Macroeconomic trends, targets & economic instruments

Mike Goldblatt, PDG

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Disclaimer

Macroeconomic trends, targets and economic instruments

Prepared by Michael Goldblatt of Palmer Development Group (PDG)

August 2009

This research paper has been commissioned as part of the process of preparing a National Waste Management Strategy for South Africa. The views expressed in this paper are those of the researcher only, and do not necessarily reflect the views of either the Department of Environmental Affairs or of the consultant team preparing the NWMS. This research paper has been prepared for the purposes of stimulating discussion and informing debate prior to the commencement of the drafting process. In order to comment on the issues raised in this paper, and for more information regarding the process of preparing the NWMS please visit www.deat.gov.za/waste/

Executive Summary

Effective waste management in both the private and public sector will yield significant environmental gains and will no doubt make a pivotal contribution to sustainability. South Africa's challenges with respect to waste management go beyond the environmental, and it is important to consider economic aspects of waste management and mechanisms for ensuring that both environmental and economic benefits are realised.

This paper begins with an overview of the size and economic contribution of the waste sector in South Africa from both the private and public perspective. While the lack of data presents a problem in terms of providing an accurate picture of the sector in this regard, it is estimated that the total annual expenditure on solid waste management in South Africa is approximately R10 billion per annum. An approximation is that about 70% of this expenditure is through the public sector, largely local government, while 30% is private sector expenditure. Looking specifically at the role of the recycling industry, the research shows that this area of activity contributes positively to job creation and GDP, although accurate data on the formal and informal contribution of the industry remains a gap in South Africa.

The paper explores the role of the public sector in terms of its contribution to employment and expenditure, observing that local government employ over 20,000 people in municipal waste departments across South Africa. However, many of these employees are located in lower category jobs and there is a need to improve the level of capacity at the management level. In terms of revenue for the waste service, the paper finds that many municipalities fail to set appropriate tariffs for both waste collection and disposal, which places constraints on the financial sustainability of the service.

A review of regulatory instruments explores the value of both Control and Command (CAC) and Economic Instruments (EIs) in addressing market failures and ensuring that the private and social costs associated with waste generation are covered. While there is arguably a role for the use of EIs in the waste sector of South Africa, these need to build upon a strong foundation. This research therefore proposes that a first stage in the process of improving the economic aspect of waste management be aimed at 'getting the basics right' and 'getting the prices right'. Included in this process is the need for improving the enforcement and monitoring of current Control and Command mechanisms at all levels of government, improving the quality and access to data in the waste sector, improving capacity and ensuring that accurate cost accounting and financial viability assessments take place in order to address the sustainability of waste service provision.

This paper argues that EI's may improve waste management, but traditional CAC instruments should be complemented by the use of EI's as part of a multi-pronged strategy to achieve the objectives of waste reduction, re-use and recycling. Before implementing the EI's a process of evaluation of the appropriateness of the instruments needs to take place and it is proposed that this be informed by the National Treasury Environmental Fiscal Reform policy framework.

This research paper considers specific options for incentives in South Africa, including waste disposal taxes, enforcement fines, deposit refund schemes and product input taxes. The research concludes with the proposal of a pathway to economic efficiency in the waste sector of South Africa. Included in this pathway are the processes of addressing financial sustainability, full cost accounting and pricing of solid waste services, the evaluation of the full social and environmental costs as well as the establishment of administrative systems to support the improvement of waste management. A thorough evaluation of the appropriateness of EIs should be undertaken to ensure that these are suitable and implementable in the current context.

Table of Contents

Executive Summary 1

1 Introduction and Objectives 7

1.1 Methodology and Research Process 8

2 Nature and Size of the Waste Industry 8

2.1 Waste Management as an Economic Sector 8

2.1.1 Number and scale of waste management companies 9

2.1.2 Municipal solid waste – economic indicators 9

2.2 Recycling Industry 12

2.2.1 Economic Value 17

2.2.2 The role of the informal (recycling) sector in meeting targets 12

2.2.3 Summary of socioeconomic impact of the waste sector 21

2.3 The contribution of the mining and agriculture industries 22

2.4 The role of the public sector 24

2.4.1 Characteristics of waste management in South Africa 24

2.4.2 Constraints facing municipal solid waste management 25

2.5 Improving waste management in South Africa: Identification of areas for regulation and support 29

2.5.1 Improving economic efficiency in waste collection and disposal 29

2.5.2 Application of economic analysis 30

2.5.3 Waste Tariffs 30

2.5.4 Targeting market failures 32

2.5.5 Industrial policy 33

2.5.6 Economic regulation 33

3 Regulatory Instruments 33

3.1 Command and control 34

3.2 Economic Instruments 35

3.2.1 The use of EI's in mining – findings from literature review 41

3.2.2 The use of EI's in agriculture – findings from literature review 43
3.3 Developing a solid foundation for effective regulation in South Africa 43
3.3.1 Improving data access 44
3.3.2 Improved enforcement and creating a culture of compliance 44
3.3.3 Building capacity in the sector 44
3.3.4 Supporting voluntary initiatives 45
4 Framework for the implementation of economic instruments 45
4.1 Legal parameters 45
4.2 National Treasury Environmental Fiscal Reform Policy 47
4.3 Additional factors influencing instrument choice 50
4.3.1 Balancing environmental and economic gains 50
4.3.2 Differentiation of economic instruments by location 50
5 Consideration of Specific Incentives 51
5.1 Waste Disposal Taxes 51
5.2 Enforcement Fines 54
5.3 Deposit Refund Schemes 55
5.4 Product and Input Taxes 56
5.5 Community Based Waste Collection Programmes 58
5.6 Economic incentives for local government 58
5.7 Financial implications of the recommended economic instruments 59
5.8 The role of waste management activities in contributing to a green, low carbon economy 59
6 A Pathway to Economic Efficiency in the Waste Sector 60
6.1 Capacity requirement and cost implications for pathway to economic efficiency in the waste sector 62
References 64
6.2 Websites 65

Table of Figures

Figure 1. Waste sector employment estimates 8
Figure 2 Scale of recycling industry by product 16
Figure 3 Employment in recycling industry by product 17
Figure 4. Identification of EI's 48

Table of Tables

Table 1. Employment in municipal waste management 10
Table 2. Financial census of municipalities 10
Table 3. Estimates of capital investment in the waste sector 11
Table 4. Cost estimates for capital investments in solid waste 11
Table 5. Contribution GDP and employment (2007) 15
Table 6 Total estimated economic impact 18
Table 7 The macroeconomic impact of the recycling industry under different scenarios 20
Table 8. Comparison: recycling industry's economic contribution versus economy as a whole 21
Table 9. Best practice performance of Metros 26
Table 10. Landfills in SA municipalities 28
Table 11. Economic instruments for solid waste management 38
Table 12. Criteria for evaluating and comparing economic instruments for waste management 40
Table 13. Performance of economic instruments against relevant criteria (CSIR analysis) 40
Table 14. CSIR and National Treasury comparison of economic instruments 50
Table 15 Capacity requirement and time frames for action plan 62

1 Introduction and Objectives

Effective waste management in both the private and public sector will yield significant environmental gains and will no doubt make a pivotal contribution to sustainability. South Africa's challenges with respect to waste management go beyond the environmental and it is important to consider economic aspects of waste management and mechanisms for ensuring that both environmental and economic benefits are realised.

According to 2007 figures, 23% of South Africa's labour force is unemployed and nearly half the population are living in poverty. Economic considerations are therefore essential if South Africa is to make headway in achieving the objectives of the Accelerated and Shared Growth Initiative for South Africa (ASGISA). ASGISA's targets include addressing income inequality and maintaining an average growth rate of 6% between 2010 and 2014, alongside a government target of halving unemployment by 2014 (Presidency, 2007).

There are three areas where the application of an economic approach to waste management appears especially warranted. These are the following:

- *Economic potential of waste management*: In a context of high unemployment and poverty there is increasing pressure to stimulate growth, develop an efficient economy and achieve socioeconomic gains. In this context it becomes particularly important to assess the potential of the waste sector to meet economic policy objectives while ensuring that environmental objectives are met.

- *Economic instruments for waste management*: A second, but related, consideration is whether economic instruments (such as pricing interventions, taxes, charges and other market incentives) are appropriate mechanisms for meeting waste management objectives. Motivations for using such instruments would be that they are more cost effective in meeting environmental objectives, or that they meet objectives that otherwise cannot be achieved. These motivations would, however, have to be demonstrated for any particular instrument.

- *Economic evaluation of waste regulation*: It is very important to evaluate strategic options in the sector on cost-benefit grounds. In other words, whether a proposed strategic intervention is likely to have greater benefits than costs. There are numerous examples internationally of well-intentioned but inefficient and costly regulatory interventions in waste management. In the context of a developing country with clear and basic priorities in waste management unnecessarily costly regulatory interventions must be avoided.

This research piece begins with a brief overview of the waste sector in South Africa, looking at both the private and public sectors. The research piece then goes on to discuss potential regulatory instruments, before moving to focus specifically on the applicability of economic instruments in South Africa. The paper does not consider the use of cost-benefit analysis in waste management regulation in any depth but it is hoped that the importance of this is demonstrated in the general approach of the report.

1.1 Methodology and Research Process

The research is in large measure based on secondary research from available literature and data sources, as well as internal Palmer Development Group (PDG) models or data sources. It must be noted that there is a paucity of reliable and comprehensive data in the waste sector in South Africa and the report is limited by this data limitation.

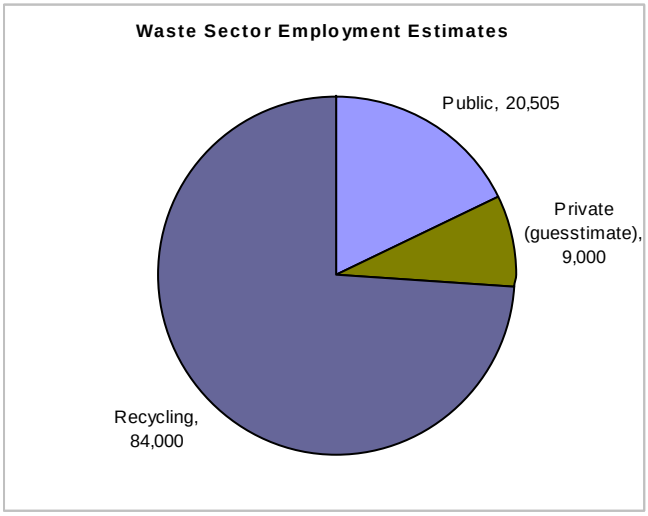
2 Nature and Size of the Waste Industry

This section provides an overview of the context in terms of the nature, contribution and role of the private and public sectors in terms of effective waste management practices.

2.1 Waste Management as an Economic Sector

It is estimated that the total annual expenditure on solid waste management in South Africa is approximately R10 billion per annum. An approximation is that about 70% of this expenditure is through the public sector, largely local government, while 30% is private sector expenditure. It should be noted, however, that some proportion of the public sector expenditure is spent, in turn, on private sector service providers and sub-contractors.

Figure 1: Waste sector employment estimates



The waste sector is not a standard 'industrial' sector and therefore statistical information on value added in the sector is hard to come by. The sector includes transport, and some of the value of the sector would be measured within industrial statistical data. Other components of the sector would be included under the public (municipal) sector, and probably manufacturing (in the case of recycling).

It is similarly difficult to find sound data on employment in the sector. Most unionised workers in the waste sector appear to be within transport sector unions. Other workers in the sector would fall under municipal workers unions, and there are also significant numbers of informal and semi-formal workers in the recycling industry. A rough estimate of employment in the waste industry is provided in the figure[1]. As can be seen in the chart, from an employment perspective the recycling industry dominates the sector (although, as shown later, it is a relatively small portion of the industry in annual turnover).

[1] Please note: private sector estimates are still to be verified.

This rough estimate also hides the very variable nature of the jobs created – those in the supply channels of the recycling industry are likely to be highly insecure, low paid and possibly hazardous, while those in the more formal areas of the industry include a range of workers including many unionised and relatively protected municipal workers and a some semi-skilled and skilled workers.

The private sector plays a particular important role in some components of the sector, most notably the recycling industry, industrial and mining waste management and hazardous waste collection, treatment and disposal.

2.1.1 Number and scale of waste management companies

It is difficult to estimate the exact economic contribution of the sector because of a lack of data hereon.[2]

The two largest private waste management firms in South Africa are Enviroserv and Interwaste. Both companies are listed on the JSE. According to their respective company profiles, Enviroserv employs over 1 500 people and has a market capitalisation of R470 million. The annual turnover for the firm has increased steadily over the last few years, growing from R223 million in 2002 to R267 million in 2004 (www.enviroserv.co.za). Interwaste employs over 500 staff and has a market capitalisation of R350 million. The annual turnover at the end of 2006 was in the order of R250 million (www.interwaste.co.za). Both Interwaste and Enviroserve are focusing significant attention on improving their Black Economic Empowerment (BEE) status. Interwaste reported a BEE participation of only 3% in 2007, but aims to increase this to 26% in the short to medium term. Enviroserve is currently undergoing restructuring with an emphasis on empowerment, aiming to complete this process by the end of August 2009.

Despite the lack of information it is clear that the sector is an important one in terms of turnover and employment aside from its environmental relevance.

2.1.2 Municipal solid waste – economic indicators

Key economic indicators in the municipal sector include employment figures, municipal expenditure and the extent of capital investment in the sector.

2.1.2.1 Employment

National Treasury has identified municipal solid waste management as one of the areas of municipal functioning with the greatest potential for job creation, particularly with respect to unskilled or semi-skilled labour (National Treasury, 2008).

In terms of local government staffing levels, there appears to be a decline in the number of positions available in refuse removal services in municipalities, coupled with an increase in the percentage of vacancies. The table below illustrates the trends over the 2005 and 2006 financial years, showing that in Metros the total number of positions in municipalities declined by 5% between 2005 and 2006, while vacancies increased from 15% to 17% over the same period.

[2] The Institute for Waste Management in Southern Africa (IWMSA) was approached to assist with information in this regard. However, they do not attempt to track the number of private sector firms operating in the waste sector and are not aware of any such database.

In the category B and C municipalities a similar trend is observed, albeit it to a lesser degree with a 1% decline in the number of post and a less than 2% increase in vacancies (National Treasury, 2008). The data covers technical, professional and ordinary posts.

Table 1. Employment in municipal waste management

	2005			*2006*		
Category	**Total positions**	**Positions filled**	**% positions vacant**	**Total positions**	**Positions filled**	**% positions vacant**
Metros	11,073	9,454	14.6	10,491	8,708	17
Category B and C	13,514	12,106	10.4	13,439	11,797	12.2
Total	**24,587**	**21,560**	**12**	**23,930**	**20,505**	**14**

Source: National Treasury,2008

More recent data from StatsSA shows that of the total posts available in waste management departments across all municipalities in South Africa (24 072), 14% were vacant as at the end of the 2006/07 municipal financial year. The total number of posts filled amount to 20 645, of which 92% are full-time appointments, while the remaining 8% of occupied are part-time positions (StatsSA, 2008).

2.1.2.2 Contribution of solid waste to municipal revenue

In 2007/08 municipalities reportedly received a total income of R6.5 billion for solid waste, of which refuse removal charges accounted for R3.476 billion.

According to StatsSA's non-financial census of municipalities, there has been an 8% increase in revenue collected from refuse removal charges in South African municipalities, between 2007 and 2008 (StatsSA, 2009). Compared to the contribution of other municipal services, refuse removal charges typically constitutes a relatively insignificant source of revenue. According to the most recent financial census of municipalities, solid waste contributed just below 3% to municipal income in 2007, dropping slightly to contribute 2.7% in 2008 as shown in the table below.

Table 2. Financial census of municipalities

	2,007		*2,008*	
Income	***R million***	***% contribution***	***R million***	***% contribution***
Refuse removal charges	3,225	2.90	3,476	2.70
Sewerage and sanitation charges	4,474	4.10	4,875	3.80
Property rates received	18,331	16.60	20,956	16.40
Grants and subsidies received	29,244	26.60	35,535	27.80
Water sales	11,595	10.50	12,562	9.80
Electricity and gas sales	25,589	23.20	27,880	21.80

	2,007		2,008	
Income	***R million***	***% contribution***	***R million***	***% contribution***
Other income	17,666	16.00	22,347	17.50
Total income	**110,123**	**100**	**127,630**	**100**

Source: StatsSA P9114 (2009).

2.1.2.3 Expenditure

In terms of expenditure in waste management, employee costs constitute the largest expense in municipalities accounting for 32% of total expenditure in 2007 and 2008. Contracted services also account for a significant proportion of total spend, with municipalities spending approximately 15% of their waste management budgets in 2007 and 14% in 2008 on contractors (StatsSA, 2008).

