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# WASTE MANAGEMENT

## IN SOUTH AFRICA

FLANDERS INVESTMENT & TRADE MARKET SURVEY



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# “WASTE MANAGEMENT”

## South African factsheet



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FLANDERS INVESTMENT & TRADE JOHANNESBURG

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## LIST OF ACRONYMS

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DEA – Department of Environmental Affairs

DOE – Department of Energy

eWASA – e Waste Association of South Africa

e-Waste – Electronic Waste

EPR – Extended Producer Responsibility

FBS – Free Basic Service

GDP – Gross Domestic Product

IndWMP – Industry Waste Management Plan

IWM – Integrated Waste Management

IWMP – Integrated Waste Management Plan

MSW – Municipal Solid Waste

NECSA – Nuclear Energy Corporation of South Africa

NEMA - National Environmental Management Act, No. 107 of 1998

NEM: WA - National Environmental Management: Waste Act, No. 59 of 2008

NPSWM - National Pricing Strategy for Waste Management

NWIB - National Waste Information Baseline

NWMS - National Waste Management Strategy

PRASA - Paper Recycling Association of South Africa

PRO - Producer Responsibility Organization

REDIS - Recycling and Economic Development Initiative of South Africa

REIPPPP - Renewable Energy Independent Power Producer Procurement Programme

SABIA - Southern African Biogas Industry Association

TGRC - The Glass Recycling Company

WMB - Waste Management Bureau

WtE - Waste to Energy

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## 1. EXECUTIVE SUMMARY

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South Africa's commitment to sustainable development has a number of implications for waste management whereby attention is given to raw material use, product design, resource efficiency, waste prevention and minimization where avoidance is impossible. Economic development, growing population and increasing rates of urbanization in South Africa have resulted in increased waste generation which requires establishing and implementing effective waste management policies and programs. A number of issues continue to be challenges for effective waste management.

These include ineffective data collection systems and lack of compliance and enforcement capacity; lack of education and awareness amongst stakeholders within the waste sector; operational costs for management of waste; support for waste reduction at local government level; availability of suitable land for waste disposal, and lack of structured incentives for reduction, recycling and/or re-use of waste. Municipal solid waste constitutes a large percentage of the total waste generated in urban and rural areas. Municipalities are the key players in dealing with waste. A total of around 239 municipalities perform solid waste management functions servicing around 8.4 million households, or around 64% of all households.

South Africa has experienced rapid growth in waste volumes, associated with a prolonged period of economic growth. During the last decade, general waste generation rose to nearly 67 million cubic meters, or by 62%. This represents an annual average growth rate of around 5%. The big metropolitan municipalities continue to allocate more budget, appoint better qualified staff, and have well organized structures to deliver waste services. However, there is still a strong need for continued strengthening and expansion of waste services to reach people without access to such services.

The overall backlog in the provision of solid waste services is around two million households, with some 900,000 households not receiving any service. The service backlogs are highest in metropolitan areas and secondary cities. Waste management services rely heavily on landfills for the disposal of waste, as over 90% of all South Africa's waste is disposed of at landfill sites. The reliance on waste disposal by landfills has limited the incentive to devise alternative methods of dealing with waste.

For hazardous waste, a general lack of adequate reliable information exists making quantifying mass balance for hazardous wastes difficult. An indication of the status of hazardous waste in South Africa can be sourced from Provincial Hazardous Waste Management Plans. However, only four provinces have completed Provincial Integrated Hazardous Waste Management Plans. It was found that in Gauteng, almost all hazardous waste generated is disposed to landfills, and that in Western Cape and North West most hazardous waste generated is unaccounted for in relation to treatment or landfilling. There was no data for Mpumalanga.

Electronic waste (e-waste) is a relatively new waste category for which there is currently a lack of formal disposal mechanisms. Due to the many hazardous components and materials used in the manufacture of electronic goods, including mercury, brominated flame retardants, and cadmium, this is considered a hazardous waste stream. There is significant job creation potential in the recycling of e-waste, and several initiatives have and are being set up. The hazardous nature of this waste stream and the small margins of profit generated must be carefully considered when encouraging the recycling of waste electrical and electronic equipment. Some municipalities have begun waste-to-energy schemes. eThekweni is extracting landfill gas and generating electricity from the Marianhill and Bisasar Road landfills, and Johannesburg has piloted energy generation from incinerating health care risk waste.

Energy recovery schemes are incentivized by the potential to generate carbon credits and their associated revenues. It is estimated that landfill energy plants can have a capacity of between 20 and 50 megawatts, with a life-of-plant of 30 years. Landfill gas projects can be seen as a means of dealing with historic disposal of organic waste and resultant landfill gas generation. Despite waste minimization, recycling and re-use initiatives and the gradual implementation of the National Waste Management Strategy, much remains to be done to reverse the trend of increasing waste volumes and to improve the safe re-use or disposal of wastes that are generated. Land requirements for the stockpiling or disposal of growing mining, industrial or domestic wastes reinforces the negative trend.



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## 2. South African Overview

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The waste industry in South Africa currently consists mainly of collection and landfilling, with a limited amount (10%) of recycling. Household waste is managed by municipalities and/or their service providers and commercial and industrial waste is typically managed by the private sector in larger municipalities, although some waste may still be disposed of at municipal landfills.

