includes investment in capacity building for waste management and

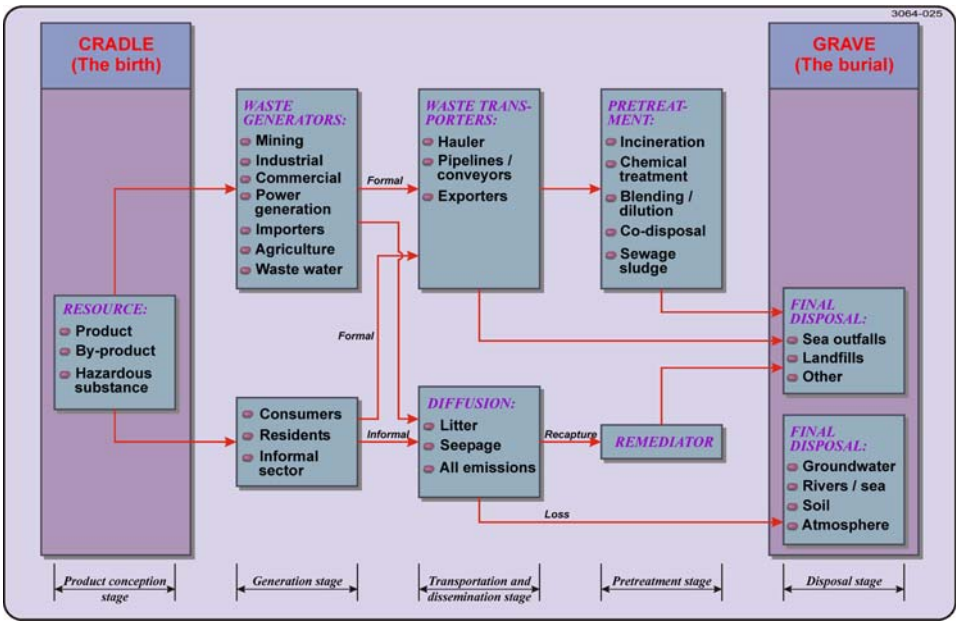

Figure 4. Waste cycle.

recycling. Waste management activities are mainly handled by municipalities most often constrained by capital, human capabilities and institutional abilities that contribute to huge service back-logs.

However, as an example, it would appear that outside of South Africa, Botswana has been the most successful in implementing a basic waste management system in terms of legislation, planning and infrastructure development. A number of up-graded and new waste disposal facilities have been developed together with an awareness campaign which has been successful in involving local communities. An active Chapter of the Institute of Waste Management of Southern Africa has also been instrumental in raising waste awareness in Botswana and has the active support of the First Lady who is also a Patron of the Botswana Chapter. The Botswana Chapter also hosts a biennial waste management conference which attracts delegates from most of the SADC countries. This conference usually provides a vibrant forum for waste management practioners across the spectrum, to discuss issues of mutual concern and to bemoan the fact that there is generally a serious lack of capacity and financial resources to carry out effective waste management planning and implementation. Despite Botswana's success, there is still scope for further planning and infrastructure development.

An opposite extreme would be the example of Swaziland, where despite the development of a national waste management strategy (funded by DANCED/DANIDA) over a period of some 3 years and which was completed in 2003, there has been no further progress in terms of the implementation thereof. The reasons

cited once again include lack of capacity and financial resources. It would appear that there is also a lack of political willpower in concluding the implementation.

Countries such as Mauritius have developed waste management plans which, in turn, have focused solely on the collection and disposal aspects of waste management and have ignored the other elements such as waste minimisation, treatment, recycling etc, which would form the basis of an appropriate Integrated Waste Management approach. In reviewing the SADC countries, it would appear therefore that a lot of potential exists for the development and implementation of IWMPs subject to the necessary political will.

5. What is zero waste? a strategy to reduction and minimization of waste

The South African, Polokwane Declaration on Waste Management of September 2001 has as a goal, to ''Reduce waste generation and disposal by 50 and 25%, respectively by 2012 and develop a plan for *ZERO WASTE* by 2022''.

The Polokwane Declaration also reaffirms a commitment to the Integrated Pollution and Waste Management Policy, the National Waste Management Strategy and the principles of waste minimization, reuse and recycling for sustainable development.