Other indicators on the operating and capital budgets and expenditure for the solid waste service are discussed in more depth in the research paper on "Cooperative governance, local government and the municipal domestic waste services" by D. Savage.

2.1.2.4 Scale of capital investment in the sector

In terms of the estimated capital investment in the sector the following very rough estimates may assist in providing a perspective of the scale of sunk costs (i.e. costs which cannot be recovered once they have been incurred) in the sector and the capital expenditure required to continue providing the capital base required.

Table 3. Estimates of capital investment in the waste sector

Indicator	***Value (where available)***
Estimated value of permitted landfill sites	*≈ 500 sites @ R50 million/site = R25 billion*
Estimated cost of permitting un-permitted landfill sites	*≈ 1 500 sites @ R20 million/site = R30 billion*
Estimated value of hazardous waste disposal sites	*≈ 30 sites @ R200 million/site = R6 billion*

Data limitations constrain the extent to which we are able to paint a picture of the scale of capital investment. Preliminary research into the costs of landfills and vehicles suggests that these vary significantly by municipality and are influenced by contextual factors. Generating an average cost therefore proves difficult. The table below illustrates some of the cost estimates found:

Table 4: Cost estimates for capital investments in solid waste

Type of capital investment	***Municipality***	***Estimated cost/budget (R)***	***Year***
New landfill (to replace three existing landfills)	City of Cape Town (metro)	433 million	2008/09
Investigate and develop new general landfill	Emfulleni LM (Category B1 municipality)	895,000	2006/07

New landfill	Mbombela LM (Category B1 municipality)	732,462	2005/06
Compactor Truck	Umhlathuze (Category B1 municipality)	1.4 million	2006/07
Compactor Truck	Thaba Chweu Municipality (Category B3 municipality)	760,000	2006/07

2.2 Recycling Industry

2.2.1 The role of the informal (recycling) sector in meeting targets

There are numerous and growing examples of the use of community based collection approaches to both domestic refuse collection and recycling in South Africa. These appear to offer both low cost and efficient mechanisms of delivering solid waste services – especially in smaller municipalities where capital budgets are limited; less dense settlements where there is less need for large compactors; and areas where conventional refuse removal is difficult.

Some examples of these approaches are outlined. In Pietermaritzburg in Msunduzi, a city of some half a million people, an award winning Habitable Environments Partnership has been running successfully over the past four years. Initiated by the Built Environment Support Group the programme now renders services and support to about 4 500 low-income households. The programme involves a partnership between communities, an NGO and local government. Local community based organisations employ people from the community and enter into an agreement with the municipality to provide services. They are then paid for these services. The NGO's role has been to set up the programme, provide facilitation and support to both the CBOs and the municipality. The programme includes household refuse collection and has created employment opportunities for local residents, especially women from families where there are dependents and no breadwinner. 43 people are presently employed. The programme has also helped to forge a co-operative relationship between local government and the community[3].

A similar approach has been carried out in Tembisa/Phomolong in a ward-based refuse collection project in Ekhuruleni. The area was divided into 13 wards and the responsibility for refuse collection was placed into the community's hands. Instead of having a single refuse collection contract, 13 ward-based contracts were issued, which will eventually be renewable every five years. Each ward has a contractor, a monitor, a driver, and 22 cleaners. The project has created 200 more jobs than were generated by the previous refuse contract and about 70% of the cost to render the service is now retained within each ward. In the past, and using conventional methods, 20-30% of the project costs were salaries. This project is more cost effective than a conventional project with a main contractor and monthly cost savings amount to R150 000 - R180 000.

The Centre for Public Service Innovation (CPSI, 2002) noted that the main constraint has been to ensure that contractors have contact with financial institutions to obtain

[3] Centre for Public Service Innovation (CPSI), 2002: *Habitable Environments Partnership Programme, South Africa*, Innova, Issue 3 of 2002.

loans so that they can upgrade and maintain necessary equipment such as refuse compactors and vehicles to ensure a reliable service. The fact that contracts are awarded for a short period of a year makes it difficult for contractors to invest in costly equipment. Once contract periods are lengthened this should improve, however this could then give rise to the potential concern that if small contractors invest in labour-saving equipment, the project's benefit of increasing jobs will be reduced. This could be overcome by initiating a contractual requirement for labour-intensive techniques to be used, and for each contractor to be obliged to employ a predetermined minimum number of workers.

Similar case studies looked at by the Centre for Public Service Innovation included the Long-term Cleaning Project in Oudtshoorn; the Oasis Recycling and Waste Management Project in Cape Town and a similar Durban Solid Waste collection programme. From these case studies the CSPI concluded that:

- Labour-intensive approaches to service delivery are not necessarily more expensive than traditional approaches and can, in fact, be considerably cheaper.
- High standards of service and infrastructure can be maintained through labour-intensive approaches. In some cases, adopting these approaches has enabled services to be provided to areas that would have been likely not to receive services if conventional methods of delivery had been used.
- There are numerous less quantifiable benefits of adopting labour-intensive approaches, the most notable being the improved skills levels and associated confidence of workers, greater community commitment, and increased civic pride, all of which have long term financial and other benefits for the municipalities in which the approaches are adopted[4].

A report was prepared for the Extended Public Works Programme on community based domestic waste collection programmes[5]. The report came to relatively similar conclusions to the CPSI case studies. Specifically, the EPWP (2007) report concluded that because the levels of service and scope of each case study differed, depending on the specific objectives set by each Municipality for its programme as well as on the resources available to each Municipality, each model investigated had its particular strengths and weaknesses. However, importantly the EPWP noted that "each model could find efficient and effective implementation depending on circumstances and on the objectives of the programme in the particular Municipality." Of the projects examined only one provincial model was found to be overly complex and inefficient.

The EPWP analysis suggested that the SMEs involved can be either contractors, cooperatives, NGOs and/or other forms of CBOs. It is, however, critical that the SME, in whatever form, is properly constituted as a legal entity that a municipality can contract with.

The overall conclusions of the EPWP research was that community based waste collection programmes in the various forms analysed can be cost effective, appropriate

[4] Centre for Public Service Innovation (CPSI), 2004: *Innovation Insights*, Number 4.

[5] Expanded Public Works Programme, 2007: *Domestic Waste Collection Documentation of Case Studies of Community Based Domestic Waste Collection Programmes in South Africa,* Consolidation Report.

and successful provided that due diligence is applied in the planning, procurement and programme administration processes. The report stated that:

"Key objectives that can be met through the implementation of these programmes include:

- Relatively fast track extension of services to un-served communities;
- Provision of cost effective services that can achieve desired levels of cleanliness and improve the environmental, aesthetic and health aspects within the communities being served;
- Sustainable SME development;
- Sustainable job creation at the community level; and
- Skills development at the SME, SME employee and Municipal Official level.

The evaluation of the case studies has shown that SME based, labour intensive domestic refuse collection programmes would be an effective approach to dealing with the waste collection challenges in RSA, particularly in the extensive and generally low income urban, peri-urban and dense rural unserved communities in Municipalities throughout RSA." (EPWP, 2007).

The data presented by the EPWP suggest that this type of approach can be both labour intensive and cost effective. The research suggests that the cost effective programmes on which SMEs employ seem to range from 300 to 500 households per full time job. More jobs can, however, be created if a rotational employment system is used where employees do not work full time but rotate with other employees.

Although costs are quite variable the case studies indicate that programmes that are cost effective and where there is no requirement for bulk transfer of waste to the disposal site range from about R17 to R20 per house per month (EPWP, 2007).

Data presented to the National Treasury from the same EPWP research programme provides some indication of the potential of scaling up these community based approaches to a national level[6]. On the basis of approximately 50-70% of households currently not served with a refuse removal service being served through community based schemes the opportunity for the EPWP was estimated to be:

- Between 400 and 700 SME opportunities
- Between 7,000 and 14,000 permanent jobs

The costs of the programme were estimated at:

- Estimated cost for planning and implementation: R20 per household per month (including the supporting of SMEs for the life of their contract)
- Estimated number of un-serviced households in 209 municipalities: 5,249,849
- Assumed that 50% of households are serviceable
- Estimated cost to implement:

[6] EPWP Environmental Sector: *Domestic Waste Collection Programme*, undated presentation to the National Treasury.

- 2,624,925 (hh) X R20 = R52,498,500 per month
- R1,259,963,760 over a 2 year period or R1.3 billion

While recycling initiatives are many, the recycling industry continues to operate in an informal, rather than formal capacity. In addition, a significant portion of the industry is vertically integrated meaning that external pricing and quantity information is not available for large proportions of the sector. This has limited the ability to adequately assess the size and contribution of the recycling industry in both economic and environmental terms. Recent research has attempted to paint a picture of the recycling industry and this section of the report provides a review of current findings. A primary question in this analysis is the current nature and contribution of the recycling industry to the economy.

Research by the Human Science Research Council (HSRC) (focused on creating the first economic database of plastics, glass and paper recycling activities in South Africa) found that demand for recyclable material is increasing in certain waste streams, where virgin input prices are rising (Lowitt, 2008)[7]. The increasing capital investment across the waste streams (particularly glass, paper and plastic) is said to bode well for the growth of the industry (Lowitt, 2008).

Further, although parts of the recycling industry are capital intensive, thousands of employment opportunities are created at the collection stage of the recycling process. Specifically this research estimated the following economic impacts:

Table 5. Contribution GDP and employment (2007)

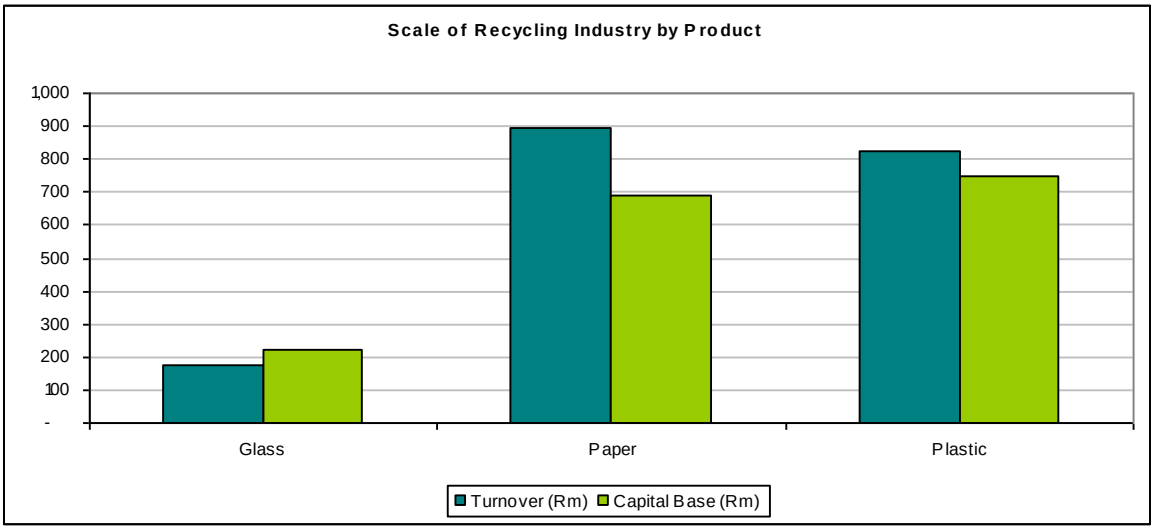
	Turnover (Rm)	***Capital Base (Rm)***	***Employment***	***Number of enterprises***
Glass				
Collection	102	90	1,700 (direct) 10,000 (channels)	110
Recycling	74	131	257	4
Paper				
Collection	478	198	11,000 (direct) 34,000 (channels)	326
Recycling	416	493	729	6
Plastic				
Collection	396	254	4,350(direct) 27,000 (channels)	150
Recycling	429	492	3,000	60
Total	**1 793**	**1 568**	**90 336**	**546**

Source: HSRC (2008)

[7] See Lowitt, S., 2008: *A preliminary analysis of the plastics, paper and glass recycling database: an introduction to the nature and dynamics of the industry*, Human Sciences Research Council.

The figure below shows the relative scale of the main components of the recycling industry by both turnover and capital base.

Figure 2 Scale of recycling industry by product



The findings indicate that the main employment gains are achieved through collection rather than in the process of recycling waste (Lowitt, 2008). Understanding the nature of employment within the recycling industry is important when considering options in terms of economic instruments.

Data obtained from the Packaging Council of South Africa (PACSA) indicates that the industry is recycling around 40% of all packaging and paper consumed. In 2007, it was reported that recyclers (as opposed to waste collectors) provided direct employment to over 10 000 individuals. In addition, the paper recycling industry has invested an estimated R400 million in recycling initiatives in South Africa and large scale investments have also been noted in the recycling of glass, cans and plastics.[8]

[8] PACSA Interview, 28 June 2009.

Figure 3 Employment in recycling industry by product

Different research conducted for the DTI by Global Insight suggests somewhat different employment data. This research indicates that plastics make the biggest contribution employing 40 000 people, followed by cans (37 000), glass (16 800) and then paper (12 600).[9] The research further concluded that in terms of per ton recycled, aluminium cans generate the most GDP and employment (Global Insights, 2008). The main difference is that the DTI data suggests that paper recycling employs only about 13 000 people while the HSRC data suggests a much larger number of about 46 000 people. The difference is probably due to the method of accounting for employment in the supply channels of paper recycling. The DTI data also includes the can recycling industry bringing total employment (using the ***maximum*** of both studies) to 128 000 people.

2.2.2 Economic Value

In terms of gauging the most valuable recycling commodity, the direct economic contribution of paper, plastics, glass and cans are in the order of R266 million (2007 prices), the bulk of this coming from paper (74%), followed by glass (11%), plastics (8%) and cans (7%) (Global Insights, 2008).[10] This conclusion is based on an analysis of the estimated overall economic impact of recycling these materials, shown in table below:

[9] These figures are based on Scenario 1 (i.e. status quo in 2007) and represent the upper bound figures only.

[10] These figures are based on Scenario 1 (i.e. status quo in 2007).

Table 6 Total estimated economic impact

	GDP (R million, 2007)	*Employment opportunities*
Paper	607	14 717
Plastics	61	40 185
Glass	77	17 009
Cans	50	37 136
Note: Figures are broad estimates of impact. Source: Global Insights, 2008.		

While the DTI has identified that there are significant opportunities for job creation in the recycling industry, it is imperative that more research be undertaken to fully understand the industry and its operations. Of particular importance is the issue of where job creation gains are the greatest in the recycling process. The recent HSRC study noted that given the capital intensive nature of the recycling process, "recycling itself will never be a major job creation source, but waste material collection and sorting, and job creation via the development of new enterprises creating alterative products from waste materials is full of potential" (Lowitt, 2008:12).

Waste collection is highly dependent on labour at present and while there is potential for job creation at this stage, there may be a need in future to adopt more efficient waste collection processes, which are less labour intensive, in order to increase the rate and inflow of recyclable materials into the industry (Lowitt, 2008). This could therefore lead to job losses. These are important issues for consideration when contemplating economic instruments.

BKS / DTI Scenarios (to be viewed with caution)

The BKS/DTI identified a gap between the current performance of the recycling industry (in 2007) and the potential of the industry. Therefore, in modelling the recycling industry, three scenarios were examined:

- *Scenario 1:* The status quo of the recycling industry (2007).
- *Scenario 2:* The recycling industry at full capacity (based on available literature).
- *Scenario 3:* The recycling industry at full capacity – based on percentage contribution of the waste stream for recyclables to the total waste stream calculated for 2006.

According to the 2007 data collected by the BKS Consulting Engineers (as part of an independent survey of the recycling industry in 2008)[11] it is estimated that the recycling industry contributed an average of 84,045 direct employment opportunities, while an average 4 390 indirect jobs were created (DEAT, 2009). In terms of the financial contribution of the industry, this is estimated to include a direct contribution by the recycling industry of R4.6 billion to production, R1.1 billion to Gross Domestic Product (GDP), with the total impact on production equalling an estimated R9.8 billion and a total impact on GDP of R3.3 billion. Furthermore, it is estimated that capital of R1.1 billion was required in order to sustain production of R4.6 billion. These results are

[11] Cited in DTI Report on *Proposed Roadmap for the cycling industry*, 2009.

reflected in Scenario 1 in Table 1 below, where Scenario 1 refers to the status quo in 2007.