The waste management landscape is changing from predominantly landfilling to more waste diversion. This is mainly due to policy and regulatory reform, pressures on municipalities (e.g. limited landfill airspace) and, to some extent, an increase in awareness of sustainability imperatives in the industry. Furthermore, the government, through various green economy policies and strategies, is also focusing on the waste economy as a job creator

According to the South African Constitution, local municipalities are mandated to collect domestic waste. Municipalities can either provide the collection services directly or appoint private contractors (these contracts are generally for three years). The commercial and industrial sectors are responsible for the safe disposal of their own waste, which includes both general and hazardous waste fractions, and generally appoint waste service providers to manage their wastes.

The National Environmental Management: Waste Act (No. 59 of 2008) (NEM: WA) and the National Waste Management Strategy (NWMS) (2011) mandate municipalities to implement alternative waste management to divert waste from landfill and minimize environmental degradation. Based on current waste management costs and limited capacity the implementation of alternative waste management practices (such as recycling) is perceived as costlier, relative to landfill. This perception has been partially responsible for the slow uptake of alternative waste management measures, despite national laws and mandates.

The demand for basic services, coupled with the demand for alternative waste treatment (which is usually accompanied with the need for new infrastructure), cannot be met using current (allocated) government finances. As a result, municipalities need to look into innovative and alternative ways of funding these support functions. This includes partnerships with the private sector, and provincial and national government playing a role in the implementation of extended producer responsibility (EPR), allowing for the levies charged to offset some of the infrastructural and operational demands.



## The Provinces of South Africa

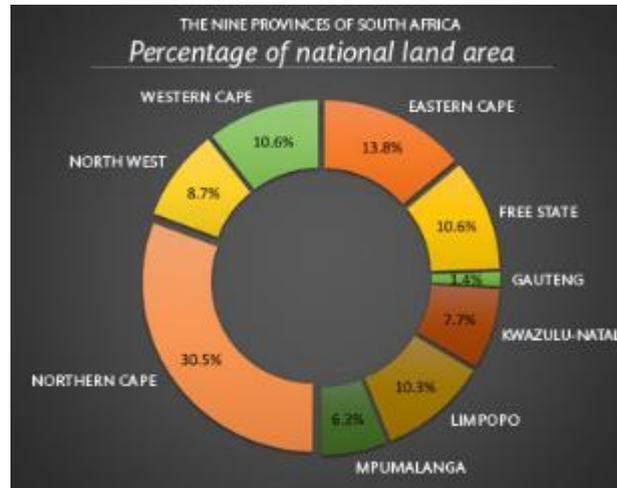
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South Africa has nine provinces, each with its own legislature, premier and executive council – and distinctive landscape, population, economy and climate.



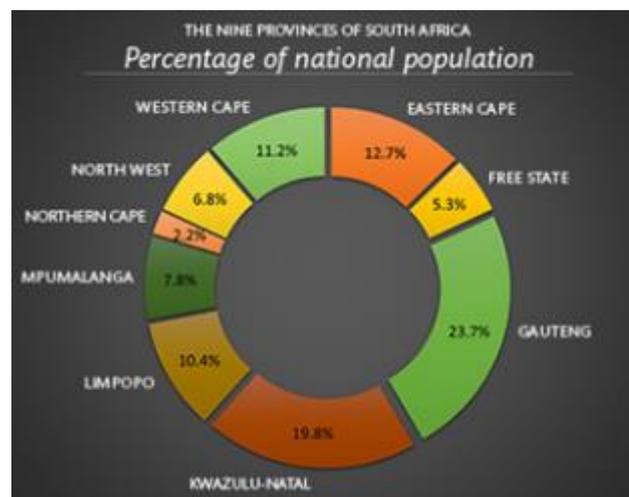
## Land Area

There are vast differences in the size of the provinces, from tiny and crowded Gauteng to the vast, arid and empty Northern Cape. Mpumalanga is the second-smallest province after Gauteng, with the rest all taking between 8% and 14% of South Africa's total land area.



## Population

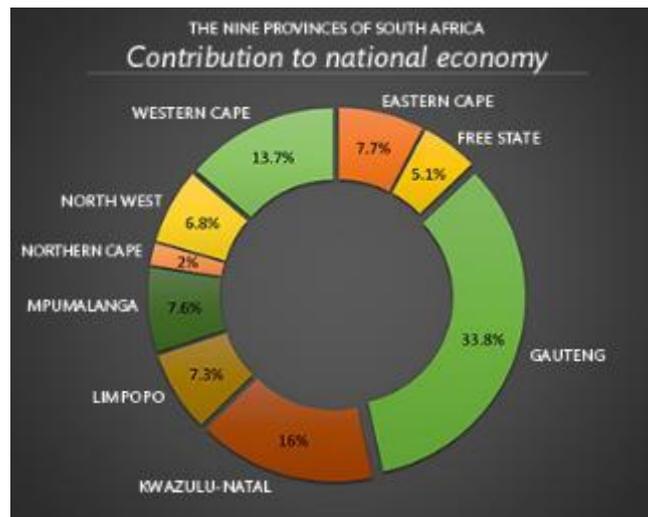
The number of people living in the provinces also varies considerably. Gauteng, the smallest province, has the most people living there – nearly a quarter of South Africa's population. The Northern Cape, which takes up nearly a third of the country's land area, has the smallest population: only 2% of the national total.