Although the definition of Zero Waste is hard to come by, and is not spelt out in the above declaration, the most commonly understood definition or perception of the concept of Zero Waste appears to include for the minimization of waste generation, the reuse and recycling of waste, and hence the diversion of waste away from landfill or incineration. This approach concurs with Nirmala Nair philosophy of *''Nature does not produce waste. In nature, the waste of one organism or process becomes the food for another''*.

It is therefore clear that wastes should be regarded as a resource and sustainable development solutions should be sought in terms of their reuse and recycling.

> Zero Waste is a goal that is both pragmatic and visionary, to guide people to emulate sustainable natural cycles, where all discarded materials are resources for others to use.
>
> Zero Waste means designing and managing products and processes to reduce the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them.
>
> Implementing Zero Waste will eliminate all discharges to land, water or air that may be a threat to planetary, human, animal or plant health. (Zero Waste International Alliance, 2004)

6. Opportunities in the waste management sector

Certain municipal services, primarily waste-water treatment and solid waste disposal (landfills) generate significant amounts of methane gas which enter the atmosphere. Methane is a local pollutant and a powerful greenhouse gas (GHG) globally and is one of the gases targeted for reduction under the Kyoto Protocol to the United

Nations Framework Convention on Climate Change (UNFCCC). Methane is also a source of energy and is the main constituent of natural gas. The reduction and use of methane therefore has the dual benefits of removing a pollutant while harnessing its energy content productively.

Reductions in methane emissions are not only beneficial to the environment they also offer municipalities the potential for new sources of revenue and investment. Under the Clean Development Mechanism (CDM) of the Kyoto Protocol methane reductions can give rise to the generation of certified emission reductions (CERs), commonly known as carbon credits. The sale of these credits, coupled with revenue from the sales of methane as an energy source, can be used to finance infrastructure improvements and potentially provide a new source of income to local authorities.

Methane, as a constituent of biogas or landfill gas and historically viewed simply as a hazardous waste gas, has the potential to be a new resource for South African municipalities. It is important to demonstrate the new opportunities made available to municipalities by carbon finance and the scope that municipalities have to simultaneously meet domestic environmental and energy targets and benefit financially under the emerging global emissions trading regime.

The Clean Development Mechanism (CDM) established under the Kyoto Protocol provides an opportunity for projects in developing countries that can reduce greenhouse gas emissions to attract financing or technology investment from industrialized country companies in exchange for carbon credits, formally known as Certified Emissions Reductions (CERs). One CER is equivalent to one ton of carbon dioxide equivalent reduced. The CDM was established under article 12 of the Kyoto Protocol (UNFCCC, 1997). The Protocol states in article 12 (3) that under the CDM:

> (a) Parties not included in Annex I will benefit from project activities resulting in certified emission reductions; and
>
> (b) Parties included in Annex I may use the certified emission reductions accruing from such project activities to contribute to compliance with part of their quantified emission limitation and reduction commitments under Article 3, as determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

Methane reduction projects are particularly attractive under the CDM since methane is 21 times as powerful a greenhouse gas as carbon dioxide thereby generating 21 CERs for each ton of methane reduced. There has been much interest recently in developing LFG reduction projects as CDM projects in South Africa, led by eThekwini Municipality that is developing such a project in collaboration with the World Bank's Prototype Carbon Fund.

The certified emission reductions are the commodity that is generated from the CDM component of the project. These certified emission reductions can then be sold or traded internationally to buyers who require such certificates to offset their own greenhouse gas reduction commitments. Such buyers include institutional purchasers, such as the Prototype Carbon Fund of the World Bank, brokers, utilities and firms, and some national governments, such as the Dutch and Danish Governments.

Because the CDM is still in its early stages there is not yet a highly liquid market for certified emission reductions and most sales of certified emission reductions happen on a bilateral basis under a contract between a seller, the project owner, and a buyer. In some cases these transactions are facilitated by brokers.

In order to participate in the CDM, a country must be a Party to the Kyoto Protocol. South Africa acceded to the Protocol on July 31, 2002 and hence is eligible to host CDM projects. The Conference of the Parties to the UNFCCC also decided to facilitate a prompt start for the CDM, allowing certified emission reductions to be obtained starting with the year 2000. Despite the fact that the Kyoto Protocol has not yet come into force the UNFCCC has established the international mechanisms for the CDM, and countries and private organizations are actively participating in the mechanism globally.