While the above scenario provides an overview of the industry as per data collected in 2007, further research into the implications of the sector operating at full capacity suggest that even greater direct and indirect employment gains are possible. In the second scenario, which is based on available literature, the sector could employ just under 150 000 labourers directly, with the number of induced employment opportunities estimated to be in the order of 8 719, resulting in a total impact of 165 134 jobs. The total impact on production is estimated at over R15 billion and on GDP at R5 billion (2007 prices). These results are reflected in Scenario 2, in the table below.

A third scenario is based on expert opinion of the industry and as shown in the table below it is estimated that the key macroeconomic contribution of the recycling industry could be nearly double in terms all relevant indicators.

Table 7 The macroeconomic impact of the recycling industry under different scenarios

	Scenario 1				Scenario 2				Scenario 3			
	Status Quo (R millions, 2007 Prices)				Recycling Industry at Full Capacity based on available data & literature (R millions, 2007 Prices)				Recycling Industry at Full Capacity based on Expert Opinion of the Industry (R millions, 2007 Prices)			
	DIRECT IMPACT	INDIRECT IMPACT	INDUCED IMPACT	TOTAL IMPACT	DIRECT IMPACT	INDIRECT IMPACT	INDUCED IMPACT	TOTAL IMPACT	DIRECT IMPACT	INDIRECT IMPACT	INDUCED IMPACT	TOTAL IMPACT
Impact on production	4 624	2 339	2 861	9 824	7 111	3 658	4 399	15 169	14 594	7 454	9 029	31 077
Impact on Gross Domestic Product (GDP)	1 101	980	1 197	3 279	1 714	1 534	1 841	5 089	3 579	3 127	3 779	10 484
Impact on capital utilization	1 055	1 945	2 259	5 259	1 723	3 020	3 474	8 217	3 503	6 113	7 133	16 749
Impact on employment [Total Numbers]					149 459	6 956	8 719	165 134	319 339	14 084	17 891	351 314
-Total (Upper Bound)	131 130	4 390	5 671	141 191								
-Total (Lower Bound)	36 960	4 390	5 671	47 021								
-Total (Average)	84 045	4 390	5 671	94 106								
Impact on Households												
-Low income households				615				952				2 006
-Total Households				2 425				3 765				7 831

Source: DTI,2009

The data in the table above provide an estimate of the broad potential contribution of the industry under different scenarios.[12] The findings further indicate that compared to the economy as a whole, the recycling industry has relatively high ratios of employment and value added to capital. According to the DTI, the following economic comparisons illustrate this point:

Table 8. Comparison: recycling industry's economic contribution versus economy as a whole

Criteria	***SA economy as a whole***	***Recycling industry***	***Interpretation of recycling industry results***
GDP/Capital Ratio	.56	.62	For each R 1 capital used in the recycling industry, GDP of 62c is generated.
Labour/Capital Ratio	2.7	26.9	For each 1 million rand invested, nearly 27 job opportunities are created. (Note: this based on the upper-bound estimates in 2007).

Source: DTI,2009

It is worth noting that the statistics shown above, as cited in the DTI's report, are estimates based on macro-economic modelling and also reflect a view of the industry based on a particular data collection process. Some scepticism of the results has been expressed by participants in the recycling industry. While the data on the industry cannot be used to make concrete forecasts, they are useful in highlighting the potential opportunities presented by the recycling industry to the South African economy.

2.2.3 Summary of socioeconomic impact of the waste sector

2.2.3.1 Labour intensity and income levels

From a socioeconomic perspective the findings indicate that the waste sector is conducive to operational activity which supports the employment of semi-skilled and unskilled workers. Waste collection is highly labour intensive in South Africa and the recycling industry has the potential to contribute jobs in terms of materials collection and sorting of waste. Indirect job opportunities offers employment for waste collectors such as trolley men, landfill pickers, those who sell to buy-back centres as well as those who collect from drop-off centres (Lowitt, 2008).The recycling industry is volatile to fluctuations in price changes for recyclables which can be a constraining factor for small businesses and individuals operating in the industry. Typically many of those involved in recycling are lower income earners, working on a contractual or casual basis.

In terms of the public sector, the data from the DEAT assessment indicates the bottom-heavy structure of solid waste departments in municipalities. While actual salary scales are not provided, the job descriptions (labourer, general worker etc) suggest that most workers in municipal solid waste are located in relative low-income earning groups.

[12] The impacts reflected in Table 1 are based on insufficient information for making firm forecasts. It should be regarded only as a broad indication of the possible capital requirements that exist in the recycling industry (DTI,2009).

2.2.3.2 Contribution of the sector to employment and poverty reduction targets

The South African government has committed to the creation of 500 000 jobs per annum and the halving of poverty by 2014. The total contribution of the waste sector to meeting these targets is difficult to estimate, but current data on employment suggests that the sector does have an impact on job creation and therefore poverty reduction. The findings suggest that the public sector's contribution (at municipal level) is in the order of 21,000 jobs (based on StatsSA data from 2005 and 2006). The private sector's contribution is harder to gauge, due to the lack of data, however given that private firms are responsible for 30% of the total expenditure in the waste sector of South Africa it is likely to contribute towards the creation of thousands of jobs. Interwaste and Enviroserve, the two private waste firms listed on the JSE, employ a combined figure of around 2,000 people. In terms of the recycling industry, the findings indicate that it contributes an estimated range of between 90,000 and 130,000 direct and indirect employment opportunities through the recycling of glass, paper, plastic and cans (based on 2007 data from the HSRC and DTI as discussed in earlier section of report). It should be noted that informal recycling activities also contributes positively to poverty alleviation. In terms of the contribution of the waste sector to poverty reduction, this is mainly achieved through job creation initiatives in the sector.

In addition to the above, an economic overview of the sector indicates that waste management is conducive to the establishment and support of small and medium enterprises. This is due to the low barriers to entry and the relatively easy transfer of skills required to carry out the waste collection service. The recycling industry in particular presents opportunities for the establishment new enterprises, for example the use of recycled materials in the manufacture of products such as crafts or building materials. These opportunities could stimulate small business development and entrepreneurial initiatives. Public-private partnerships have also been a stimulus for job creation and entrepreneurial activity in the sector. The Entrepreneurial Development Corporation (TEDCOR) in South Africa has been involved in implementing a business model which entails entering into a contract with municipalities and agreeing to sub-contract the collection service to community contractors, sourced from the local area. TEDCOR provides training and support as well as assistance with accessing loans to the community-based contractors over a five-year period. This programme has been implemented in a number of municipalities in South Africa, including Moses Kotane and Moretele municipalities in the North West Province. To date this community-based refuse removal system has been responsible for training over 80 entrepreneurs; which have provided employment to 1,000 historically disadvantaged people and supplied refuse removal services to over 400,000 households in 16 local municipalities across South Africa (Business Action for Africa, 2006). While this is but one example of a public-private venture of this sort, the programme's achievements since its inception in 1992 indicate the potential economic contribution of the sector in this regard.

2.3 The contribution of the mining and agriculture industries

Mining and agriculture make significant economic contributions to South Africa, both in terms of GDP and employment. These industries however also present a number of problems with respect to waste management. These issues are discussed in the section below.

2.3.1.1 Mining

South Africa is one of the most important mining countries in terms of the variety and quantity of minerals produced in the world. Mining's contribution to South Africa's GDP was 7% in 2006 and the sector directly accounted for 6.5% of total fixed investment. The industry contributed R140 billion to South African exports in 2006. This represented 32% of total merchandise exports and the industry accounted for 25% of total forex earnings in 2006. The gold industry remains the largest employer, and was responsible for more than 50% of total mining employment estimated at 460 000 people in 2006 (Chamber of Mines, 2007).

While mining is clearly economically significant, mining is by its very nature harsh on the environment and the industry is a major contributor to waste in South Africa. Based on the baseline studies undertaken by DWAF during 1997, 90% of the total waste stream in South Africa can be attributed to industrial and mining waste. According to the Organisation for Economic Co-operation and Development (OECD) (2001), mining wastes and related by-products fall into two category types:

(a) mining-and-quarrying extraction wastes which are barren soils removed from mining and quarrying sites during the preparation for mining and quarrying and do not enter into the dressing and beneficiating processes, and
(b) (b). mining-and-quarrying dressing and beneficiating wastes which are obtained during the process of separating minerals from ores and other materials extracted during mining-and-quarrying activities.

These wastes occupy valuable land and cause harm to stream life when they are deposited near the drainage area of a stream (OECD, 2001). In South Africa, acid mine drainage presents a particular problem for water quality and surrounding ecosystems in the vicinity of mines. The management of environmental waste is particularly difficult because the extent of mine pollution impacts is difficult to determine, meaning that it is difficult to assess how much abatement of damage is necessary. A thorough cost-benefit analysis is required in order to fully understand and adequately address concerns around mining waste. It should be noted that the issue of South African mining waste is not unique to South Africa and relatively similar challenges are faced in other developed and developing countries (Porter,2002).

2.3.1.2 Agriculture

Primary agriculture contributes about 2,6% to the GDP of South Africa and almost 9% of formal employment. Accounting for strong backward and forward linkages into the economy, the agro-industrial sector is estimated to comprise 15% of GDP. For the past five years, agricultural exports have contributed on average approximately 8% of total South African exports. Approximately 15.5% of informal sector workers are employed in agriculture, making the agricultural industry the second-largest industry in terms of informal sector employment. Farming contributes some 8% to the country's total exports. Agriculture is highly reliant on natural resources, with almost 50% of South Africa's water used for agriculture, with about 1.3-million hectares under irrigation.

Agricultural waste is waste produced as a result of various agricultural operations. It includes manure and other wastes from farms, poultry houses and slaughterhouses; harvest waste; fertilizer run- off from fields; pesticides that enter into water, air or soils; and salt and silt drained from fields (OECD, 2001). There are a number residuals and

by-products which result from the production of agricultural products including soil sentiments, nutrients, pesticides, mineral salts, heavy metals and disease organisms. Residual levels are determined both by natural elements such as soil type and weather as well as the farm management practices used. Poor farm management practices can lead to a host of externalities including having an effect on water and air quality and soil erosion. Where farmers are not required to/or have no incentive to account for the social and environmental costs associated with farming they may select management practices which yield higher than desired residual pollutant levels (Weersink et al, 1998).

One of the major constraints in regulating agricultural waste relates to monitoring and accountability. Because much of agricultural pollution is non-point source, i.e. it is difficult to know which farmer caused the pollution; the regulation of agricultural waste is particularly difficult. As a result of this constraint the use of a tax to cover the marginal external costs of agricultural pollution is hard to implement without incurring significant monitoring costs (Porter, 2002). There are also definitional and jurisdictional complexities, such as whether agricultural run-off is deemed to be 'waste' or 'pollution' and whether it is addressed under waste or water regulations.

2.4 The role of the public sector

Local government plays a core function in the management of waste in South Africa and it is therefore necessary to assess the status and capacity of municipalities in delivering the waste service.

2.4.1 Characteristics of waste management in South Africa

The General Household Survey of 2007 indicates that only 39% of households or 50% of the total population of South Africa is receiving a regular waste collection service (CSIR, 2009). Service backlogs are highest in metros and secondary cities (25% and 29% respectively), with rapid urbanisation placing significant pressure on these municipalities (DEAT, 2008). A combination of political, administrative and resource-related challenges have influenced the waste management environment in South Africa. The characteristics of waste management in the country are said to be similar to that of many developing countries (CSIR, 2009). Seven characteristics of waste management have been identified by the CSIR in their research on the challenges of waste service provision in South Africa:

2.4.1.1 Priority standing

Despite the role which effective waste management plays in securing a healthy living environment, waste does not enjoy the same priority as some of the other basic services such as water and sanitation in South Africa. This has had a direct bearing on the extent to which municipalities allocate budget and capacity with respect to services, with waste generally being placed lower down on the agenda.

2.4.1.2 Political will

Linked to the above, it has been observed that political will to improve waste management is relatively low.

2.4.1.3 Lack of resources

Numerous research studies have identified shortages in terms of the capacity, finance and infrastructure resources necessary for effective waste management in municipalities. DEAT's 2007 assessment of capacity in particular highlights the many resource shortages facing municipalities.

2.4.1.4 Local culture

The local culture and political approach to waste has a significant bearing on attitudes and behaviours towards waste management. In some contexts there is a need for a shift in the culture and attitudes in order to ensure longer term sustainability.

2.4.1.5 Systems and information

One of the major weaknesses of the local government context in South Africa is the lack of reliable, valid and useful information and data for analysis and policy development. This is particularly true with respect to solid waste where there is a great need to fill the information gap.

2.4.1.6 Unacceptable waste management practices

The prevalence of illegal dumping and the low percentage of known landfills which are permitted are indicative of ineffective waste management in South Africa.

2.4.1.7 Donor funding

While donor funding *per se* does not represent a concern, the promotion of overly sophisticated and inappropriate approaches by developed countries (wishing to support developing countries) have proven to be problematic. It is clear that the policy and strategic suggestions put forward need to be relevant and sensitive to the context.

2.4.2 Constraints facing municipal solid waste management

The findings from DEAT's 2007 assessment of the capacity of local government and the status of waste management in South Africa support many of the concerns raised above. Significant findings from the assessment include the following:

2.4.2.1 Waste management capacity

Management capacity is inadequate and well below international best practice. Even in the metros where capacity levels are higher, management capacity relative to the percentage of intermediate and labourer staff figures is low (See Box 1 below).

In terms of the staff to household ratio (which provides an indication of how many households each official is responsible for serving), these are well above international best practice in the Metros (see box below). In the case of local municipalities, there was a similar trend observed with labour intensive organisational structures and high staff to household ratios (DEAT, 2008). The implication is that public sector waste service delivery in South Africa is inefficient – i.e. more people could be served with the same resources.

Box 1 Performance of metros against best practice in terms of human resource structure

Based on international literature (Henderson, 2005) it is suggested that the optimum staff breakdown should be:

- 65 % labourer,
- 25 % intermediate; and
- 10 % management;

Based on the same literature source the optimum number of households served by one solid waste staff member should be:

- between 150 and 200.

As shown below none of the metros achieved the optimum status of management constituting 10% of the staffing based and municipalities tend to be bottom-heavy. In terms of the average number of households served per solid waste staff member in metros were 273. This is higher than the international best practise of between 150 and 200.

Table 9. Best practice performance of Metros

Metros	***Staffing level breakdown (%)***			***Total staff***
	Labourer	Intermediate	Management	
City of Cape Town	71	27	2	2071
City of Johannesburg	74	21	5	2571
City of Tshwane	79	20	1	1876
Ekurhukeni Metro	70	25	5	1652
Ethekwini	70	25	5	2171
Nelson Mandela Metro	73	23	4	1754

Source: DEAT,2008

2.4.2.2 Delivering the waste service

In addition to ensuring service provision, municipalities are also responsible for promoting waste reduction and recycling. The following findings provide an indication of the status quo with respect to these responsibilities:

- The findings highlighted the relative asymmetry between metro's, secondary cities and smaller, rural municipalities, particularly in terms of service levels:
  - Metros and secondary cities provide a much higher level of service (weekly waste collection service).
  - The unplanned development of informal settlements adds to collection areas and waste volumes, particularly in metros and secondary cities where population growth rates are relatively higher. These municipalities therefore face the highest service level backlogs.
- All municipalities have pro-poor or indigent policies that cater for the poor people who cannot afford to pay for the municipal services.
- It is reported that 87% of municipalities do not have the capacity or infrastructure to pursue waste minimisation.
- An estimated 80% of municipalities have commenced recycling programmes but face difficulties in sustaining their operations due to capacity constraints.
- There is a general shift towards employing small, community contractors to undertake recycling.

2.4.2.3 Financing the waste service

With respect to financing waste services, DEAT's survey of municipalities identified the following:

- Waste management is not recognised as a priority service by Municipal Councils who are responsible for budget allocations and therefore budget allocations tend to be relatively low compared to that of other services;
- Tariff systems are centralised for all services and there is often little relationship between revenue collected for waste versus expenditure;
- Generally tariffs are not linked to the volume of waste generated. (While this is considered best practice, it generally very difficult to implement given sophisticated weighing equipment and revised billing system required. This translates to increased technical costs);
- Collection rates are low and municipalities have generally struggled with enforcement;
- Rural municipalities often failed to account for the waste service function;
- Budget increases do not mirror waste volumes handled;
- There are particular challenges in using the Municipal Infrastructure Grant (MIG) to fund solid waste related capital investments, since the grants has restrictions on what can be funded (e.g. vehicles are considered significant capital assets by municipalities but cannot be funded by MIG);
- Capital investment in landfill sites and transfer stations is typically very "lumpy" which implies that it is difficult to finance on annual capex allocations via MIG or other facilities;
- There is no direct financial recovery of certain waste services such as, litter picking and removal of illegal dumping remains. For example, at the City of Johannesburg, the funding for non-income generating waste services comes from the grant for social services managed by the office of the Mayor. At the eThekwini Metropolitan Municipality the costs for non-income generating services is recovered from the rates payers via the property assessment rate; and
- Where District Municipalities operate Regional Waste Disposal Sites, there is no funding through rate collections as rates are typically collected by the affected Local Municipalities who are managing waste collection and transportation.