## Economy

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Population density correlates with the provinces' slice of South Africa's economy, with Gauteng having the biggest. The tiny province punches way above its weight, contributing 33.8% to the national gross domestic product in 2013 and around 7% to the GDP of Africa as a whole. Next is KwaZulu-Natal with 16%, followed by the Western Cape with 13.7%. These three provinces collectively contribute nearly two-thirds to the economy.



### Municipalities of South Africa

- <http://www.municipalities.co.za/>

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### 3. Market Size

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The financial value of the formal South African waste sector (both public and private) in 2012 was estimated as R15.3 billion – 0.51% of South Africa's gross domestic product (GDP). The majority of this revenue was generated by large enterprises and metropolitan municipalities, which was more than 80% in their respective sectors.

In 2012, companies that had been in the waste industry for more than 25 years generated 62% (R4.3 billion) of all revenue from waste activities. Companies that started up waste activities in the past five years contributed a minimum of 3% (R188 million) into the economy in 2012.

According to the National Waste Information Baseline (NWIB), South Africa generated approximately 108 million tonnes of waste in 2011, consisting of 59 million tonnes of general waste; 48 million tonnes of unclassified waste; and 1 million tonnes of hazardous waste. The current status of waste management in South Africa illustrates a culture of generation and disposal, as only 10% of waste is recovered to be reprocessed or repurposed. It is estimated that 65% of the classified waste (around 38 million tonnes) is classified as recyclable, and therefore could theoretically be diverted from landfill and recovered to be reprocessed or repurposed.

The business as usual approach to waste management (90% to landfill) results in an industry that is estimated to be worth R15 billion in revenue and which provides 29 000 people with employment. Based on global trends, by diverting waste away from landfill, South Africa could increase the revenue made in this sector. The Department of Science and Technology (DST) (2014) estimated that an additional R17 billion a year worth of resources could be unlocked by 2022, if 20% of industrial and 60% of domestic waste is diverted. Accordingly, the South African government has mandated waste management as one of the critical areas it needs to address. By diverting 20% of industrial and 60% of domestic waste away from landfill the waste sector could grow by R17 billion a year.

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### 4. Waste Management Policy & Legislation in South Africa

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Waste management in South Africa focused primarily on end-of-pipe technologies such as landfilling and incineration (medical waste). With the promulgation of the National Environmental Management Act (No. 107 of 1998) (NEMA) and the NEM: WA, which ultimately aim to give effect to Section 24 of the Constitution – 'to secure an environment that is not harmful to the health and well-being of the people of South Africa' – waste management in South Africa has evolved to include additional requirements, such as waste minimization and recycling.

The NEMA and the NEM: WA are guided by integrated environmental management principles that aim to ensure negative environmental impacts are prevented, mitigated and regulated by providing a range of tools and measures to monitor and manage activities that generate environmental impacts. With the promulgation of the NEM: WA in 2008, all organs of state within South Africa were bound to achieve the objectives of the waste management hierarchy.

Among other things, the NEM: WA sets out to achieve the following objectives:

- minimize the consumption of natural resources;
- avoid and minimize the generation of waste;
- reduce, re-use, recycle and recover waste;
- treat and safely dispose of waste, as a last resort.

## Legislative Changes

In 2014, the NEM: WA was updated. This update made provision for the development of a National Pricing Strategy for Waste Management (NPSWM) and the establishment of the national Waste Management Bureau (WMB). The NPSWM aims to provide the guiding methodology and basis for setting waste management charges in South Africa. The funds raised will support the implementation of IndWMPs and the recycling and reuse of specific waste streams. The establishment of the WMB is directly related to achieving the goals of the NPSWM.

The objectives of the WMB are mainly to:

- enable waste minimization and re-use, recovery and recycling of waste materials;
- monitor and disburse revenue collected through economic instruments applied to achieve the WMB's first objective;
- implement, monitor and evaluate the effects of IWMPs;
- build capacity in the WMB to be able to provide support for municipal waste management plan development and implementation;
- develop municipal capacity-building programs.

## 5. Waste Management – Trend Analysis

Issue	Indicator	Trend		Notes
Waste management	General waste management	Improving (but there is still rapid growth in waste volumes)	↑	Rapid growth in waste volumes are linked to periods of economic growth. Waste management has a significant impact on the day-to-day lives of people. The increasing number of municipalities participating in waste management operations is a positive trend. Municipalities service nearly 65% of households. General waste production is rising at an average rate of 4.8% in SA and levels are very high in the Free State and Mpumalanga.
	Municipal waste removal	Improving	↑	The percentage of households with access to waste removal services increased from 58% in 2002 to 59% in 2010. Informal settlements and underserved areas are still problematic and experience unsafe waste disposal activities. This threatens the health of people and ecosystems.