The CDM has significant potential for municipal greenhouse gas reduction projects in general, and methane reduction projects in particular. Because of the ability to turn emission reductions into a saleable commodity the CDM has the potential to transform the environmental problem of methane emissions into the resource of certified emission reductions. Revenue generated from the sale of certified emission reductions can be used to improve infrastructure and operations at the local level.

There are two significant areas of municipal infrastructure that typically generate significant quantities of methane – anaerobic waste-water treatment and solid waste landfills. In brief, however, it is apparent that the types of waste-water treatment works and waste disposal sites typically found in the medium to larger municipalities combined with the typical operating parameters under which these are managed gives rise to a situation where significant methane reduction potential exists.

In addition to direct revenue from the sale of certified emission reductions, CDM projects are likely to make a number of alternative uses of methane possible that would otherwise not be financially viable. In many cases there is the potential for additional revenue streams that will accrue to the municipality from the sale of the methane or energy derived from the gas. These new revenue streams can be used in supporting the waste management functions of the municipality or other service provision requirements.

A series of guidelines to assist Local and District Authorities in the implementation of the National Waste Management Strategy (NWMS) have been, or are in the process of being developed. During the development of the NWMS, it became clear that areas that were densely settled (where there were more than 5000 households in an area with more than 10 dwellings per hectare [10 000 m^2]) and un-serviced areas, (which had inadequate or failed services, or no rubbish collection service at all), needed special attention. There is a need to introduce appropriate collection and transport systems for general waste in such high density and un-serviced areas.

Transportation of wastes can be broadly split into two categories, including collection at source and the transportation thereof either to a transfer station or directly to a disposal site, and long haul transportation from transfer stations to disposal sites (landfills). A need exists for the uplift of poorer communities in provided proper

waste collection systems and this in turn presents an opportunity for job creation and poverty alleviation.

Municipalities play a fundamental role in managing development and the delivery of essential services to the people of South Africa. The way they carry out their functions directly affects people and the environment in which they live. Local and district municipalities must be able to make choices that will promote sustainable living, especially in the area of managing household rubbish and waste from other sources.

A municipality must be able to set up effective and efficient waste collection systems within its area of jurisdiction and in order to do so must know the quantities and types of waste that are produced in an area; what equipment is appropriate; what management systems will be most effective, what is required to educate communities receiving the service to use the service correctly and pay for it and what systems are most suitable for outlying rural areas. Communities have a crucial role to play as well in working with their local municipality towards managing waste as effectively and efficiently as possible. They must also take responsibility for cleanliness in their own environment.

Municipalities have the responsibility of collecting waste within their municipal area in terms of the Municipal Systems Act (Act 32 of 2000) and the Health Act (Act 63 of 1977). It is also their responsibility to enforce existing litter laws (Environment Conservation Act 73 of 1989) and to ensure that litter is cleared from the streets so that it does not pose a health hazard. Every Municipality is now required in terms of the Municipal Systems Act to prepare an Integrated Development Plan. One of the elements of this is the requirement for an Integrated Waste Management Plan which, in terms of the National Waste Management Strategy, must implement the hierarchical management of waste with emphasis on waste avoidance and minimization, through to responsible disposal. The IDP is the cornerstone for municipal service delivery.

There are many different ways to collect waste. Each way combines the essential elements in different ways in the following elements:

- Primary collectors carrying waste from source to collection points (Secondary Collection Sites)
- Collection and loading of the gathered up waste from the Secondary Collection Sites
- Transport of the waste from the Secondary Collection Sites to the Disposal Site/s

Sometimes these three elements are combined into one e.g. labourers might collect waste directly from source (e.g. road verges) and put it into the collection vehicle, which transports it directly to the disposal site. Additional elements (which could be added to the service) include:

- Street sweeping and litter-picking
- Cleaning of open storm water drains

- Cutting of road verges
- Cutting of open spaces
- Clearing of storm water catch-pits

In all the cases noted above, this service can be provided by outsourcing or by the municipality itself (''in-house'' service), or by a combination of the two. (For example, contractors might collect and take the waste to the secondary collection site. The municipality would collect and transport the waste by vehicle from there to the disposal site).