2.4.2.4 Disposal

DEAT has reported that there are over 2,000 waste handling facilities nationally of which just over 25% (530) are permitted (DEAT, 2008). In terms of landfills, the survey found that the permitting of landfills was problematic in only certain municipal categories, notably the B4 municipalities, shown in table below. Overall, only 44% of South Africa's known private and public landfills are authorised by landfill site permits.

Table 10. Landfills in SA municipalities

Municipality category	***Average number of landfills***	***Average landfills licensed (%)***	***Average waste disposed (tonnes per annum)***
A	5	100%	2 41 9100
B1	3	68%	155 684
B2	3	96%	65 410
B3	2	79%	29 478
B4	2	13%	16 607

Source: DEAT,2008

Other key findings with regards to disposal include the following:

- Available airspace on existing facilities is diminishing due to increased waste volumes;
- Public access to landfill sites is often difficult due to far distances, restricted operating hours etc. resulting in illegal dumping of waste within suburbs;
- The permitting requirements for landfill facilities are stringent and require a high level of engineering skills;
- Insufficient landfill operating budgets result in inefficient operations and maintenance on sites. Increased crime and vandalism further exacerbates the situation;
- Few municipalities are planning ahead for new landfill sites in the future;
- Complex land acquisition procedures make the identification for new sites a lengthy and tedious process; and
- There is low capacity for compliance monitoring and enforcement by the provincial environmental department.

2.4.2.5 Co-operative Governance

Effective co-operative governance can support improvements in municipal waste management in a number of ways. In addition to providing policy and regulatory support, the provincial and national spheres of government support municipalities through the funding of campaigns, training programmes and assistance with planning, monitoring and evaluation. While these initiatives bode well for co-operative governance, the DEAT assessment of local government capacity (2007) highlighted some of the shortcomings in terms of the support provided by provincial and national government, including the following:

- The lack of clarity in terms of roles and responsibilities
- Insufficient interaction between local government and the national department
- Capacity weaknesses in provincial and national government have had a negative impact on the ability of municipalities to perform certain functions. For example slow environmental approval and permitting processes on the part of the responsible provincial and national departments lead to delays in related municipal processes.

In addition to addressing these concerns, engagement between the spheres is necessary in order to address issues of grant dependency, particularly with respect to

capital expenditure. Municipalities are largely dependent on grants, mainly through the Municipal Infrastructure Grant (MIG), for their capital funding. Capital investment in landfill sites and transfer stations is typically very “lumpy” which implies that it is difficult to finance on annual Capex allocations via MIG or other facilities. Capex funding approaches for waste services therefore may require some allowance for lumpy investments and alterations in the MIG approaches to become more effective and sustainable. In order to address this, municipalities should engage in discussions with the relevant provincial and national departments through intergovernmental forums.

Within the local government sphere, co-operative governance is also important. With local municipalities typically responsible for refuse removal there is a key role for districts in disposal and landfill management. Co-operation at this level could have a number of benefits through economies of scale, for example in the construction of regional landfill sites.

2.5 Improving waste management in South Africa: Identification of areas for regulation and support

Given what is known about the status quo in the private and public sector, the following have been identified as areas where regulation and support are necessary to promote effective waste management from an economic perspective.

2.5.1 Improving economic efficiency in waste collection and disposal

There is *prima facie* evidence that the public sector is not efficient in the provision of waste collection and disposal services. This conclusion is drawn from an initial look at the numbers of staff per service point served in the municipal sector. There is also evidence of the under-recovery of waste service costs and the inability to provide universal service delivery by municipalities.

Despite the uncertainties it appears that there is sufficient evidence to warrant careful strategic consideration of whether waste collection and disposal services should be preferentially provided by private sector contractors, both SMME and large firms, under local municipality regulation for the purposes of cost efficiency of service delivery. This would imply a “waste management provider” Vs “waste management authority” division as in the water sector. The collection component of the waste management sector appears to lend itself to such options as there are relatively low barriers to entry in this sector. Furthermore, the Waste Act of 2008 (s.24) allows for the use of service providers to support municipalities in fulfilling their waste collection function.

A possible concern for the greater use of private sector capacity in waste management is that waste collection services can probably be seen as a natural monopoly. However, there are mechanisms for allowing competition ***for*** the market on a regular basis that can address this concern and good examples of successful practice. Similar conditions would apply to the management of waste disposal sites although the ownership of such sites may be more complex. If an increase in public/private partnerships in the sector is considered difficult, other mechanisms should be sought to encourage greater efficiency in public sector waste delivery – including benchmarking and national oversight.

2.5.2 Application of economic analysis

Economic analysis should be applied to waste policy and waste strategy to a greater degree. The costs and benefits of waste management actions should be considered where possible in the regulatory process. Even where sufficient data is not available for quantified cost-benefit analysis, economic analysis can provide useful indications of the appropriate course of action.

From an economic perspective, for example, the notion of a zero-waste target is unlikely to be a sensible policy measure. Economic theory suggests that at some point the costs of waste reduction are likely to be higher than the full (private and social) costs of waste generation and disposal. The Polokwane Declaration aimed at a plan for zero waste to be developed by 2022 and a 50% reduction in waste by 2012. If the Polokwane goals are seen as the targets of the sector then municipalities would be encouraged to plan for a reduction in waste to landfill and eventually to prepared for zero waste to landfill. Is this realistic and does it send the appropriate technical and financial planning signals to municipalities?

A cost-benefit approach would suggest that in the setting of a specific waste minimisation target the National Waste Management Strategy (NWMS) should ask what the economic justification for the proposed minimisation target is. Waste minimisation should, at this stage in South Africa's development, arguably only be pursued if it is a less costly option than waste collection and disposal for local authorities taking into account the full costs of waste collection and disposal including environmental externalities.

Similar cost-benefit considerations should be applied to other measures, such as the setting of standards for refuse collection and disposal that require a weighing up of economic, social and environmental costs and benefits.

2.5.3 Waste Tariffs

The Waste Act (2008) (s. 23(1)) stipulates what the municipal waste collection service is subject to, including the obligation of persons utilising the service to pay the applicable charges. Revenue from the household and business payments does not, at present, adequately cover the costs of the waste collection service, with many municipalities failing to set appropriate tariffs for refuse removal or disposal. Appropriate tariff setting and revenue collection is particularly important in the local context where services to poor households are provided for free and may require some form of cross-subsidisation, in addition to what is covered through the Equitable Share. Tariff restructuring and effective revenue collection systems to accompany this could go some way in improving the financial viability of the municipal solid waste service.

The role of appropriate tariff structures is key in ensuring the financial sustainability of waste management and is dealt with in one of the parallel research briefs. However, in addition to ensuring sufficient revenue, tariffs play the further role of providing the correct price signals to waste generators. In this regards approaches towards tariff determination should ensure that the full costs of waste management are included within the analysis when setting tariffs.

The term "full costs" implies that tariff determination should include not only the annual operating and capital costs of the service but also costs that take into account the

depreciation of current assets, external environmental costs of the service, and future costs due to current actions. Key costs that are typically not accounted for in solid waste management tariff determination are:

- Administrative overheads of providing the service
- Depreciation of landfill sites (i.e. the fact that the filling of a landfill site is effectively a depreciation of the value of the site)
- Costs of closure and post-closure landfill site management
- External environmental costs due to waste disposal
- Costs of enforcement of waste related regulation

The scope of this research brief does not extend to a full discussion of waste tariff determination but it is important to note that in the development of any guidance to local authorities on tariff setting a full cost accounting approach as outlined above should be followed.

2.5.3.1 Collection Tariffs

There have been some proposals by municipalities to move toward a weight-based charging system. Under such a system households pay more for greater amounts of waste disposed of, providing appropriate incentives for waste minimisation and recycling. However, such a system requires fairly sophisticated equipment and monitoring capabilities that are currently beyond the scope of most municipalities in South Africa (Godfrey and Nahman, 2008b).

At the same time, it is important to be able to provide waste generators at the household and commercial level some incentives for waste reduction. If these waste generators face a constant charge for refuse removal regardless of their behaviour there is little incentive for them to reduce waste generation – even under circumstances of rising refuse removal tariffs.

Tariff and waste collection approaches should therefore make allowance where possible for charges related to volumes. Less technologically complex options than weight-based systems include such options as consumers purchasing special bags, with a surcharge which goes to the municipality. The municipality will only collect waste in these bags. The more refuse generated the more bags have to be bought by the household. A similar approach can be followed with the provision of special bins, allowing the rental of variable number of bins by the household or firm.

2.5.3.2 Disposal tariffs

There is a particular concern with the current levying of waste disposal tariffs. The major environmental externalities, as well as future capital costs, lie in the waste disposal part of the waste management chain. If there are inappropriate tariffs for disposal this provides a cascade of inappropriate pricing through the waste management process.

There is good evidence that waste disposal in South Africa is under-priced in almost all circumstances, both private and public due to:

- Lack of full cost accounting:
- Insufficient attention to closure costs and post –closure costs:
- Inadequate enforcement of applicable standards:
- Non-pricing of environmental externalities:

Furthermore, despite the clear importance of appropriate waste disposal tariffs the CSIR research found that 27% of the local authorities interviewed don't charge for disposal at all. Of those that do charge, 7% use a fixed fee irrespective of the quantity of waste, while 66% charge based on either weight (where a weighbridge is available), or on volume (based on the size of the vehicle). However, it is expected that these statistics would change significantly for the worse if more rural municipalities were included in the sample, since many of these municipalities do not charge for disposal due to infrastructure and capacity limitations, and concerns over increased illegal dumping (Godfrey and Nahman, 2008b).

Even where fees are charged for waste disposal it is likely that these charges are below the full social costs of disposal. In terms of valuing landfill airspace, findings suggest that the true costs of land-filling (including external or social costs as well as costs linked the scarcity of landfill airspace) are "currently not built into tipping fees in South Africa" (CSIR,2008:6). The fact that many municipalities are not covering external costs through either waste collection or disposal fees has resulted in an artificially low cost of land filling (CSIR, 2008).

There is a clear and urgent need to ensure full cost accounting for waste disposal and suitable tariff structures that reflect the real costs of disposal. Within this approach there may possibly be some argument for guidance on disposal tariffs differentiated by waste type to provide some specific incentives and disincentives for the disposal of different types of waste material.[13]

2.5.4 Targeting market failures

Given the under-pricing of waste disposal it is likely that too much of the waste collected in South Africa is going to landfill, with insufficient materials entering the recycling market. This market failure is essentially a supply side issue for the recycling industry. Households are supplying too little of the waste they generate to recycling because they receive a municipal waste collection service for a relatively low fee. Furthermore producers do not have sufficient incentives or disincentives to produce recyclable products and packaging (OECD, 2004: Addressing the economics of waste).

As noted above, correct pricing of waste disposal and collection is the first step required and should make an important difference in providing the correct incentives for waste minimisation and recycling as well as improving financial sustainability in the sector.

[13] See DEAT, 2002: *Municipal Solid Waste Tariff Strategy*, report prepared by the Palmer Development Group for the DEAT, March 2002, for more detail on these issues.

2.5.5 Industrial policy

Where possible approaches to the waste sector should include industrial policy/economic policy objectives, including:

- SMME development;
- Labour intensive production – labour intensive waste collection; and
- Labour intensive production – labour intensive recycling initiatives – removal of organics from the waste stream, and labour intensive materials recovery.

2.5.6 Economic regulation

No specific economic regulatory concerns in the private waste management sector have been raised in the literature reviewed although there are a number of reasons why this is an area worthy of oversight including:

- Natural monopoly nature of domestic refuse collection (the commercial waste collection sector appears to be well contested and competitive);
- Potential natural monopolies and significant barriers to entry in solid waste disposal, especially hazardous waste disposal; and
- Vertical integration and oligopoly in the recycling sectors.

These are probably issues for the consideration of the DTI and the Competition Commission but Department of Environmental Affairs (DEA), as the national regulatory body, being aware of these possible concerns and referring issues as appropriate.

3 Regulatory Instruments

Looking at waste through an economic lens implies focusing on the costs of handling of waste and the environmental and health costs of not handling waste correctly (Porter, 2002:3). In terms of costs, two main types need to be distinguished. The first is private costs, which is what the generator of waste pays. The second is social costs, which is what it really costs society to dispose of the waste generated. Understanding these costs and developing strategies for reducing them while aiming at a decline in waste generated is thus fundamental to the effective management of solid waste.

The legislation governing waste management in South Africa promotes a "polluter pays" policy, whereby all generators of waste (including businesses and households) are responsible for covering the costs of waste generated (DEAT,1999).[14] Included under the polluter pays principle are not only the direct private costs, but also the social costs associated with waste generation and disposal. The question is whether this principle is applied in practice in solid waste management in South Africa and what is the appropriate pathway to achieve an effective application of the principle.

There are a host of options available to government in terms of ensuring that both private and social costs are covered, while promoting environmental gains. In this regard it is worthwhile distinguishing between traditional regulatory or command-and-

[14] Both NEMA(1998) and the NWMS (1999) make reference to the producer pays policy.

control (CAC) approaches and the use of economic instruments. CAC approaches largely entail the regulation of environmental problems directly by "prescribing specific legislation and standards which must be achieved and enforcing the compliance through the use of penalties and fines" (Perman *et al*, in CSIR, 2007).

Economic Instruments (EIs) however are designed to change behaviour indirectly by creating a set of incentives and/or disincentives through pricing. While distinct, both these options are typically aimed at addressing similar waste management objectives and the effectiveness of both is reliant on adequate and appropriate capacity to implement and enforce regulation.

This section will provide an overview of CAC approaches and EI's, uncovering the debates surrounding these mechanisms and highlighting the possibilities for South Africa.

3.1 Command and control

CAC regulation dominates in terms of South Africa's current approaches to regulate waste management. Using CAC, the Polluter Pays Principle is implemented though the direct regulation of waste generators and landfill design and operation by directly enforcing a set of standards and minimum requirements. If standards are established at the correct level it can be presumed that the correct level of expenditure for waste management is occurring. Under an efficient pricing regime it can then be expected that the appropriate prices are established to cover these costs. Further, when these standards are violated, there are a set of costs which are payable. Under such circumstances, a waste producer would face the correct prices for their waste production and hence the polluter pays principle would be satisfied. In reality, however, there are a number of market and government failures that prevent the CAC outcome from meeting polluter pays principle objectives.

A first major consideration is that the CAC model is heavily reliant on effective regulation and enforcement. In this regard South Africa faces a number of challenges, including the shortage of capacity and skills in order to effectively monitor and enforce regulatory policy and it is evident that the current minimum environmental standards are often not met (see numbers of un-permitted landfill sites).

Improper tariff design and application

A second major reason why CAC diverges from the polluter pays principle is that in many instances municipal solid waste services are provided cheaply and often at no or little marginal private cost (see other research briefs and the discussion above). This means that households and some commercial enterprises typically bear no extra cost per additional unit of waste generated and are generally charged a flat fee.

In essence there are two issues:

- Lack of full cost accounting of the costs of service delivery, i.e. municipalities do not build in the full costs of providing the service (as outlined earlier)

- Tariff policies that do not ensure that insofar as practically possible the full costs are passed on to households and commercial enterprises

Incorrect Incentives

The artificially low costs being applied create a significant divergence between the private and social costs of waste disposal and create a wedge between the costs of waste disposal (the 'pollution') and the price that the waste generator (the 'polluter') pays. These low costs will tend make waste disposal to landfill a more preferable option in comparison to waste minimisation or recycling and lead to an over-production of waste. It has been argued that one of the primary reasons for the lack of a viable recycling industry in South Africa is the artificially low cost of land-filling relative to recycling (CSIR, 2008).

Properly applied, command and control regulation, in combination with correct application of waste tariffs, could be useful in substantively addressing the problem of artificially low disposal fees. This would require that municipalities undertake a full economic assessment of costs associated with waste disposal and develop mechanisms for cost recovery through appropriate fee structures. There would also need to be stricter enforcement of existing CAC regulation, particularly those which relate to standards and minimum requirements for landfill design and operations.

According to the CSIR it is expected that stringent enforcement of regulation which would increase the costs of waste disposal (to reflect true direct and external costs) relative to recycling would assist in establishing a viable recycling industry in South Africa. An objective of this approach would be to make recycling the more attractive[4] and preferred option (CSIR,2008).