*Source: State of the Environment – Department of Environmental Affairs*

## Trend Analysis Continued...

Issue	Indicator	Trend		Notes
Waste management	Illegal dumping of tyres	Increasing	↓	175,000 tonnes per annum of new tyres entering SA, and used tyres, amount to 150,000 tonnes per annum which need to be recycled or disposed of. More than 28 million tyres have been dumped illegally or burnt for the steel wire and the number is expected to increase by 9.3 million per year. This creates a serious air quality problem and is a contributor to problems from particulate matter emissions. This has been identified as a priority area and activities are underway to curb the trend.
	Available hazardous waste landfill space	No change	→	There are 97 hazardous waste sites in SA.
	Available landfill space	No change	→	Over 90% of SA's waste is disposed of in landfill sites. There is a backlog in permitting landfill sites and limited airspace available.
	Health care risk waste	Improving	↑	There are 11 licensed HCRW facilities in SA and these were operating at 80% capacity in 2007. There is a 1.5% growth in waste generation per annum. Facilities also have high levels of downtime due to breakdowns, malfunctions, and planned and unplanned maintenance, all of which affects capacity. Significant progress has been made on a national compliance strategy and to deal with HCRW related issues.
	Pesticides	Deteriorating	↓	Steady and consistent use of fertilizers and pesticides for agricultural production. Initiatives are underway for the disposal of obsolete pesticides.
	Electronic waste	Deteriorating	↓	This is a new but rapidly growing waste type and expected to become a major waste challenge. Dominated by informal private sector initiatives to recycle waste.
	Mining waste	Deteriorating	↓	88% of waste generated is mining waste and has a major impact in SA. Mine waste is contained within waste dumps (slimes and ash dams), decanted in water (AMD) or becomes air pollution.
	Capacity to deal with waste	Improving	↑	Service backlogs are highest in metros and secondary cities. The backlog for solid waste services is 2 million households with 900,000 households not receiving any service. 87% of municipalities do not have the capacity for waste minimisation. 80% of municipalities are initiating recycling activities, but don't have the capacity to keep them going.
	Employment generated	Improving	↑	Recycling creates significant job opportunities in the private sector generating over 100,000 jobs for plastic, glass, cans and paper recycling. This is likely to increase as more waste is recycled.

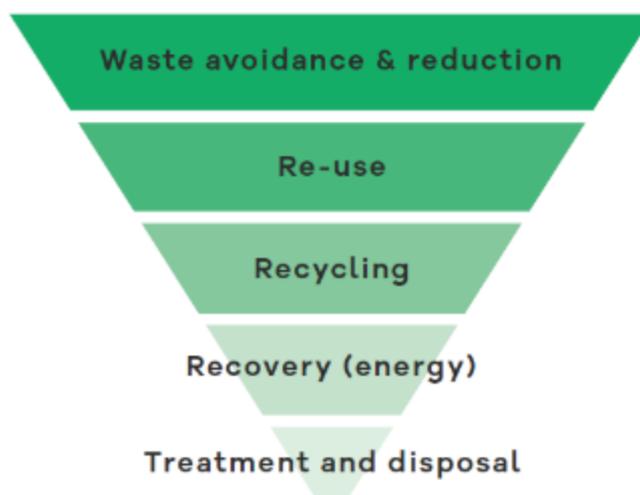
Source: State of the Environment – Department of Environmental Affairs

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## 6. Alternative Waste Management Technologies

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In terms of the waste management hierarchy, South Africa is predominantly focusing on recycling, recovery (energy), and treatment and disposal – the last three tiers in Figure 1 below.



*Figure 1: Waste Management Hierarchy*

In this regard, there is potential to increase the amount of recycling and to create opportunities for the development and sale of alternative waste treatment technologies. Among other elements, recycling may be driven by the call for the development of sector-specific IndWMPs (such as packaging, lighting and e-waste), and potentially building on the initiatives already established by the industry. Alternative waste treatment may be driven by restrictions that will come into force soon on materials going to landfill and, in the case of municipalities, due to pressures on landfill airspace, among other things.

### ❖ Recyclables

The economics of recycling are simple: if the cost of collecting and processing something is cheaper than the resulting end-product, or if there is a large enough subsidy available, then it is generally recycled. This holds true for commodities such as paper, metal and certain types of plastics typically used in packaging.

For everything else, including the vast majority of packaging types (from a blister pack to a flexible food package) and almost all objects (pens, toothbrushes, etc.), it is understood to cost more to collect and process than it is to landfill. Thus, these materials are considered as waste, which means they will either be landfilled or could potentially be used for WtE.

However, recycling is still ranked higher in the waste management hierarchy than (energy) recovery and treatment and disposal, which is an attempt to have 'rules of thumb' for more sustainable approaches to managing waste.

In the face of landfill airspace shortages and the steady (albeit slow) increase in the cost of raw materials, as well as targets set by the NWMS and expected IndWMPs, growth in the recycling industry is expected.

Although recycling is legislated within South Africa, the actual recycling activities are largely driven by industry through the establishment of industry bodies or PROs. A PRO is generally a non-profit organization funded by industry to promote the recovery and recycling of recyclable materials in South Africa.

All mainstream recyclables (paper, glass, plastics and metal), tyres and electronic waste (e-waste) have respective PROs responsible for the diversion of the waste from going to landfill. Table 1 shows a list active PROs and the tonnages generated and diverted for South Africa in 2015.