Should there be any hazardous or medical waste generated in the area, this must be provided for in the collection system, either with a completely separate service, or as a separate component of the general service. In most cases, the collection and disposal of hazardous or medical waste is outsourced to specialist contractors.

Primary collectors transport the waste to secondary collection sites in one of the following ways:

- Carry by hand
- Wheeled bins
- Handcarts or other trolleys

Collection from secondary collection sites is done by vehicle. The vehicle can vary from a half ton Light Delivery Vehicle (LDV) to a large compactor vehicle, and includes tractor–trailers, tipper trucks and other modified trucks.

When choosing the most suitable vehicle, many factors can directly affect the choice of vehicle. These include:

- *Terrain and road access conditions* – the condition of access roads (or lack of them) will obviously be a limiting factor on any choice. There are some informal areas that can only be serviced by tractor/trailer combinations. Other areas have good surfaced roads, but space and turning limitations due to the width of the roads mean that large compactor vehicles cannot be used.
- *Waste density* – waste density can vary greatly, but is generally much higher in poorer, informal communities, where a larger proportion of the waste is ''wet'' organic waste, such as vegetable peels. The density of waste generated can significantly affect the choice and viability of a compactor vehicle. The choice of vehicle size and power must also be suited to the waste density.
- *Waste type* – waste in informal areas is often both abrasive (sand and ash) and corrosive (decomposing food or vegetable matter), requiring the use of robust and easy-to-maintain vehicles.
- *Service frequency and waste generation rates* – how often the area is to be serviced and the speed at which waste is generated in an area will determine the vehicle productivity and load speed choice.
- *Haul distances to landfill/transfer station* – how far and how often waste has to be transported to the disposal site will also determine vehicle type. For example, a tractor/trailer combination will be completely unsuitable where frequent, long

trips to a disposal site are required whereas a mobile compactor vehicle would be appropriate.
- *Crew size for loading/unloading* – for example: non-compaction vehicles require a larger crew than compaction vehicles.

It is obvious from what has been discussed above that there are many different ways of combining methods to manage waste. Possible alternative collection systems need to be identified and evaluated. The municipality must assess its own capacity to evaluate these systems. Specialized companies could be employed to do the evaluation, or other municipalities may be asked to help. Essentially, the municipality has a choice of three broad options:

- *Municipality to provide the service (''In-house'' option)* – In this instance the municipality opts to provide all the resources (labour, equipment and plant) necessary for the service. This may be the best option where the municipality has existing resources available. Alternatively the municipality must employ additional staff, and purchase all (or extra) vehicles and equipment. Political pressure or municipal policies may also dictate the use of this option
- *Community Collection programmes* – in this instance the municipality works together with the community. The community itself undertakes the primary collection, with the municipality undertaking (or contracting out) the disposal of waste from the secondary collection sites. The municipality may also provide basic tools and equipment to the community. This requires a high level of education and involvement from the municipality.
- *Awarding contracts to individuals or contractors (''Contracted Out'' option)* – in this instance, the municipality contracts out all or part of the service to a private contractor. The size and nature of the contract can vary greatly, from individual ''one-person'' contractors doing primary collection from a small number of houses, to major contractors providing a full service, including collection, transport and disposal. This option is often considered where the municipality has no resources of its own, and does not wish to develop a new department to undertake this service. This can be a cost effective option.
- *Combination of the above* – a system that incorporates some, or all, of these options, may be the most effective way to provide the service.

There is huge interest in many communities in individuals starting their own businesses. Any call for tenders will elicit a great response, especially from potential contractors with little experience. The municipality must decide if they wish to stipulate minimum criteria for tenderers to qualify to tender.

Such criteria should allow emerging contractors the chance to start their own small enterprise but should also require some capacity in the potential contractor in terms of experience, possibly as a subcontractor on a similar contract.

Restricting tenderers to a particular community or region is a frequent cause of conflict (sometimes giving rise to legal challenges), and is better handled by awarding

preference points to preferred groups. This is specifically allowed for in the Preferential Procurement Policy Framework Act.

Essentially, a more open policy would ensure that the widest possible audience is made aware of any tender. A series of workshops could then be held to explain the implications of taking on this sort of enterprise. Adjudication criteria, which would eliminate unsuitable tenderers, would be spelt out at this stage.