A typical concern with command and control regulation is that these measures are "restrictive policy measures aimed at managing end-pipe issues resulting from market disorders rather than addressing the source of the pollution and waste". (DEAT,2008). They are also seen to be ineffective because they impose restrictive information, monitoring and enforcement requirements and do not allow for innovation nor sufficient incentives for addressing waste generation and pollution concerns (DEAT,2008).

In some cases such concerns are valid and, as discussed below, there are options for providing additional incentives to more efficient waste management. However, it should be noted that much waste related regulation (especially around waste disposal), as opposed to pollution control regulation, is, by definition "end-of-pipe", and command and control regulation remains the core component of solid waste management in all countries.

3.2 Economic Instruments

Economic instruments are defined as:

"A means by which decisions or actions of government affect the behaviour of producers and consumers by causing changes in the prices to be paid for these activities. Environmental taxes fall into this category, as do direct charges for

government provided environmental services. In fact the boundary between these two is rather fluid and may change noticeably over quite a short period of time." (OECD, 2005)

Economic instruments seek to control waste generation by harnessing market incentives and are seen to offer a more cost-effective and dynamic form of regulations that traditional approaches. It has been argued that the main benefit of EI's are that they may allow for the meeting of a target at a lower overall cost that traditional CAC mechanisms (Austin,1999).

In terms of solid waste management, EI's are incentives or disincentives that influence waste generators (consumers and producers) to minimise waste, increase recycling and recover waste (CSIR, 2007). Many of the economic instruments considered by governments are aimed at reducing the amount of waste generated and or diverted from landfill to recycling (CSIR, 2007). Typically the range of EI's which are most commonly considered include taxes, quantity-based charges and fees, subsidies and credits and concessions.

Research suggests that EI's may have significant benefits in terms of efficiency, particularly when compared to traditional regulatory mechanisms such as CAC approaches. In general EI's are seen to have a host of advantages over CAC's, including the following (CSIR, 2007):

- *Cost effectiveness*: targets can be met at a lower cost than if CAC measures are used;
- *Economic efficiency*: those polluters / waste generators able to reduce waste at the least cost will reduce the most;
- *They are consistent with the Polluter Pays Principle*: the cost burden primarily falls on the waste generator;
- *They provide incentives for innovation*: the price signal created by the instrument provides incentives for continual innovation in waste minimisation;
- *They have revenue generating potential*: taxes, in particular, can raise revenue for the government or regulatory authority; and
- *The provide the potential for self-regulation*: some economic instruments can be industry developed and managed.

However, EI's are not necessarily the easiest options in terms of implementation, particularly in the context of a developing country. While they have the potential to reach efficiency gains, they do require the market to be well functioning. They also require the institutions governing these processes to have sufficient capacity and to be committed to seeing the successful implementation of these instruments.

In the case of South Africa, this means that current market distortions need to be removed, the legal and judicial system strengthened and capacity at the level of municipalities in particular needs to be improved in order to adequately play the monitoring role and enforcement role. This is because solid waste is generally the responsibility of municipalities.

The available empirical evidence raises concerns that the pre-condition for effective economic instruments of well-functioning markets may not exist. For example, it is apparent that waste disposal prices in many instances are not reflective of the full marginal costs of disposal.

As noted above, there is similarly strong evidence that the institutional requirements for economic instruments are not met in many areas of the country – particularly the monitoring and enforcement capacity required.

In addition, the collection of waste related data and statistics is weak (CSIR,2007) which makes cost-benefit analysis and market structure evaluation difficult. This suggests that there will be difficulties in designing optimal or effective economic instruments.

The CSIR has conducted extensive research into the range of economic instruments available to South Africa and created a useful system of assessing these instruments in terms of criteria. The table below provides an overview and description of the main types of EI's:

Table 11. Economic instruments for solid waste management

Class	Type	Instrument	Example	Purpose	Mechanism
Taxes and Charges	Product and input taxes	Virgin material tax/levy (or subsidy reductions)	Aggregates Levy (UK)	Reduce final disposal and increase reuse/recycling by encouraging reuse of waste materials instead of extraction of virgin materials	Increase prices of virgin materials relative to reused/recycled materials
		Hazardous material levy		Reduce environmental impact of waste by changing composition of waste (reducing hazardous waste)	Increase prices of hazardous materials
		Packaging material levy	Europe	Reduce waste generation by discouraging over-packaging	Increase prices of materials used to manufacture packaging
		Product charges	Tyre levy & plastic bag tax (SA); also applied to batteries, fridges, etc	Reduce waste generation & final disposal and increase recycling by discouraging purchase of waste-generating products and encouraging reuse	Increase prices of waste-generating products
	(Quantity-based) user charges/ fees	(Quantity-based) collection charges	Household waste charges / kerbside charges (Australia, USA, Canada); hazardous waste charges	Reduce amount of waste generated / encourage recycling	Increase cost of waste collection services (per unit of waste generated)
		(Quantity-based) disposal charges	Landfill tax (UK), Landfill Tipping Fee (USA)	Reduce final disposal e.g. waste disposed of to landfill / increase recycling	Increase cost of waste disposal services (per unit of waste disposed of)
Subsidies	Subsidies and credits	Recycling credits	Recycling credit scheme (UK)	Encourage recycling	Increase private benefits (to recycling companies) of collecting recyclables
		Payments/subsidies for recycling	Drop-off centres, 'reverse vending machines' and subsidised composting bins (UK, Australia)	Encourage recycling/composting	Increase private benefits (to households) of recycling
	Concessions	Tax concessions / exemptions	Collection/disposal charge reductions upon proof of recycling	Encourage recycling	Increase private benefits (to households) of recycling
		Government procurement price preferences for recycled products		Increase recycling	"Favour products with more recycled content" (Inter-American Development Bank, 2003:17).
Deposit-refund systems	Deposit-refund systems	Deposit-refund scheme	Beverage containers; batteries	Decrease waste generation by discouraging purchase of waste-generating materials (deposit = product tax); encourage recycling (refund = recycling subsidy)	Increase prices of waste-generating products and increase private benefits (to households) of recycling
Other	Market creation and facilitation	Privatisation		Minimise costs of SWM	
		Tradable recycling permits/ obligations	Marketable permits for increasing waste paper and board recycling (eg newsprint - USA)	Increase recycling	
		Tradable landfill quotas			

Class	Type	Instrument	Example	Purpose	Mechanism
		Packaging requirement certificates trading	UK		
	Liability and enforcement systems	Liability law		Payment for damages to discourage environmentally damaging waste disposal practices	"Increase the financial cost of irresponsible waste handling or disposal" (Inter-American Development Bank, 2003:10).
		Non-compliance fees		Penalties for non-compliance with regulations to discourage non-compliance	
	Extended Producer responsibility/ product stewardship	Product life-cycle assessment, Cradle to grave & manifest approaches; & take-back schemes	German Packing Ordinance and Take-Back scheme	Increase recycling / Reduce final disposal	Make producers responsible for impacts of product from cradle-to-grave

Source: CSIR,2007.

In order to assess the above, the CSIR developed a set of criteria against which the EI's can be evaluated. This includes:

Table 12. Criteria for evaluating and comparing economic instruments for waste management

Criterion	***Description***
Environmental effectiveness	Extent to which instrument is effective in reducing waste generation, increasing recycling or reducing disposal to landfill
Potential to deal with hazardous waste	Extent to which instrument can reduce the hazardous waste component of municipal solid waste
Unintended consequences	Extent to which instrument creates perverse incentives, e.g. for illegal dumping
Administrative practicality	Extent to which an instrument is administratively simple and cost-effective to implement
Economic efficiency	Extent to which overall impact on welfare is positive
Equity / distribution	Extent to which instrument is progressive or neutral (as opposed to regressive) in terms of the distribution of wealth
Policy integration	Extent to which instrument is consistent with existing policy framework
Revenue generation	Extent to which instrument has potential for raising revenue
Political acceptability	Extent to which instrument is politically feasible

Source: CSIR,2007

Based on the above criteria, the assessment of EI's yielded the following results:

Table 13. Performance of economic instruments against relevant criteria (CSIR analysis)

Criterion	***Product/input tax***	***Quantity-based charge***	***Subsidy/credit***	***Deposit-refund***
Environmental effectiveness	✓ (have been shown to decrease generation)	✓(have been shown to decrease disposal to landfill)	✖ (not effective if used in isolation)	✓ (effective for waste types that apply)
Potential to deal with HW	✓ (price differentiation can be used according to degree of impact)			
Unintended consequences	✓(no incentive to dump illegally)	✖ (incentive to dump illegally)	✓(no incentive to dump illegally)	✓(no incentive to dump illegally)
Administrative practicality	✓ (simple; levied at point of sale)	✖ (e.g. monitoring and enforcement is difficult)	✓ (relatively simple; self-enforcing)	✓ (relatively simple; self-enforcing)
Economic efficiency	✓ (simple and cost-effective)	✖ (due to high costs & unintended consequences)	✖ (subsidies generally distortionary)	**?** (evidence is mixed)
Equity / distribution	Depends on extent to which tax/subsidy affects poor vs. wealthy households			✓ (poor households more likely to return)
Revenue generation	✓ (tax – provides revenue)	✓ (charge – provides revenue)	✖ (subsidy – requires revenue)	**-** (revenue neutral)
Political acceptability	✖ (tax – consumers worse off)	✖ **(**charge – households have to pay)	**?** (benefits recipients, but violates PPP)	✓ (consumers may be no worse off)
✓ = performs well; ✖ = performs poorly; - = neutral; ? = uncertain; HW = Hazardous waste				

Source: CSIR,2007

The CSIR's analysis highlights the pros and cons associated with each instrument. The analysis seems to support deposit-refund schemes (DRS) and product and input taxes in particular, on the basis that these EI's perform particularly well on all six criteria. Specifically, DRSs are said to be effective for certain waste types such as beverage containers, tyres and batteries, they are relatively easy to administer and do not encourage illegal dumping. Product and input taxes are useful because they generate revenue and have proven to be effective economic instruments.

While the benefits of these instruments are noted, it is important that the relevant industry stakeholders' views on these options be taken in account. Engagement with PACSA suggests that DRS policies are not favoured by industry as they are seen to be ineffective due to their costliness for both producers and consumers (including transaction costs) and with limited gains in terms of recycling rate. These concerns are, at least with respect to transaction costs, generally supported by international experience (Porter, 2002).

Furthermore, PACSA has suggested that a disadvantage of attaching a "regulated" value on a product (such as a beverage bottle) is that it creates an incentive for theft of the product, creating the need for secure storage which is costly (PACSA, 2009). This example illustrates the need for engagement with stakeholders in the development of EI's.

The CSIR research provides a useful assessment of EI options, however their research and analysis suggests that it is important that economic instruments are not seen as an alternative to regulatory measures, but rather as further mechanisms to support command and control regulation. As noted in the CSIR study, "EIs operate best in combination with a legal framework and regulatory instruments" (Forum for Economics and the Environment (2002) cited in CSIR, 2007). Furthermore, findings suggest that because of the problems noted with certain economic instruments, such as subsidies and quantity-based user-fees, these should not be used in isolation but instead only considered in combination with complimentary instruments (CSIR,2007).

3.2.1 The use of EI's in mining – findings from literature review

A brief review of international literature shows that the following are some options for consideration in terms of using economic instrument for managing mining waste.

3.2.1.1 Environmental Bonds

International literature has identified a number of options for the use of economic instruments in managing waste from mining. One such EI promoted internationally is the use of environmental bonds, which are used to control the external effects of pollution and the depletion of resources. They are linked to the concept of material user fees, where a private firm is required to post a bond covering any potential environmental damage, with aim of ensuring that "the firm internalises the perceived social costs into its private resource allocation decisions" (Shogren, Herriges et al,1992:111) . This mechanism aims to shift responsibility for controlling pollution, monitoring and enforcement to individual producers who are charged in advance for potential damage. This is one strategy to mitigate the high costs associated with cleaning up and the reclamation of abandoned land after mining.

Environmental bonds are said to be useful instruments because they ensure that:

i. resource extracting companies and potential polluters take adequate measures to minimize the environmental damage caused by their activities;

ii. they effect clean up and restoration of residual damage in the most cost efficient manner; and
iii. adequate funds are available for the clean up of waste and restoration of damaged environments by anyone who fails to comply (Panayotou,1994:21).

South Africa has a system of environmental bonds for the mining industry. This includes financial provision for the waste management aspects of mine closure such as the rehabilitation of over-burden and spoils. The risk class of the mine used in calculating the required financial amount to be set aside also depends on the presence on site of either mine and mine waste only, or mine, mine waste, processing plant and processing plant waste (DME, 2004).

This is a highly complex issue and is an area in which there should remain ongoing dialogue and collaboration between the Department of Minerals and the Department of Environmental Affairs on the regulatory approach followed and its effectiveness, the adequacy of the quantum of financial provisions made and so forth.

3.2.1.2 Self-regulation

Another alternative proposed in the literature is the implementation of induced self-regulation, which is said to be more efficient and cost-effective than direct government regulation because industries have a better understanding and capacity to control their own waste. Self-enforcement takes place through the desire to be accepted by other members of the industry or association. The costs associated with monitoring and policing are reduced, because this is the responsibility of the producer. Government is then only responsible for the monitoring of ambient quality and will impose charges on the association for non-compliance or offer a warning of direct regulation. While it is noted that this approach is not necessarily useful in all industries, there are a number of examples where it has been effective (Panayotou,1994).

3.2.1.3 Environmental tax on mineral extraction

Environmental taxes or levies on mineral extraction are market mechanisms used to account for the environmental costs of mining, leaving the market to decide whether or not to change behaviour based on commodity price. The UK government has shown a preference for market mechanisms when reviewing options for environmental policy governing surface mining (quarrying). The Aggregates Levy, an indirect tax applied to all sand, gravel and crushed rock used for construction purposes which are mined in the UK was first implemented in 2000. The aims of the levy included addressing the environmental costs associated with quarrying, such as noise, dust, damage to diversity etc. In addition, the levy aims to reduce the demand for quarried aggregates and encourage the use of alternative materials, including recycled materials (Morgan, 2002).

While there was criticism from the industry, the UK experience is said to reflect a good example of environmental taxation. There has been a reduction in the demand for primary aggregates and firms have responded by diversifying into recycled aggregates in addition to primary aggregates so as to maintain and develop market share (Morgan,2002).

There is merit for the consideration of similar levies in South Africa where a particular minerals extraction process is identified as causing unwarranted externalities and where there exists the potential for the use of preferred alternatives to that mineral. A possible

example may be asbestos mining. However, significant further research at this level of detail is outside of the scope of this paper.

3.2.2 The use of EI's in agriculture – findings from literature review

The literature has identified a number of constraints around using EI's in the regulation of pollution created by the agricultural industry. A Canadian study explored a number of incentive-based economic instruments for pollution reduction in the farming industry. The study found that the use of EI's may not be the most effective approach because the pollution emissions tend to come from diffused rather than specific sources (for example runoff, seepage and soil erosion), making it difficult to trace the origin of the pollution. The research concluded that other challenges in developing EI's for the farming sector include that:

- Many farms may be contributing towards pollution making attribution difficult;
- Where many farms are responsible for pollution, the likelihood of their co-operation in the reduction of pollution is less, especially for those farms that contribute relatively less to the problem;
- The costs of monitoring agriculture are high because of the complex nature of the environmental processes which make it harder to infer emissions from observable inputs; and
- The impact of a farm's actions on the environment depend on the location, therefore policy may need to target individual firms.

(Weersink et al,1998).

This research therefore conclude that the diffuse nature of pollutants in the farming sector make it difficult to implement EIs such as ambient taxes or tradable permits. Rather they propose that resources be placed into enhancing the information technology to monitor application levels and techniques as prerequisites for assessing the feasibility of EI's in this sector.

In the United States, a similar set of problems constrain the use of EI's in the farming industry, however voluntary agricultural environmental programmes are used to encourage environmentally friendly farming practices. The programmes generally entail the government paying farmers a certain percentage of any approved environmentally beneficial practices that farmers undertake (Porter,2002). This is essentially a means of incentivising farming practices which are beneficial to society as well as the farmer's own interests.

This section has identified the strengths and weaknesses of both CACs and EI's, as regulatory instruments for the improvement of waste management from an economic perspective. The next section looks at issues for consideration and a framework for application when considering the use for regulatory tools.

3.3 Developing a solid foundation for effective regulation in South Africa

While there is arguably a role for the use of economic instruments in the waste sector of South Africa, these need to build upon a strong foundation. It is therefore proposed that a first stage in the process of improving the economic aspect of waste management be aimed at 'getting the basics right' and 'getting the prices right' as discussed below.