**Table 1: PRO's & Recyclables Managed**

Name of PRO	Material	Generated (tonnes)	Diverted from landfill (tonnes)	Still available for recycling (tonnes)
Paper Recycling Association of South Africa (PRASA)	Paper	2 200 000	1 100 000	1 100 000
Plastics SA	Umbrella organisation for plastics <sup>9</sup>	1 400 000	315 000	1 085 000
The Glass Recycling Company (TGRC)	Glass	845 663	338 265	507 398
e-Waste Association of South Africa (eWASA) South African e-Waste Alliance (SAEWA)	e-Waste	322 000	45 000	277 000
Metal Recyclers' Association of South Africa	Scrap metal	3 121 000	2 497 000	624 000
REDISA	Tyres	270 000	109 906	160 094

#### ✓ Paper & Cardboard

According to PRASA's paper statistics, over 2.2 million tonnes of paper was used in South Africa in 2014. Only 1.6 million tonnes (72%) of the paper produced is considered recoverable, whilst 620 000 tonnes (27%) is unsuitable for recycling – including tissue and wax paper, bank notes, etc. or paper that has been exported and cannot be locally recovered (PRASA 2015).

Of the 72% of recoverable paper waste, 1.1 million tonnes (66%) is recycled and 570 000 tonnes (34%) could still be diverted from landfill. South Africa's consumption of office paper has declined in line with global trends. The consumption of non-recyclable tissue paper has increased, as more people can afford such convenience products (PRASA 2015).

The growth in the use of tissue paper also suggests that there is some potential for this to be used in alternative waste treatment (anaerobic digestion or other WtE projects), provided this can be separated out adequately and economically (e.g. collected with the organic fraction for anaerobic digestion, separated at source or managed with residual waste).

#### ✓ Plastics

According to Plastics SA, 1.4 million tonnes of plastics was produced and 315 000 tonnes was diverted from landfill in 2014, resulting in a recycling rate of 23%. Of the 315 000 tonnes of plastics diverted from landfill, 280 000 tonnes (90.2%) was recycled in South Africa and 31 000 tonnes (9.8%) was exported for reprocessing overseas (mainly China) (Plastics SA 2015).

Over 220 000 tonnes (80%) of the plastics recycled in South Africa come from post-consumer sources (domestic and industrial use), and the other 20% is either directly from the factory producing the plastic (ex-factory) or reused in-house.

✓ **Glass**

TGRC reported that in 2014, 845 000 tonnes of glass packaging (which includes jars and bottles, etc.) was produced; of this, 338 000 tonnes (40%) was recycled. However, in terms of glass bottles, of the 3 million bottles produced, 2.4 million bottles (80%) were diverted from landfill through a combination of recycling and the return and re-use deposit system (TGRC 2015).

Based on TGRC's data, it is estimated that 190 000 tonnes of glass is available for recycling in the Western Cape. However, it should be noted that TGRC's membership only comprises of glass packing companies, and does not include manufactures of float or automotive glass. In light of this, it is likely that the market for glass recycling is even larger than estimated.

✓ **e – Waste**

According to eWASA, South Africa produces approximately 322 000 tonnes of electronic waste (e-waste) per annum. Table 2 provides the tonnages of total waste, as classified by eWASA. Currently, only 45 000 tonnes (12%) is being recycled (Data week 2015).

*Table 2: e – Waste total Waste Classification*

e-Waste classification	Tonnes	Percentage recycled
Large appliances (stoves, fridges)	125 000	39%
Consumer equipment	78 000	24%
Information technology (IT) equipment	77 000	24%
Small household appliances (toasters, kettles, etc.)	40 000	13%

E-waste is classified as hazardous waste in terms of the NEM: WA, and obtaining a waste management license is a costly and lengthy process. This is a barrier for business development in this sector, as most recyclers operating in this space are medium-sized enterprises that cannot afford the associated environmental impact assessment (EIA).

✓ **Construction & Demolition Waste**

Builders' rubble is largely landfilled in South Africa, in spite of its potential for re-use and the high financial and societal costs of landfilling. One of the biggest opportunities in the recovery, processing and application of builders' rubble lie in the uptake of material into roads. There are, therefore, prospects on the supply side for the crushing industry, and on the demand side in road material, for both the public and private sectors.

The economy in builders' rubble must be considered at a regional scale, due to the low value of the material relative to logistics costs. Economic viability is therefore dependent on the local sourcing and processing of materials, such that the transport and processing costs do not exceed the economic value of the resources.

There are currently few externally imposed drivers on the economy, such as policy and legislation dictating diversion from landfill, or industry body oversight governing the handling, treatment and disposal of builders' rubble. Due to the scarcity of landfill airspace, incentives to divert wastes and disincentives to dispose of wastes may very well be implemented at local municipal level in the next five years, if the current practice of disposing large volumes continues.

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## 7. Waste to Energy

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To date, the main WtE projects undertaken by the private sector revolve around the small to medium scale, biogas projects, where the energy (electricity, heat and/or gas) is for own use, or wheeled through the grid to a nearby private buyer.

The other market opportunity is the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), which has allocated 145 MW for large-scale biogas, biomass and landfill gas projects (those above 5 MW). Of the 145 MW, 59 MW has already been allocated – see Table 3.

*Table 3: REIPPPP Bioenergy Allocations*

Technology	Round 1: MW allocation	Round 2: MW allocation	Round 3: MW allocation	Round 4: MW allocation	Remaining MW
Landfill gas	0	0	18	0	7
Biomass	0	0	16	25	19
Biogas	0	0	0	0	60

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### Challenges faced by waste to energy projects

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While WtE has been widely implemented in many European countries, such as the Netherlands and Germany, the uptake has been limited in South Africa. Growth remains slow compared to other renewable energy sources, such as solar and wind. This is mainly due to a lack of economic viability, but also legal and regulatory barriers.