7. Financing waste management for sustainable development

The financial factors that will influence the choice of collection and transport system for effective waste management in South Africa include:

- Capital costs of each alternative – finance required to start the system up
- Operating costs of each alternative – finance required to keep the system running
- Costs of supervision and monitoring – finance required to make sure the system operates correctly
- Expected tariff recovery – anticipated costs which may be recovered from the community (either through new charges or additional charges to existing rates)
- Possible cross-subsidization – higher charges which may be recovered from business or industry to make charges to communities lower.

However, opportunities exist for providing financial assistance by way of loans or grants to facilitate the establishment of waste management collection and transport systems to either municipalities (who require assistance) or to assist private individuals or companies in establishing new businesses.

Financing of waste management in South Africa has been at ad hoc basis. For example, DBSA has financed a few projects in Western Cape on a loan arrangement to rehabilitate the Libertas and Harrismith landfills and on a grant basis to provide technical assistance for the development of integrated waste management plans for Nketoana, Setsoto and Tswelopele. If there was a systemmatic Waste Management programme at DBSA, a lot more could have been done in the country and contributed to job creation, income generation and environmental management activities. Due to the extensive nature of the waste management sector in South Africa and the various opportunities that are presented in terms of job creation and the alleviation of poverty, the DBSA is in a unique position where it can positively contribute in terms of its financial role in support of the National Waste Management Strategy.

Traditionally, and in terms of the Municipal Systems Act (No32 of 2000), the management of all domestic wastes (general waste) has been the responsibility of local authorities. However, it is a well known fact that except for some of the larger metropolitan municipalities with larger resources, that most local authorities lack sufficient resources in terms of skills and in particular, financial resources, to carry out effective waste management programmes. Waste management with respect to

general waste (domestic wastes) is therefore, by and large, funded out of rates and taxes collected by the local authorities. Due to the extraordinary demand on municipal financial resources for the provision of infrastructure including housing etc, the available financial resources set aside for waste management is woefully inadequate. This is an area that presents an ideal opportunity for the DBSA in terms of investment in accordance with a well prepared integrated waste management plan.

The management of hazardous wastes has likewise been the responsibility of the private sector including industry. This has over the years led to a situation where very few players have entered the market due to the high entry level and the ever changing regulatory environment which has increased standards in the industry over the last 15 years with significant effect. The waste management companies in this sector have been financed mainly by the commercial banks. As a result of increased standards and a need to be profitable, the cost of hazardous waste management has risen significantly over the last decade.

Waste minimization and recycling initiatives have been funded by local authorities and the private sector to a limited degree. Generally, these initiatives are or have been funded with grant money, limited municipal budgets or international agency grant funding such as DANCED, GTZ, DANIDA and have not been sustainable. These programmes are, in general, run by NGOs and CBOs and require grant type funding in order to survive. There are a few private sector initiatives where commercial companies that are of small scale in nature carry out recycling operations with varied success due to the vagaries of the recyclables. This is an area which probably represents the best opportunities for investment by the DBSA in the creation of job opportunities and the development of SMMEs.

The DBSA has been involved in a varied number of waste management and related projects ranging from knowledge sharing, through capacity building to the support of local authorities for IWMPs and the provision of waste management infrastructure/facilities such as the upgrading or development of landfill sites. A brief description of recent projects and their current status is presented in the following Figure 5.

There have also been requests for funding from the private sector for the development of high technology hazardous waste treatment facilities such as the EQ Plasma project and the Seane medical waste microwave disposal facility. In cases such as these it is difficult for the DBSA to assess the viability of such projects particularly in terms of the technology, which may or may not be proven internationally and may not be financially viable in terms of the local market. The long term viability of these projects is of significant importance when determining what is considered to be best international practice and the changing environmental legislation in the context of cost-benefit analysis.