3.3.1 Improving data access

3.3.1.1 Data on the sector

The data and information limitation has been identified, with the National Waste Information System serving as a response to this challenge. Data on the waste sector more broadly is necessary in order to adequately develop and target regulatory tools and sector support initiatives. For example, while there is a general awareness that the private sector makes a significant contribution to recycling, it remains largely informal, making it difficult to get a full sense of its capacity. There is benefit therefore in collecting reliable data on the industry in order to a gain a more accurate sense of its size and economic contribution.

In the design of data collection systems it is important to ensure that data necessary for the cost-benefit analysis of waste disposal in particular is gathered were possible. Much of this data is relatively easy to source and consolidate – especially during the EIA process and includes such information as proximity to watercourses and population, nature of materials to be accepted by disposal sites and so forth.

3.3.1.2 Financial data and assessment

Within municipalities, financial management of the waste service needs to improve. Gathering and assessing financial data is necessary in order to understand the true cost of the service (in terms of collection and disposal) and therefore develop the appropriate tariff systems. Prior to the consideration of any additional waste disposal taxes the appropriate solution is full cost accounting for waste disposal and suitable tariff structures that reflect the real costs of disposal.

3.3.1.3 Investing in data collection and equipment

Effective regulation cannot take place with access to reliable data and measuring equipment. The investment required to improve data may, for example, include weight-bridges (for measuring volumes of waste entering landfills) or weighing equipment on trucks (for the implementation of a volume-based tariff system).

3.3.2 Improved enforcement and creating a culture of compliance

Current regulatory mechanisms, such as municipal by-laws governing illegal dumping and minimum standards and requirements for disposal should be enforced as the first step to improve regulation in the waste sector. This is a necessary precondition for fostering a culture of compliance. As the culture of compliance improves it is envisaged that the monitoring of activities such as illegal dumping becomes less of burden because it will occur less frequently and be easier to manage (CSIR, 2008). Once enforcement capacity of current laws and regulations is improved, it is suggested that EI's be phased in gradually, starting with simpler mechanisms and moving towards more complex ones as the institutional capacity grows over time. EI's should therefore be used to support existing regulatory mechanisms.

3.3.3 Building capacity in the sector

Capacity constraints are a major obstacle to the effectiveness of any regulatory instrument, be it CAC or EIs. Building capacity in the sector is therefore important. Notable areas for capacity development include the following:

3.3.3.1 Enforcement capacity

Municipalities, provinces and the national department need to be adequately trained and equipped to monitor and enforce laws governing waste management.

3.3.3.2 Financial capacity

Many municipalities face capacity constraints in terms of their ability to manage the financial aspect of waste management. The current under-pricing of land filling for example, poses a particular challenge.

3.3.3.3 Capacity of waste generators

It is imperative that households, businesses and producers become capacitated and informed in order play their role in satisfying South Africa's waste management goals.

3.3.3.4 Recycling industry capacity

Developing capacity in the recycling industry could assist meeting recycling targets and create job opportunities.

3.3.4 Supporting voluntary initiatives

Feedback from the Packaging Council of South Africa highlights the efforts already being made within this industry in terms of reducing, re-using and recycling in particular (e.g. Collect-a-can). There are similarly other initiatives in other sectors. It is important therefore that government acknowledge and harness the potential vested in these voluntary initiatives as a means of facilitating an effective partnership with relevant industries.

The factors mentioned above are seen as some of the fundamentals which need to be in place before pursuing EIs as regulatory tools for the waste sector. These fundamental issues should maintain their priority and there should be a sustained effort to improve the level of compliance and capacity across the sector.

EI's may improve waste management and traditional CAC instruments can be complemented by the use of EI's as part of a multi-pronged strategy to achieve the objectives of waste reduction, re-use and recycling. The next section of this paper presents a framework for assessing if (and which) EI's are appropriate and realistically applicable to the South African context.

4 Framework for the implementation of economic instruments

When considering the use of EI's there are a number of important issues for consideration, including legal, administrative and process issues which shape the relevance, applicability and appropriateness of the instruments in targeting the problem areas identified. These are discussed below, beginning with the legal parameters. The National Treasury's Environmental Fiscal Reform policy provides a useful framework for assessing the applicability and implementation of EI's in South Africa. This will be discussed in this section.

4.1 Legal parameters

The current legislation governing waste management in South Africa plays a role in shaping the parameters of regulatory instruments for use in the sector. A number of areas where the Waste Act allows for implementation of economic instruments have been included below.

- ***Priority Wastes*** (s. 14(1)) of the Act provides for the identification of specific waste streams to which specific management measures can be applied. This provides a mechanism for the targeting of economic instruments to a specific waste stream – for example, used tyres, compact fluorescent light-bulbs and so forth.

- ***Extended Producer Responsibility*** (s. 18(1)) of the Act allows for the Minister to specify the financial arrangements of a waste minimisation programme on support of extended producer responsibility arrangements. This could include, for example, deposit-refund systems or similar incentives for supporting extended producer responsibility.

- ***Recognition Measures*** (s. 42(1)) allows for the establishment of public recognition programmes for significant waste management achievements. This could conceivably include awards and incentives for excellent performance.

- ***Application for a Waste Management license*** (s. 45 (2a)) requires that a prescribed processing fee be paid for licenses. The determination of the scale of this fee allows for some measure of implementation of the polluter pays principle. The fee should:

    a. allow for the recovery of the administrative costs directly attributable to that license application
    b. allow for the recovery of costs associated with the administration of that license, including ongoing monitoring costs (or relevant portion thereof)
    c. be linked to the risk and complexity of the licensed activity, and hence the operational costs of administering the license.

This similarly applies to the ***transfer of a waste license*** (s. 52(4a)) and a ***renewal*** (s. 55(3a)).

- ***The Waste Management License conditions*** (s. 51 (2f)) specifies the financial arrangements that a license holder must put in place for remedial work or decommissioning of the site. This is of particular relevance for municipalities setting aside sufficient funds for the closure of sites.
    - This creates the legal basis for the introduction of landfill closure bonds similar to those in force in the mining sector. It should be noted that some industry representatives have expressed concerns related to the mining closure bonds process and should be consulted on this issue if more specific recommendations were to be made in the NWMS.

- The ***Regulations by Minister*** (s. 59(1o)) allows for the ***financial arrangements of waste minimisation programmes***; (s. 59(1x)) requirements in respect of ***the funding or insuring of a waste management activity***; and (s. 59(1bb)) ***incentives or disincentives to encourage a change in behaviour towards the generation of waste and waste management*** by all sectors of society.

The Waste Act outlines specific prohibitions on waste disposal that is not to authorized or suitable disposal sites or facilities (s. 26 (1) and (2)). As noted, the success of this prohibition rests significantly on the enforcement capacity (likelihood of being caught) and

the enforcement severity (penalty if caught). The combination, i.e. probability of being caught and severity of penalty is a key factor in effective enforcement and international experience has shown that people are highly sensitive to increases in waste disposal penalties as it increases the combined risk of punishment. Therefore, it is recommended that the scale of penalties, including fines, be looked at closely in the NWMS to ensure that these are sufficient to provide an adequate deterrent. The possibility exists for experimentation with different levels of penalties in different jurisdictions to evaluate impact.

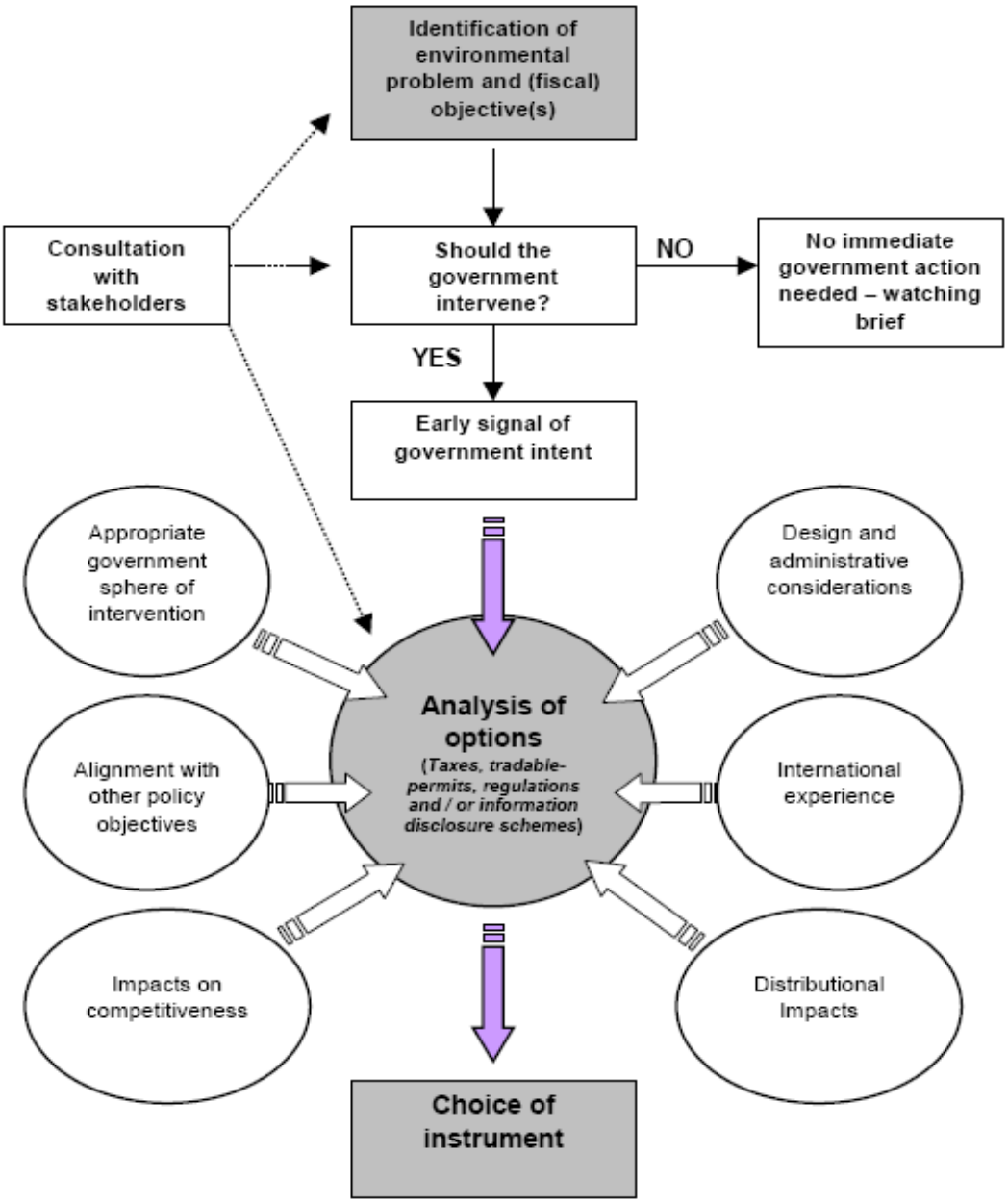
Similar considerations would apply in the case of littering (covered in Part 6, section 27 of the Act). The NWMS should consider the use of fines as the 'strong end' of economic instruments and experimentation with severe penalties for littering should be undertaken to evaluate their impact. This is not simply a punitive approach – the costs of cleansing are a significant burden on local authorities and if a high penalty regime is a more cost effective method of reducing littering of public spaces and of illegal dumping it should be utilized.

There are number of instances where legal approaches are more appropriate than EIs in controlling aspects of waste management. Chapter 4, Part 5 Waste Act (2008) (s. 25(1)) details the duties of persons transporting waste, specifying expectations in terms of the management hereof. Waste transportation serves as a useful example of a case where legal instruments rather the EIs are suitable regulatory mechanisms. EIs are only appropriate where risks are easily managed and where the consequences of not controlling an activity are not sudden and severe. Waste transportation, particularly with respect to hazardous waste is high risk and the use of EIs would therefore not be appropriate. Instead effective legal regulation and enforcement is required in order to control and manage the risks associated with this.

4.2 National Treasury Environmental Fiscal Reform Policy

The National Treasury policy provides a framework for the introduction of economic instruments. The stages involved in the process of deliberating and selecting appropriate EI's is illustrated below.

Figure 4. Identification of EI's



The policy framework identifies a number of key areas for consideration when selecting and introducing the most appropriate EIs:

- *Environmental effectiveness*: There should, as far as possible, be a clear environmental objective and the tax must be well targeted to that objective. To ensure that the tax is as effective as possible, the best design should be aimed for and the number of exemptions kept to a minimum.
- *Tax Revenue*: The level of tax revenues and the way in which they are used are important considerations. Certain environmentally-related taxes will be capable of raising significant amounts of revenue, particularly where the demand for the good or

service being taxed is price inelastic. In other cases, tax revenues may be small and therefore of secondary importance.

- *Support for the tax*: Taxes are necessary to fund government activities and the provision of public goods and services. With every tax reform, there are likely to be winners and losers and these groups of stakeholders need to be clearly identified. All relevant stakeholders should be engaged in the assessment process.
- *Legislative aspects*: Legislative aspects also need to be considered. The Minister of Finance is responsible for the imposition of taxes, duties and levies. Different environmentally-related tax instruments may require different legislative amendments (e.g. direct versus indirect taxation). With respect to international commitments, environmentally-related tax measures will need to be compatible with World Trade Organisation (WTO) rules and possibly with on-going tax harmonisation efforts within the Southern African region through SADC.
- *Technical and administrative issues*: Technical and administrative issues are important considerations that can influence whether or not a tax instrument may be appropriate. Ideally, the tax base should be as close as possible to the environmental objective although in certain cases, a proxy may be required. Where there is a clear environmental objective, the tax rate should be set according to the level of the externality. Where this is not possible, the tax rate must be sufficient to achieve the environmental (and / or fiscal) objective. Minimising the possibilities of tax avoidance, tax evasion, compliance and collection costs are other important design considerations.
- *Competitiveness effects*: The impact of environmentally-related taxes on domestic industries and other aspects of the economy such as employment and inflation are of critical importance. Where impacts on competitiveness are deemed ex ante to be unacceptable, mitigation measures may need to be considered. These may include, amongst other things, reduced tax rates, tax ceilings, tax refunds, appropriate mechanisms to recycle tax revenues, or tax shifting options.
- *Distributional impacts*: An understanding of the way in which environmentally-related taxes impact on different income groups is important. For every proposed tax reform, the likely tax burden on different income groups and the anticipated distribution of environmental benefits needs to be assessed. The possibility of making environmentally-related taxes progressive should be integral to the design of any proposed instrument. Where there are likely to be adverse impacts on income distribution, mitigation or compensation measures may need to be considered. In some cases, such measures can be built into the tax instrument itself whilst in other cases it may be necessary to compensate certain groups through alternative (income supporting) measures.
- *Adjoining policy areas*: The extent to which environmentally-related taxes can assist in meeting other government policy objectives is an important consideration. From an environmental point of view, it is important therefore that any tax measure is aligned with other regulatory or voluntary approaches. In certain cases, other policy processes may be driving an environmentally-related tax reform measure and it is important that environmental considerations are effectively integrated (e.g. company car tax and allowance reforms or the Electricity Industry Restructuring process). The extent to which environmentally-related taxes can be designed to contribute to policy goals such as job-creation, poverty alleviation and the expansion of basic services is also important.

The National Treasury criteria have been compared to those used by the CSIR in their initial evaluation of economic instruments (see table below). It can be seen that the CSIR criteria effectively address the criteria required by the National Treasury. It should therefore be relatively easy to comply with the National Treasury process in the further elaboration of any economic instruments identified.

Table 14. CSIR and National Treasury comparison of economic instruments

CSIR Criteria	*National Treasury Criteria*
Environmental effectiveness	Environmental effectiveness
Potential to deal with hazardous waste	*Specific to the waste sector*
Unintended consequences	
Administrative practicality	Technical and administrative issues
Economic efficiency	Competitiveness effects
Equity / distribution	Distributional impacts
Policy integration	Adjoining policy areas Legislative aspects
Revenue generation	Tax revenue
Political acceptability	Support for the tax

4.3 Additional factors influencing instrument choice

In addition to the specific elements of the National Treasuring frameworks, additional considerations implicit in the above are worth specifying:

4.3.1 Balancing environmental and economic gains

Given the economic challenges of unemployment, the need to balance job creation alongside the pursuit of environmental gains is significant in the South African context. It is necessary therefore to know the nature and extent of employment in the sector in order to design instruments appropriately.