The main challenges faced include:

- Low gate fees for the waste at landfill, which makes it difficult for other technologies to compete with the cheaper option of landfilling.
- Low electricity prices compared to developed countries. Although the cost of electricity is rapidly increasing, WtE is still more expensive (c. R1.40-R1.60/kWh) compared to bulk electricity prices (i.e. R0.50-R0.90/kWh more on average).
- Access to sufficient feedstock. Many thermal WtE technologies require large-scale facilities to achieve economies of scale and become affordable (e.g. 1 000-2 000 tonnes/day). However,

aggregation of waste may result in location of facilities far from waste-generation sources, increasing transport costs drastically and could reduce the financial viability of a WtE facility.

- A lack of feed-in tariffs for renewable energy outside of the REIPPPP, which only applies to projects larger than 5 MW. Such projects are limited by the feedstock challenge.

Additional challenges include:

- Absence of a policy/regulatory framework for grid connection by independent power producers outside of the REIPPPP.
- Long-term supply contract for waste facilities. Most WtE facilities will have a payback period of 15-20 years, and require contracts of the same duration period for the waste feedstock to attract investors. This has proven challenging in the South African context for companies that target municipal solid waste (MSW), as municipalities typically have three to five-year procurement contracts renewable. Note that this is not applicable to commercial and industrial wastes (e.g. malls, factories, abattoirs, etc.), as these facilities are responsible for handling their wastes in a responsible manner. However, financiers may also not consider securing such long-term contracts from the private sector as bankable.

## Waste to Energy Opportunities

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There are, however, some WtE opportunities that show current and future growth potential in South Africa, including:

- landfill gas and biomass through large-scale REIPPPP projects;
- small-scale facilities, such as:
  - small-scale to medium-scale biogas, where the energy (electricity, heat and/or gas) is for own use, or wheeled through the grid to a nearby private buyer;
  - small-scale pyrolysis plants generating biodiesel from waste oils;
  - fuel replacement in industrial boilers using biomass.

## Large REIPPPP Projects

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These technologies still face significant challenges with regard to the lengthy and costly environmental and bidding processes. Thus far, one landfill gas and two biomass projects have been successful, at R0.94/kWh and R1.40/kWh respectively, during the third and fourth rounds of the REIPPPP.

The biogas allocation for large-scale projects (>5 MW) was removed from the fourth round, due to lack of industry uptake at R0.90/kWh. However, the South African Biogas Industry Association (SABIA) organized a biogas survey to understand the preferred tariffs that would stimulate the biogas sector. The outcome was presented to the Independent Power Producer (IPP) Unit within National Treasury. It is understood that this engagement has resulted in a tariff increase to R1.40/kWh.

## Small scale Biogas Projects

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The business case for biogas from animal husbandries, such as abattoirs, has emerged as a real short-term opportunity, due to the fact that:

- The energy (heat and electricity) generated can be used on site.
- The facilities can achieve cost savings through avoiding the costly disposal wastes generated, as these are generally considered hazardous. Moreover, the waste management classification legislation published last year requires the safe disposal of, and submission of disposal certificates

for, all hazardous wastes (e.g. contaminated blood and/or animal carcasses). This has resulted in higher disposal costs for abattoirs.

## Waste to Energy Project Implementation

### Gauteng

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As South Africa grapples with an electricity crisis, the Joburg Waste to Energy project strives to keep the lights on while cleaning up the municipal sites around Johannesburg.

- The Challenge

Municipal landfill sites are not only an eyesore on our landscapes, they also pose serious environmental and health hazards by generating huge quantities of methane gas. Methane gas is produced through decomposition, which happens when organic waste is broken down by bacteria that is naturally present in the waste as well as in the soil used to cover the landfill. Organic waste includes food, garden waste, street sweepings, textiles, wood and paper products. Methane is a very potent greenhouse gas, 21 times more harmful to the environment than carbon dioxide. Methane gas can also migrate underground in the right conditions, and become highly explosive. However, if managed correctly the methane gas can be captured and destroyed by flaring it. The Joburg Energy to Waste project goes further, by using methane gas to generate electricity, solving two serious issues that South Africa currently face.

- The Solution

Five municipal landfill sites around Johannesburg have been developed using the latest technology by the energy management company Ener-G Systems.

The solution involves retrieving the methane gas and converting it into electricity. This is done by installing pipes into various places in the landfill. The gas is pumped through the pipes into a chimney where it is combusted into harmless emissions, as is currently happening at the five landfill sites across Johannesburg. The next phase of this project will be to install generators through which the gas will be channeled as fuel for electricity generation. The renewable electricity will be “exported” by connecting the generators to the municipal distribution grid, owned by either Eskom or City Power. By 2016, it is anticipated that 19 megawatts of electricity will be produced from these five landfill sites – enough to power 16 500 medium-sized houses. When completed, this will be the biggest landfill gas-to-energy project in South Africa.