Effective management of waste has cost implications. At municipal level where waste is managed, least-cost option approach is applied regardless of potential social benefits likely to accrue from better waste management practices. Given the broad acceptance of cost-benefit analysis and its broad applicability as a tool to assist financial institutions such as DBSA, it is necessary to apply cost-benefit analysis in

TYPE OF DBSA SUPPORT	PROJECT EXAMPLES	STATUS
Knowledge Sharing – DBSA as advisor/partner - this ECBU provides inputs into policies at local, regional and national level by bringing case studies to policy makers and helping ensure policies are effectively dealing with needs in the EC province and other provinces with similar needs	Participation in the national stakeholder team advising DWAF on the development of national guidelines for Marine Outfalls in SA.	Complete and policy in operation
	Participate on the national committee Reviewing the Minimum Requirements for Waste Management	Draft complete and undergoing updates regarding the changed role of DEAET and DWAF
DBSA as a ***loan finance*** provider	Buffalo City (East London) landfill site	In implementation
DBSA as a ***grant finance*** provider – EC Business Unit Budget for Hot Spot areas (goes beyond the mandate of ordinary DBSA grant finance)	Grant funded NGOs and Municipalities from the EC to participate fully in the international IWM conference held at Sun City in 2004. This was done in the form of a partnership with the IWMSA	Completed with success
DBSA as ***grant finance*** provider for Technical Assistance under the ECBU budget.	Grant Funded a contribution towards an IWMP for Ndlambe Municipality	This project was approved but as yet has not been implemented as the municipality is still seeking additional funding from other sources – 2004
	Grant Fund for an IWMP for Kouga Municipality	Project positively appraised by DBSA project team and Unit but project turned down by Executive Management as it was not the type of project that should be funded under ECBU technical assistance budget – 2004. New directive to process these through the DF budget for capacity building.
DBSA ***grant finance*** provider for Capacity Building Assistance under the Development Fund budget.	Grant Fund for Elundini Municipality IWMP	In implementation – progress slow and DBSA advice in implementation sought at every stage e.g. drafting the tender, the advertisement, the selection process etc. This is due to little personnel involved in IWM and total over commitment of municipal personnel. The project stopped as municipality top management were suspended and DBSA contract in implementation was legally made null and void and project transferred to District Municipality

Figure 5. DBSA involvement in waste management.

appraising waste management projects, programmes and policies. At the present time, DBSA has not applied this tool to assist in decision-making in relation to financing waste management projects other than dependent on investment officers'

TYPE OF DBSA SUPPORT	PROJECT EXAMPLES	STATUS
	Grant Fund for Ukhahlamba District Municipality IWMP	In implementation – progress slow as municipality has limited personnel in the field of Environmental Health and Waste Management. One person does everything and waste management is just one of many functions he has and he is totally overloaded. DBSA provides ongoing support required to help draw up terms of reference etc.
	Grant Fund for Chris Hani District Municipality IWMP	In Implementation
	Grant Fund for Alfred Nzo District Municipality	Project approved at ECBU level but stopped at Executive Management Level as DF changed approach regarding funding IWMPs. This is now the subject of debate.
DBSA ***grant finance*** provider for Capacity Building Assistance under the Development Fund budget.	Grant Fund for Tambo District Municipality	In appraisal stages - This is now subject to the outcome of the above debate – alternative route is to retry TA ECBU budget grant funds.
	Grant Fund for Cacadu District Municipality	In appraisal stages until further notice regarding outcome of above debate. Alternative route is to retry TA ECBU budget.
DBSA ***partnerships and linkage*** with other organizations such as MIIU.	Grant Fund for PPP for Makana Municipality	Still in appraisal stage with MIIU contribution. DBSA contribution complete and project first phase completed – Makana LEAP.
Special projects, for example, the WSSD provided a unique opportunity for DBSA to support legacy projects and the ECBU participated in this although these projects took place in Gauteng.	Project managed the "Zero Waste Project" for Greening the Summit for the Nasrec Site (NGO sector of the Summit)	Completed successfully
	Project managed the Green House Project which involved reuse and recycling of waste products and a case study in asphalt and construction waste material reuse and recycling.	Completed successfully
DBSA as a ***loan finance*** or provider	Harrismith Landfill (Libertas site)	Permitted 1997. Ongoing monitoring of site management.
DBSA ***grant finance*** provider for Capacity Building Assistance (Free State BU)	Technical assistance grant for 5 municipalities in the Free State for IWMPs.	Current

Figure 5. Continued.

judgments. Application of cost-benefit analysis will assist DBSA in identifying investments and cost gaps in the waste management sector.