With respect to recycling, which is a major employer in the waste sector; findings indicate that jobs are primarily created at the collection and sorting stages, a factor which may influence the choice of options. For example, promoting initiatives such as separation at the source (e.g. separation by households) may increase the efficiency rate of waste collection but will also have a bearing on employment and may lead to the reduction rather than increase in the number of jobs created. It is therefore important to take cognisance of these sorts of considerations when developing and adopting EI's. In other words, one may want to choose a regulatory option that is second best from an economic efficiency perspective but which is preferred from an employment creation perspective. The key issue when making any such decisions is transparency in the process and a clear recognition of the winners and losers.

4.3.2 Differentiation of economic instruments by location

In those components of the waste management sector where economic interventions may be applicable consideration needs to be given to the possibility that these may need to be differentiated between types of municipalities (or waste streams). For example, sophisticated

solid waste disposal tariffs and additional taxes may be appropriate at the metro level and for hazardous waste disposal but not at smaller municipalities for the following reasons:

1. At the better managed metro sites there are the required conditions for monitoring and enforcement.
2. Volumetric charging for waste collection may be possible in limited jurisdictions

Notwithstanding the above, there may be unintended consequences such as transfer of waste out of a jurisdiction that need to be considered if instruments are applied on a geographic basis.

5 Consideration of Specific Incentives

According to the National Treasury (2006) the excise tax on plastic shopping bags is the only waste-related product tax in South Africa. National Treasury states that the levy does not seek to incentivise changes in consumer behaviour but rather seeks to raise revenue, some of which is used to fund plastic recycling operations. An important issue for consideration in the NWMS is whether greater emphasis should be given to the use of economic instruments for the furtherance of the strategy's objectives.

The section below considers some specific economic incentives considered to improve the effectiveness and efficiency of waste management. The next section then goes on to provide some more general recommendations on the use of economic instruments in South Africa.

5.1 Waste Disposal Taxes

Waste disposal taxes have been promoted in many countries as a means to reduce the generation of waste and to provide incentives for recycling and re-use. These taxes would be taxes levied "at the weighbridge" on solid waste. Such a tax could be levied on an *ad valorem* basis, or a volumetric basis and could also be distinguished by the type of waste (such as hazardous or general). The rationale for the consideration of waste disposal taxes is that they address the external social and environmental costs of waste disposal and provide pricing such that the full costs of disposal are taken into account in the waste generation and disposal decision by private actors. The expected outcome would be a reduction in the level of waste going to landfill – due to an overall reduction in waste volumes generated and/or an increase in the diversion of waste to recycling or other disposal alternatives.

Prima facie consideration of waste disposal taxes in the South African context suggests that there are clear externalities associated with solid waste disposal – the majority of which is to landfill. These include leachate infiltration into groundwater and surface water; odours and local air pollution; aesthetic and property value impacts; and greenhouse gas emissions. In this regard, the imposition of disposal taxes makes *theoretical* economic sense. However, there are some significant concerns with landfill taxes, especially in the South African context, including:

- *Diversion of waste streams*: waste streams will tend to be diverted to less costly alternatives. These will include recycling, which is a positive outcome, but will also include diversion to incineration and to illegal disposal. A landfill tax will only be a useful

instrument if enforcement capacity is sufficient to ensure that no significant additional illegal waste disposal occurs.

- *Incidence of incentives*: waste disposal taxes will only have an impact on waste generation if the generators experience the increase in costs. In current practice this means that private industrial waste generators who dispose of waste at landfill sites will feel an increase in disposal costs. Households and some commercial enterprises, however, will be shielded from such costs unless these are passed through in increased municipal tariffs. Such pass-through does not necessarily happen given current municipal tariff approaches. Private operators who do not dispose of waste to external landfills, i.e. those who dispose on-site such as mines and some large industrial generators, will not face the same incentives unless the tax is extended to their internal operations.

- *Capacity and costs of alternative disposal:* a diversion of waste streams to incineration would be an acceptable policy outcome if incineration facilities had sufficient capacity, were managed in accordance with regulations, and were themselves appropriately priced (and taxed). If not, there would be a shifting of a social cost from one source of disposal to another. It is not clear that incineration meets these requirements.

- *Insufficient information on external costs:* a disposal tax should be based on a reasonable approximation of external costs of disposal. Such costs are not yet available but would be possible to determine with a reasonable level of confidence.

- *National cost differences:* notwithstanding the above point, there are likely to be significant differences in external costs across landfills. This makes the establishment of a sensible, single waste disposal tax difficult. The main externalities of concern are probably water resource contamination which can probably be evaluated on a case by case basis.

The most pressing problem in South Africa with regards to solid waste disposal is the financially sustainable provision of landfill sites that are developed and managed in compliance with the current "Minimum Requirements" standards for waste disposal. Although there are certainly externalities associated with landfills there is no strong evidence that landfills sited in accordance with current EIA legislation and in accordance with regulatory requirements impose *significant* external costs of concern relative to the costs of poorly managed and sited disposal sites.

Intuitively, the most significant external costs of waste disposal are likely to be from unmanaged sites; sites not closed properly or monitored after closure, and informal dumps accepting hazardous waste (such as medical waste) and accessible to the public. A landfill tax would not lead to behaviour that would address these costs – and in fact may exacerbate some of them, particularly illegal dumping.

The above analysis suggests that an additional tax on solid waste disposal to landfill does ***not*** appear warranted in general. A more appropriate strategy is to:

- *Ensure all new sites meet the minimum requirements for site establishment*. Although a cost/benefit analysis has not been conducted on the minimum requirements it is (highly) likely that they provide a sufficient level of environmental protection.

- *Address site closure*: mechanisms to ensure that sites are closed properly and monitored thereafter should be examined. These could include site closure bonds (akin to those required in the mining industry, site closure insurance (possibly state managed), or stringent financial planning requirements for site closure for both public and private operators (i.e. sufficient financial provision for site closure and ongoing costs).

    - *Site closure or permitting fund*: there are currently approximately 1 500 un-permitted landfill sites in South Africa. It is probably that the majority of these do not meet environmental standards. The permitting, and closure where needed, of these is likely to be costly and these costs are unlikely to be able to be borne by the local authorities in whose jurisdiction the sites are located. In addition, those responsible for the establishment of the sites will typically not be identifiable. This large public-good problem calls for the consideration of a national fund for waste disposal clean-up. There is no specific reason, however, why such a fund should be financed from within the waste sector. There is also the danger that such a fund is over-capitalised.

      In reference to the last point, any landfill "clean-up fund" should carefully prioritise sites that pose risks to local residents; fire or landfill gas migration hazards, or groundwater contamination. Significant resources should not be diverted from the primary focus on financially sustainable provision of adequate and affordable refuse removal and disposal from all households. There is clear evidence that the costs of landfill regulation in a number of developed countries significantly outweigh the economic benefits (see Porter (1997) for example: an analysis of 1991 EPA regulations on landfill suggest that the average cost for death avoided is in the order of at least US$25 million per death and may be as high as US$32 *billion*. Even the lower number is many orders of magnitude greater than warranted (i.e. many more lives could be saved from other uses of the same resources)). Although the impacts of un-managed sites could be greater in South Africa care needs to be taken to not fall into the same trap as these countries.

      As noted above, there should be parallel consideration of site closure bonds and/or other financial provisions for responsible site closure, post-closure rehabilitation and management; and possibly replacement site establishment.

The National Treasury (2006) in principle support the notion of a disposal site clean-up fund and/or financial mechanisms to ensure appropriate site closure and management. They note "*Rehabilitation funds, financial guarantees and insurance schemes form part of a menu of different mechanisms that could be used for this purpose. The implications of each option, both for the government and those responsible for the environmental liability, can differ greatly with rehabilitation funds providing perhaps the greatest degree of certainty. For the mining sector in South Africa, government prescribes that mining operations must establish rehabilitation funds that make financial provision for the adequate closure of mining sites once mineral extraction has finished. In order to encourage such provisions, government allows contributions to such funds to be written off against taxable income. The context in*

which rehabilitation funds are used to address other specific environmental concerns (such as those outlined above) should be further explored."

- *Targeted cost interventions*: there may be specific cases where a specific waste disposal site is clearly under-priced. There should be the capacity for intervention to tax a specific site to meet public good objectives or to intervene in the level of charges levied. For example, if a municipality is not meeting site closure financial provisions a site-specific "site closure tax" could be imposed to allow a suitable fund to be raised for provincial or national management of site closure. Similarly, if a particular site was found to be generating significant external costs a special tax on that site could be levied to encourage waste diversion to another location.

    - *Possible targeted tax interventions could address hazardous waste disposal*: This requires further analysis but the majority of hazardous waste disposal is well controlled in comparison to general waste disposal and there are possible arguments that externalities are likely to be greater from such sites. There is also likely to be a more direct transfer of such taxes to primary waste generators and hence a more likely behavioural response.

It should be noted that an additional argument ***against*** disposal taxes in the South African context is that greenhouse gas emission reductions carry their own incentives via the CDM and that therefore there is already appropriate economic incentives (subsidies) for methane recovery in landfill sites.

5.2 Enforcement Fines

The effectiveness of enforcement of waste management practices is a central issue when selecting any regulatory instruments – economic or command and control. The effectiveness of enforcement is related to two factors:

- the probability of being caught, and
- the severity of the penalty levied.

Consideration should be given as to whether penalties (fines) for the enforcement of illegal dumping and illegal operation of a waste disposal site are sufficiently severe. Although not often seen as economic instruments, fines levied on illegal actions are, in practice, important economic instruments for waste management.

There is evidence (see Porter (1997)) that firms and individuals respond greatly to even a small increase in the probability of being caught conducting illegal acts. There is therefore an argument to increase the resources spent on enforcement, alongside waste disposal standards. Resources spent on enforcement may be more effective than other mechanism used to induce compliance.

The issue of enforcement and compliance should be an important element of the NWMS and needs to cross-link with the other papers (those on governance and licensing and compliance management in particular)

5.3 Deposit Refund Schemes

The CSIR's analysis suggests that deposit-refund schemes (DRS) perform particularly well on all of their six criteria. Specifically, DRSs are said to be effective for certain waste types such as beverage containers, tyres and batteries, they are relatively easy to administer and do not encourage illegal dumping.

In their analysis of potential economic instruments the National Treasury (2006) suggest that deposit-refund systems are most suitable for products that:

- Are easy to identify and handle;
- Are feasible to reuse and/or recycle;
- Require careful disposal (e.g. batteries); and
- Where cooperation is feasible between producers, retailers and consumers.

The Treasury evaluation appears to be supported by reviews of international experience (see Porter, 2002). The Treasury also notes that SA has had some experience with DRS schemes, primarily in glass beverage containers but that international experience indicates that deposit-refund systems can be successfully applied to a wide range of other products as well such as batteries, reusable chemical containers and even car bodies.

Despite a relatively positive view of deposit refund schemes Treasury supports the industry (PACSA) position that the administrative and compliance costs of these schemes can be high in comparison to alternative options and suggest that in considering the use of deposit-refund systems, administrative and compliance costs should be taken into account, including any possible knock on impacts for other waste management services.

International experience with DRS schemes also suggests the following issues requiring consideration:

- *Effectiveness:* Mandatory deposits do achieve redemption of products. International experience shows the deposits on beverage containers lead to significant increases in returns of such containers;
- *Consumption of beverages goes down with DRS schemes on beverages*: the additional costs in either time or effort do seem to act as a tax on beverages and reduce overall consumption. This would possibly be a positive impact in the case of beverage containers for alcoholic drinks but would be an economic loss to society overall and the beverage industry in particular (a so-called deadweight loss of the instrument);
- *DRS systems do increase recycling but in an expensive way:* DRS have been shown to lead to increased recycling but collection by producers tends to be a very expensive way of recycling;
- *There are mechanisms of making DRS systems more efficient:* these include single government mandated redemption centres and not single brand redemption centres; and
- *DRS systems can be seen as a source of income for the unemployed:* by their nature DRS systems are imperfect and there will tend to be significant amounts of redeemable products that can be collected and redeemed by informal sector waste collectors.

In the South Africa context there appear to be two main objectives that would support the promotion of DRS schemes:

1. To encourage recycling of specific waste streams and hence both support the recycling sector and waste minimisation; and
2. To target specific waste streams of concern that are currently not well handled in the waste management system leading to: illegal disposal (including littering), disposal of hazardous materials in general waste disposal facilities; and other waste stream specific concerns.

However given the fact that deposit refund schemes appear to be a relatively expensive approach to increasing the supply of recyclables there should be caution in adopting such schemes on a wide-spread basis. The lack of strong recycling industry support for such schemes further suggests that these should not be used as an important mechanism to increase recycling (however, broader industry views on these schemes should be solicited).

Tentative recommendations, to be open to discussion with stakeholders, would be that:

- DRS systems should probably not be applied in South Africa to support recycling except where there are specific market failures identified preventing recycling and where the relevant recycling industry has identified the need for such a scheme; and
- DRS systems should always be designed in very close consultation with the industry sector concerned.

There appears to be more merit in considering deposit refund schemes to address specific waste streams of concern. Again, tentative recommendations would be that:

- Within the NWMS DRS systems should be considered but only for specific waste streams of concern where the private sector is not addressing the issue. The waste streams of concern would be typically where:
    - The product is a hazardous waste; or
    - The product is typically illegally disposed of.
- Any introduction of a DRS for specific waste streams be done in close consultation with the industry concerned; and
- Any introduction of a DRS be subject to a cost / benefit analysis to ensure that the costs of the scheme to producers, retailers and consumers does not exceed the environmental benefit and does not exceed the costs of alternative mechanisms of achieving the same objective.

5.4 Product and Input Taxes

The CSIR research suggests that product and input taxes are useful because they generate revenue and have proven to be effective economic instruments. It is debatable whether these taxes can be considered economic instruments for waste management. For example, a tax on mercury would tend to decrease the use of mercury in products and hence would tend to decrease the total amount of mercury in the waste stream. However, such taxes

would not incentivise more responsible management of waste mercury or removal of mercury containing products from the general waste stream.

Such taxes are therefore most properly directed at products or materials for which there is the policy intention to over time diminish or remove from production or use.

At the same time it should be noted that there are industry initiatives to use voluntary "taxes" or charges on specific products for waste management purposes. In particular the tyre industry, through the South African Tyre Recycling Process Company (SATRP) has proposed the following scheme:[15]

"*It is proposed to raise within the laws of the country, a green fee on each of their new tyres sold in SA to create a collection fund. In brief, the monies raised will be used to cover the cost of transporting waste tyres from tyre dealers and delivering them to processors. Money will also be used for auditing, administration and a limited proposed disposal fee to Waste Tyre Processors who have signed contracts with the SATRP Company.*

The green fee will be widely publicised by the SATRP Company in order to make the public aware of the costs and which tyre brands are involved.

The level of the Green Fee will be solely based on the cost to operate the SATRP Company, no profit will be made. The major portion of the fee will be required to transport and store the waste tyres before processing. Finally the total cost of tyres in SA will be recovered once the waste tyre collection process operates properly and land fill sites are relieved of the burden. The social problem associated with waste tyres should also be minimised.

The tyre industry proposals are not pure product and input taxes as they are specifically aimed at financing an industry-wide collection and disposal process. The scheme seems to offer the potential to provide significant benefits – in respect of waste management[16], the establishment of a viable tyre recycling industry and other areas such ashealth and safety. It is likely that similar schemes could be established in other sector and the NWMS should support such initiatives. These would typically be outside of the ambit of legislated input taxes, but in some cases, especially where there would be significant free-rider problems, the industry may require a legislated input tax to ensure scheme success. It appears that the Waste Act allows for such government intervention / support to industry measures.

General, but somewhat tentative, recommendations in relation to input or product taxes for waste management purposes are:

- Product taxes may have a role to play if there are specific products of concern that are targeted for removal (or significant reduction) from the waste disposal system or from use in production (a possible example would be asbestos);

[15] The SATRP Company's National Waste Tyre Project (see http://www.rubbersa.com/)

[16] SATRP states that "It is estimated that at present only 4% of the annual arising of waste tyres in SA is actually recycled or turned into useful products. The remaining 96% is either, illegally dumped in the veldt or collected by people who re-sell them next to the road; few are legally delivered to landfill sites."

- These instruments should therefore be allowed for in the NWMS but there are no specific waste/products yet identified in other parts of the strategy where applicability could be considered;
- These instruments need to be looked at carefully as they disincentivise the creation of waste streams but do not remove them – for example mercury in CFLs. The disposal problem remains and it is possible that other instruments – such as extended producer responsibility or DRS schemes or compulsory exchanges may be better suited to the problem at hand;
- These instruments are not only waste instruments – they affect the general use and consumption of the product and these elements must be considered alongside the waste management objectives; and
- Industry led input charges – where directed at a specific waste management objective in the industry – should be encouraged by the NWMS and supported by regulation where required.