## Western Cape

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A R400 million waste-to-energy conversion plant was officially opened in Athlone, Cape Town, on 25 January 2017 with high hopes of reducing the city's landfill sites and creating jobs. It symbolized the city's move from being a distributor of electricity to generating electricity in its goal of having 20% renewable energy as part of its energy mix. The city wanted to give the citizens of Cape Town greater choice on what type of energy they wanted. Patricia De Lille – Mayor City of Cape Town said she felt it was wrong that Eskom had a monopoly and forced the city to purchase its fossil-fuel power. The sprawling plant was thought to be the first of its kind in Africa, and would pave the way for more plants to turn rubbish into gas. Helen Zille – Premier of the Western Cape said the project fit into the province's plans of being the hub of the green economy.

The project is a collaboration between Waste Mart and Clean Energy Africa, and will be run by New Horizons Energy. New Horizons Energy – CEO Mr. Egmont Otterman said the city generated around 8000 tons of waste a day. If another eight plants of the kind were built, there would be no more need for landfill sites. Cape Town was perfect for the first plant because of its high landfill prices, a progressive government, and a shortage of gas. The plant would use 500 tons of organic household, municipal, and industrial waste per day, in an anaerobic digestive process, to produce methane, food-grade carbon dioxide, and organic fertilizer. The plant could supply around 4% to 5% of the city's liquid petroleum gas requirement. There has been a noticeable link between economic growth and increased waste. These plants provided a "zero waste" landfill facility because everything produced by the mechanical processes was used.

In addition, the people who worked there would not have to pick through waste like those at rubbish dumps. They would have decent working conditions, including unemployment insurance. Afrox – Linde Group was expected to purchase methane and carbon dioxide from the plant. The plant would initially employ 80 people. What got everybody excited was the prospect of fewer landfill sites festering with rubbish as waste would be diverted to the plant and its successors. Helen Zille said the plant would allow Africa to leap-frog centuries of technology to be at the forefront of energy creation. It would contribute to Cape Town's energy stability - an attraction for foreign investors. Western Cape government-funded entity Green Cape had helped with technical support and would work with other municipalities in the province to roll out similar initiatives.

## Kwa Zulu Natal

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The Durban Municipal Solid Waste Project is a gas collection system at the Mariannhill landfill in Durban. The project uses some of the recovered gas to generate renewable energy; this is, in turn, fed to the municipal grid to replace electricity based on fossil fuels. The World Bank Group's Prototype Carbon Fund will purchase approximately 337,000 carbon credits from the project. The Durban Municipal Solid Waste Project was the first of its kind to be registered in Africa under the Clean Development Mechanism. The project is being implemented by Durban Solid Waste (DSW), which is the municipal solid waste department of eThekweni Municipality. The electricity produced from the landfill gas is sold to the municipal electricity department. The Mariannhill landfill was declared a National Conservancy Site in 2004, the first time a landfill, has been incorporated into an ecosystem restoration site.

When the project started in 2004, no landfills in South Africa collected and used the methane that they emitted. Today, the minimum requirements for waste disposal at landfills include gas monitoring at all large, hazardous landfills and the periodic reporting to national authorities if the concentration of soil gas exceeds 1%. In addition, permanent venting systems are required if methane concentrations in the air exceed five percent. However, gas flaring, gas collection, and the use of methane as a renewable energy are still not required by law.

### ❖ Achievements Thus Far

- As of April 2015, the project has issued about 181,000 carbon credits.
- The project is providing the municipality with about 3MW of electricity.

- The Mariannhill landfill now serves as an important natural corridor for migratory species and is contributing to preserving an indigenous ecosystem and minimizing biodiversity loss in the area. In addition, nearly 2,000 people have been educated in the landfill's conservation and waste management principles.
- The project has improved the air by reducing the amount of landfill gas released into the atmosphere at the landfill and by displacing electricity from the grid and reducing the negative effects of coal transport and coal mining (e.g., dust and acid mine drainage). It also lessens the risk of dangerous methane gas concentrations and reduces nearby residents' exposure to the odor.
- The methodology for greenhouse gas accounting from "use or flaring of landfill gas" was developed for this project. This methodology subsequently served as the basis for the development of the UN's consolidated methodology for "Flaring or Use of Landfill Gas," which is now used worldwide.
- The landfill site has won numerous awards, including the Dubai International Award for Best Practices to Improve the Living Environment (2008); the Honorary Energy Globe Award for Sustainability (2009); and several conservancy and green energy awards in South Africa. In addition, the project made KPMG's list of "100 most innovative and inspiring urban infrastructure projects in the world."



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## 8. Concluding Remarks

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According to the South African Constitution (and other legislation) local government must provide communities with equitable, affordable and sustained basic services, which include waste management. Yet today the majority of municipalities and cities in South Africa face serious economic, social and environmental challenges related to waste management. New and innovative mechanisms for financing waste management are needed in order to address these challenges in an integrated and coordinated manner. The environmental and financial costs associated with current waste management practices can be reduced.

Municipalities traditionally generate revenue through user charges (tariffs), levies, rates and taxes. However, in most cases, these revenue sources are inadequate and, because they are mainly taxes, are becoming unaffordable for communities, especially poor and indigent households. Many South African municipalities contain a large indigent population who cannot afford to pay for basic services. Government's policy on free basic services (FBS) provides these indigents with basic services that include refuse removal. Ironically, refuse removal is a FBS that most municipalities do not have the resources to offer, as they either do not have (or do not keep updated) a register of the indigent households. For municipalities with large indigent populations, generating revenue from refuse tariffs, rates and levies is neither sustainable nor adequate to run waste management services.