Application of cost-benefit analysis contributes to effective interpretation of different attitudes to investment risks that can be complemented by considering non-quantified costs or benefits realized from the efficiency of projects, programmes, policies or regulations. The application of cost-benefit analysis to appraise Bank's projects will enhance:

- Ability to aggregate impacts from various waste streams into monetary measure of net benefits associated with development impacts;
- Responsibility in providing support for transparency and resulting into accountability of projects, programmes and policies;
- Capability for provision of consistent framework for data collection on waste streams; and,
- Support to identification of gaps and uncertainties in knowledge necessary for effectiveness and efficiency towards achieving sustainable development impact.

With the significant lack of resources in the waste management sector both in terms of capacity (skills) and financial, there is an ideal opportunity for the Bank to provide support and form partnerships with appropriate institutions in order to achieve the objectives and address challenges raised by the National Waste Management Strategy. These partnerships could take various forms as defined in the Bank's "Vision 2014: Strategic Guidance on Smart Partnerships" (draft, July 2004).

The strategic thrust of these *smart partnerships* is driven by the central imperative facing DBSA – the need to address massive infrastructure and human resource gaps in the country and region that neither it, other public sector institutions nor the private sector can tackle on their own. Notably, there is growing pressure on the Bank to address wider complex and interconnected socio-economic and environmental issues.

8. Conclusion and recommendations

In South Africa, the private sector is doing a lot more in the waste management sector especially in recycling. This is done because of the incentives and existing demand from the packaging industry that to some extent has to comply to international standards that require the industry to meet certain environmental criteria. At grassroots level there are *ad hoc* initiatives through NGOs and CBOs that encourage waste separation and recycling to generate income and employment for poor communities and contribute to cleaning up of the environment.

Issues of concern and lessons that have been identified and require significant attention in development of Integrated Waste Management Planning include recognition and support of community waste management and servicing as well as trans-boundary effects on environmental quality. There is a need to enhance private and public sector partnerships in waste management initiatives. Therefore, support

to capacity building is critical to strengthening institutions and legislative framework that would encourage effective waste management systems.

In addition, consolidated asset management has been deliberated as a concept with potential and opportunities for effective and efficient system of managing waste. There has always been an issue of cost-recovery from waste management system that municipalities and other operators find difficult. For instance, in recycling initiatives, more energy may be consumed than the business as usual practice and recovering cost prove un-economical although environmental friendly. Other situations relate to treatment of raw sewage and efficient sanitation as well as disposal of hazardous waste from ICT and transportation of hazardous waste to safety site are costly.

A range of opportunities therefore present themselves, in terms of *capacity building* and *skills transfer* within the following spheres of activity:

- Education and training – bursaries and research grants for tertiary institutions.
- Waste awareness campaigns – local authorities, NGOs and CBOs, short and long term initiatives.
- Capacity building, specifically for NGOs.
- Integrated waste management plans for local authorities – development and implementation – including waste collection, recycling, transportation, treatment and disposal.
- Waste management infrastructure – both local government and private sectors.

Numerous opportunities for the development and support of SMMEs, empowerment initiatives and job creation exist within the above areas.

In terms of a *strategic approach*, it is proposed that the DBSA provide grant funding, project funding and technical assistance as required and focus on the following:

- Education and training (IWMSA training courses)
- Waste awareness programmes (municipalities and NGOs)
- Development of SMMEs entering the waste management market
- Financing municipal initiatives – IWMPs (grant funding) and implementation (loan/project funding)
- Financing private sector projects (loan funding)
- Financing Public-Private Partnerships (PPPs)

Smart Partnerships should also be formed with institutions such as the Institute of Waste Management of Southern Africa (IWMSA) and the National Recycling Forum (NRF) as this would be essential in identifying and prioritizing the needs of the waste management sector. It is recommended that the DBSA commit to providing the necessary partnership and financial support for the waste management sector.

It is further recommended that:

- In assessing or reviewing all waste management projects for support or funding, be it educational or of practical implementation, that a philosophy of *Zero Waste* and sustainability be pursued.

- The Bank should therefore develop an integrated policy and strategy which promotes Zero Waste within the sustainable development framework.
- In order to progress on a way forward, it is also proposed that the DBSA appoint a waste management forum consisting of various stakeholders, including the private sector, government and NGOs, to assist in identifying and prioritizing investment opportunities in the waste management sector.

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