5.5 Community Based Waste Collection Programmes

Some countries, notably Brazil in the city of Curitiba, have experimented relatively successfully with programmes whereby domestic refuse is exchanged for food rations or other goods such as public transport tokens or school note-books. These programmes have been implemented in areas where refuse removal by the municipality itself is difficult or expensive and where unemployment is high, such as in informal settlements with difficult road and access conditions. While these are not economic instruments per se, they do support the consideration of alternative “incentives” for waste collection.

Similar schemes have been implemented in South Africa, where the focus has been on employment creation rather than trading community service for non-cash benefits. A brief overview of labour intensive community based refuse removal schemes has been carried out in section **Error! Reference source not found.**. This showed the significant potential for such approaches in the South African context for employment, cost reduction and service extension.

These options for waste collection are more formalised than the “refuse for food” systems but are on the same continuum – especially labour intensive block collection systems where semi-formal arrangements can be made for local small businesses to collect waste and deposit it at a central skip for a fee per house served. Although not an economic instrument per se, such schemes would improve the contribution of the waste management sector to economic development objectives through the mechanisms of its operations.

The merits of such approaches are:

- Labour intensive collection approaches (possibly for integration within the Expanded Public Works Programme)
- Cost reductions in waste collection
- Use of appropriate technology for specific settlements
- Ability to extend services in the absence of municipal capacity.

5.6 Economic incentives for local government

Economic incentives can be directed at local government as well as end consumers. For example, certain MIG grant streams for solid waste management can be made conditional on the meeting of certain requirements such as full cost accounting and planning for disposal and demonstration of labour intensive approaches to waste management. It is recommended that the inclusion of suitable incentives and disincentives in the intergovernmental finance system are considered and used where appropriate.

5.7 Financial implications of the recommended economic instruments

It is difficult to compare the costs of economic instruments with the costs of command and control regulation. In general terms the expectation is that the social costs of economic instruments targeted at a specific waste management problem are less than the use of a command and control regulation aimed at the same end. However, this does not mean that the administrative costs for government of such instruments are lower. Typically, the costs of enforcement, compliance and administration for economic instruments will be as high or higher than the equivalent command and control regulation and these costs need to be considered in the establishment of any such instruments.

5.8 The role of waste management activities in contributing to a green, low carbon economy

Solid waste disposal on land is a significant source of greenhouse gas emissions. These emissions arise from the creation of methane in landfills from the anaerobic digestion of the organic component of solid waste. Methane typically makes up between 40-50% of landfill gas. This methane, which is 21 more times powerful a GHG than carbon dioxide, slowly enters the atmosphere as it escapes from landfill sites. In addition to the landfill gas releases, there are also smaller emissions largely due to fuel use in transport of solid waste.

The draft 2000 Greenhouse Gas Inventory for South Africa indicates that waste sector is the forth most significant GHG emitting sector in the country. It is responsible for the emission of 8 085 000 tonnes per annum of carbon dioxide equivalents (2000 base year) and accounts for about 2% of total emissions[17]. Although the emissions are small relative to the energy sector they are important and also offer a number of opportunities for mitigation.

The most important mitigation activity is the capture of landfill gas and the combustion of this gas. Methane has a high energy content and therefore the combustion of the gas not only reduces GHG emissions by a factor of 21 times but also creates the potential to use the energy released for power generation or for thermal energy use, such as brick-making, glass manufacture or wood drying. Such uses of landfill gas are now common in many developed countries. Importantly, landfill gas capture and use is eligible under the Clean Development Mechanism and the significant GHG reductions offer important income streams for such projects.

The current Minimum Standards for waste disposal do not require the capture and flaring of landfill gas unless such gas poses a local health and safety or environmental threat. Therefore, the implementation of such projects and the investment required, is additional to

[17] It should be noted that the inventory has not yet been released for public comment or peer review and that these proportions are therefore interim results and subject to change following verification.

actions required under regulation. This allows for such projects to be eligible for the CDM. The DEA is faced with the option of either regulating the capture and flaring of landfill gas further, or relying on the market forces of the CDM to encourage such projects. It is strongly recommended that the status quo is retained, as this allows landfill gas capture to remain eligible for carbon credits and provides important financial incentives for such projects to occur. In the absence of the CDM it is likely that, even in the presence of more stringent regulation, few landfill gas capture projects would occur due to the inability of municipalities and other landfill site owners to finance such projects without revenue from the sale of carbon credits.

Although direct regulation is not recommended, there are other ways in which the DEA can support the establishment of additional landfill gas to energy projects. This includes the provision of technical advice and knowledge sharing to municipalities, and possibly the direct development of such projects on behalf of smaller municipalities who lack the capacity to undertake such projects independently. Such projects reduce GHGs, typically lead to lower local air pollution and also will bring in additional revenue to waste management authorities.

There are other mechanisms that can be used to ensure that the waste management sector supports a low carbon and green employment economy. The recycling industry itself typically creates new products with a lower use of energy, and hence carbon emissions, than the use of virgin material. Therefore support to the recycling sector is typically a GHG mitigation action. The removal of organic materials from the waste stream for use as aerobic composting material will also reduce methane emissions due to anaerobic digestion and is typically a job creating process. Similarly, the use of waste as fuel, such as the use of waste tyres in cement kilns or other waste-to-energy processes both displaces fossil fuels and also reduces landfill gas formation. These options should be explored and encouraged further through the strategy.

6 A Pathway to Economic Efficiency in the Waste Sector

In large measure the analysis and discussion above suggests that the introduction of economic incentives in the waste sector should not be seen as the most significant regulatory tool in ensuring an efficient, effective and financially and environmentally sustainable waste management sector. However, that being said, a crucial component of an effective National Waste Management Strategy is ensuring that there is a proper understanding of costs in the sector and corresponding pricing of waste management services. ‘Getting the prices right’ in the sector is not, strictly speaking, an ‘economic instrument’ but it lays the basis for more refined instruments to be introduced at a later stage. Some of these potential instruments have been discussed above.

This approach coincides in large measure with the CSIR’s (Godfrey and Nahman, 2008b) conclusions related to the introduction of economic instruments which are that a number of fundamentals had to be in place first, including:

- promulgation of the Waste Management Bill, which will create an enabling environment for enforcement and provide a framework within which EIs can be implemented;
- political will (waste management must be seen as a priority at all levels of government);

- education and awareness (waste management must be seen as a priority among business and communities, to encourage waste minimisation and recycling and to enable acceptance of instruments);
- development of capacity at all levels of government (for administration, monitoring and enforcement of instruments, and billing for services);
- increased access to resources for waste management departments (to allow for development of capacity, recovery of costs, and improved waste management services);
- waste licensing and data (e.g. through a waste information system); and
- infrastructure for extension of basic waste services, improvement in existing services, and to enhance the convenience of recycling (e.g. drop-off centres, possibility of kerbside pickup, etc).

More specifically the following strategic approach is proposed as a general approach to the preparation for and consideration of economic instruments:

1) ***Financial sustainability of the waste management system***: ensure that public sector waste management is managed as a financially sustainable service. This does not mean that all revenue needs to come from within the sector and due account needs to be taken of intergovernmental subsidies (see governance paper). Financial sustainability also includes the use of cross subsidies as appropriate for under-provided public goods and for addressing negative externalities of inadequate service provision.

2) ***Full cost accounting and pricing of solid waste services***. This includes ensuring that the full financial costs are accounted for and considered in the process of tariff setting. This includes the full costs of service provision, monitoring and enforcement costs, airspace development, and landfill closure costs. In support of this the NWMS should provide:

    a. Tariff setting guidelines and requirements for municipalities and other providers of waste disposal services including full cost accounting requirements in a simple format; and
    b. Guidance on the need to separate collection charges from disposal charges – and for municipalities to have appropriate internal charge / cost allocation systems for the provision of the correct internal incentives in the system.

3) ***Evaluation of the full social and environmental costs***: Once the full financial costs of solid waste management are accounted for there should be further evaluation of the external costs of resource degradation and external costs of inadequate service delivery.

    a. This process can run in parallel to steps 2 and 3.
    b. As discussed, an essential component of this is the development of the waste information system and associated research.

4) ***Establishment of administrative mechanisms***: this is addressed in the governance components of the NWMS. It is a given that the establishment of the administrative

mechanisms needed for effective management of the sector (primarily information, monitoring, compliance and enforcement, and pricing) are preconditions for economic instruments.

a. This process will run parallel to the others as it is a cross-cutting theme for the NWMS.

5) ***Specific consideration of selected instruments*** : The NWMS should establish a process of evaluation of the specific instruments outlined for consideration in this paper.

a. There are specific instruments that have been identified as worthy of consideration. Some of these, such as deposit-refund schemes for selected waste streams, may be appropriate in the short to medium term and the need and pre-conditions for their application may exist. The CSIR and National Treasury procedures provide an adequate framework in which to evaluate such instruments.

b. The starting point for these instruments needs to be clear strategic objectives in the NWMS and once such objectives have been identified further 'mapping' of a process for the specific options raised can be undertaken.

6.1 Capacity requirement and cost implications for pathway to economic efficiency in the waste sector

As discussed in various sections of this paper, there are a set of fundamentals which need to be in place to improve regulation more broadly and prepare for the use of economic instruments specifically. This section attempts to provide an initial estimate of the time and capacity requirements in order to respond to the proposed pathway.

Table 15 Capacity requirement and time frames for action plan

Focus area	*Capacity requirement*	*Resource commitment and estimated time frames*
Enforcement of CAC regulatory measures	Legal expertise to update municipal by-laws where necessary	Municipalities should, as part of their Integrated Waste Management Planning process, address this. Therefore it is estimated that a time frame of one year is reasonable for the updating of by-laws, with provincial and national departments providing support where needed.
	Legal expertise establishment/updating of appropriate Minimum Standards and Requirements where these are lacking	Many of these are in place. Any revisions should take place within DEA and sector departments such as the Department of Water Affairs. A six month – one year time frame is estimated.
	Enforcement and monitoring capacity development across all spheres of government	This is a major concern in South Africa. It is suggested that resources be channelled to support enforcement and monitoring and that the department aim to see an improvement within one to two years.
Financial sustainability	Finance skills in order to conduct financial viability assessment and cost-benefit analyses	This requires an overall shift in the way solid waste is managed from a financial perspective and how the service is perceived in the public sector. DEA's commitment to address this can include engagement with

Focus area	*Capacity requirement*	*Resource commitment and estimated time frames*
		other sector departments, the provision of support to municipalities and development of strategic guidelines for improving financial sustainability. The department should aim to see a shift in the financial viability of the sector in the medium-term i.e. two -three years.
Full cost accounting and pricing of solid waste service	Tariff setting	Municipalities in particular will require support but the establishment of tariff setting guidelines developed by DEA should be a short-term goal. The department should aim to have these developed with six months to a year.
	Financial systems set-up	The department may need to support municipalities in undertaking financial assessments and setting up the appropriate financial systems. A reasonable aim would be to see an improvement in cost accounting in the short-medium term, within two years.
Evaluation of full-social and environmental costs	Development of Waste Information System	The WIS has already been established. However there is much progress needed in terms of filling the data and information gap. The department should aim to address this as a short-term but continuous goal.
	Financial and Economic modelling	Municipalities will need support in this regard. It is suggested that DEA aim to address the evaluation of external costs in the short-to-medium term, i.e. within two years
	Environmental economics expertise	
Administrative mechanisms	Monitoring and Evaluation Systems	The effective functioning of a national M&E system and guidelines for establishing aligned systems at provincial and local level should be a short-term goal. The department should aim for six-months to a year.
Evaluation of Economic Instruments	The CSIR and National Treasury have already developed a Framework to guide this process. There may be a need for training on carrying this out.	The evaluation of Economic Instruments will take place as the need for the use of EI's is identified.

References

Austin, D. 1999. “Economic Instruments for Pollution Control and Prevention – A Brief Overview”. World Resource Institute.

Business Action for Africa. 2006. “Waste Management – a model for generating entrepreneurs”. Case study prepared for InWent/World Bank Institute 11th International Business Leaders Forum, 2006.

Centre for Public Service Innovation (CPSI), 2002: “Habitable Environments Partnership Programme, South Africa”, Innova, Issue 3 of 2002.

Centre for Public Service Innovation (CPSI), 2004: “Innovation Insights”, Number 4.

Department: Environment Affairs and Tourism. “National Waste Management Strategy – Phase 2 Research: Macroeconomic trends, targets and economic instruments”.

Department of Trade and Industry. 2009. “Proposed Road Map for the Recycling Industry: A Recycling Industry Body (RIB) with relevant working groups”. DTI Recycling Report (090126)

Department: Environment Affairs and Tourism, 2002: “Municipal Solid Waste Tariff Strategy”, report prepared by the Palmer Development Group for the DEAT, March 2002

Department: Environment Affairs and Tourism. 2009. “Packaging Waste, What is the Solution”. City of Cape Town.

Department: Environmental Affairs and Tourism. 2008. “Report on: Incentive Programme for South African Industries”. Environmental Quality Protection (EQP): Pollution and Waste Management

Department: Environmental Affairs and Tourism. 2007. “Assessment of the status of waste service delivery and capacity at the local government level”.

Department of Minerals and Energy, 2004: “Guideline Document for the Evaluation of the Quantum Of Closure-Related Financial Provision Provided by a Mine”, Rev 1.5, 23 April 2004.

EPWP Environmental Sector: Domestic Waste Collection Programme, undated presentation to the National Treasury.

Global Insight Southern Africa. 2008. “Macroeconomic Impact Assessment of the Recycling Industry in South Africa”. Final Report.

Godfrey, L and Nahman, A. 2008a. “Are Economic Instruments the Solution to Sustainable Waste Recycling in South Africa?”. Natural Resources and the Environment (NRE), Council for Scientific and Industrial Research. Presented at the 9th Bi-ennial Waste Conference, 6-10 October 2008, Durban.

Godfrey, L and Nahman, A. 2008b. “Economic instruments for solid waste management in South Africa: Opportunities and constraints to implementation”. Natural Resources and the Environment (NRE), Council for Scientific and Industrial Research, Pretoria.

Lowitt, S. 2008. “A Preliminary Analysis of the Plastics, Paper and Glass Recycling Database: An Introduction to the Nature and Dynamics of the Industry”. Centre for Poverty Employment nand Growth, Human Sciences Research Council.

National Treasury. 2008. “Local Government Budgets and Expenditure Review”. Pretoria.

Nahman, A and Godfrey, L. 2007. “Economic Instruments for Solid Waste Management in Developing Countries: A Literature Review”. Final Report. Council for Scientific and Industrial Research.

Nahman, A and Godfrey, L. 2007. “Economic Instruments for Solid Waste Management in South Africa: Summary Report”. Final Report. Council for Scientific and Industrial Research.

Morgan, P. 2002. “Environmental Taxation of Surface Mining in the United Kingdom”.

OECD. 1997. “Evaluating Economic Instruments for Environmental Policy”, OECD, Paris, France.

Office of the Presidency,2007. “ASGISA Annual Report 2007”. Accelerated and Shared Growth Initiative for South Africa. Pretoria.

Oelofse,S. 2009. “Addressing challenges with waste service provision in South Africa: Waste sector challenges and Vision Report”. Council for Scientific and Industrial Research, Pretoria.

Panayotou,T. 1994. “Economic Instruments for Environmental Management and Sustainable Development”. United Nations Environmental Program: Environment and Economics Unit.

Porter, R.C. 2002. “The Economics of Waste”. Resources for the Future. Washington, DC.

Shogren,J., Herriges,J and Govindasamy,R. 1992. “Limits to environmental Bonds: Lessons from the Labor Literature”. Center for Agricultural and Rural Development (CARD) at Iowa State University

Statistics South Africa, 2008. “Non-Financial Municipal Census of Municipalities for the Year ending June 2007”. Pretoria.

Statistics South Africa, 2009. “Financial Municipal Census of Municipalities for the Year ending June 2008”. Pretoria.

Weersink,A., Livernois,J. Shorgen,J and Shortle,J. 1998. *“Economic Instruments and Environmental Policy in Agriculture”.* Canadian Public Policy. Volume 24: No 3.

6.2 Websites

Enviroserv: www.enviroserv.co.za . Date Accessed: 22 July 2009

Interwaste: www.interwaste.co.za. Date Accessed: 22 July 2009

Chamber of Mines: www.bullion.org.za. Date Accessed: 24 July 2009

Organisation for Economic Co-operation and Development: www.oecd.org Accessed: 24 July 2009