All spheres of government need to take a radically different approach to waste management, which is adequately laid out in the National Waste Management Strategy (NWMS) as promulgated in terms of the National Environmental Management Waste Act, Act 58 of 2009. The NWMS calls for an integrated approach to waste management that adopts waste hierarchical principles: avoid, reduce, recycle, re-use and (only as a last resort) dispose of waste. The current narrow view of cost effectiveness needs to look further than the limited financial perspective (i.e. the financial cost effectiveness based on the monetary values of the service or product in the market). A broader approach is required, one that considers the socio-economic challenges of South Africa, the equity policy, the Bill of Rights, the environmental cost and the impact of waste management.

A strengthened approach to waste management alternatives and their funding is needed. Alternatives include waste minimization, recycling, re-use and regionalization of waste management activities in the form of disposal sites, transportation and waste incinerations. Currently, despite alternatives in place, waste management services favor landfill sites, because of the lack of incentives or punitive measures to act otherwise. The regionalization of waste management activities can be done in a phased approach to cater for the different capacities of municipalities. For example, eThekweni, the City of Johannesburg and the City of Cape Town have started converting waste to energy, but other non-metros could start with regional landfills, transportation and gradually move to the waste incineration (i.e. burning of waste completely and turning it into ashes) and energy conversion methods. Unlike traditional methods of waste disposal such as landfills, incineration has low carbon emissions but may result in high transportation costs, as waste has to be moved from source to landfills to incineration sites.

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## 9. Well known Waste Management Service Providers

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1. **Waste Man:** <http://www.wasteman.co.za/home/>
2. **The Waste Group:** <http://www.wastegroup.co.za/>
3. **Enviro Serv:** <http://www.enviroserv.co.za/>
4. **Waste Plan:** <http://www.wasteplan.co.za/>
5. **Waste Mart:** <http://www.wastemart.co.za/>
6. **Remade Recycling:** <http://www.remade.co.za/>
7. **Oricol Environmental Services:** <https://www.oricoles.co.za/>
8. **Skip Waste:** <http://www.skipwaste.co.za/>
9. **Averda:** <https://www.averda.com/>
10. **Iwesco:** <http://www.iwesco.co.za/>
11. **SA Waste:** <http://www.sawaste.co.za/>
12. **Enviro Waste:** <http://www.envirowaste.co.za/>
13. **Tedcor:** <http://www.tedcor.co.za/>
14. **Piki Tup:** <http://www.pikitup.co.za/>
15. **DSW:**  
[http://www.durban.gov.za/City\\_Services/cleansing\\_solid\\_waste/Publications\\_Policies/Pages/DSW-Profile.aspx](http://www.durban.gov.za/City_Services/cleansing_solid_waste/Publications_Policies/Pages/DSW-Profile.aspx)

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## 10. Useful Links

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- <https://www.environment.gov.za/>
- <http://sawic.environment.gov.za/?menu=13>
- [http://www.durban.gov.za/City\\_Services/cleansing\\_solid\\_waste/Documents/eThekweni%20Municipality%20Integrated%20Waste%20Management%20Plan%202016%202021.pdf](http://www.durban.gov.za/City_Services/cleansing_solid_waste/Documents/eThekweni%20Municipality%20Integrated%20Waste%20Management%20Plan%202016%202021.pdf)
- [http://www.joburg-archive.co.za/2011/pdfs/iwm\\_plan2011.pdf](http://www.joburg-archive.co.za/2011/pdfs/iwm_plan2011.pdf)
- [https://www.environment.gov.za/sites/default/files/legislations/nema\\_amendment\\_act59.pdf](https://www.environment.gov.za/sites/default/files/legislations/nema_amendment_act59.pdf)
- [https://www.environment.gov.za/sites/default/files/docs/nationalwaste\\_management\\_strategy.pdf](https://www.environment.gov.za/sites/default/files/docs/nationalwaste_management_strategy.pdf)
- <http://sawic.environment.gov.za/documents/1880.pdf>
- <http://www.dst.gov.za/>
- [http://wastepolicy.environment.gov.za/home/nwms\\_v1/3/4/5](http://wastepolicy.environment.gov.za/home/nwms_v1/3/4/5)
- [http://www.gov.za/sites/www.gov.za/files/40200\\_gon904.pdf](http://www.gov.za/sites/www.gov.za/files/40200_gon904.pdf)
- <http://www.saatca.co.za/DNN/LinkClick.aspx?fileticket=rP1U2kKEw0Q%3D&tabid=124>
- <http://www.infrastructurene.ws/2016/06/06/waste-management-bureau-to-be-realised-in-2016/>
- <http://www.recyclepaper.co.za/>
- <http://www.plasticsinfo.co.za/>
- <http://www.theglassrecyclingcompany.co.za/>
- <http://ewasa.org/>
- [http://www.energy.gov.za/files/events\\_overview%20IPP.html](http://www.energy.gov.za/files/events_overview%20IPP.html)
- <http://www.energy.gov.za/>
- <https://www.ipp-projects.co.za/>

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