



Waste Economy

–

2015

Market Intelligence Report

–



Disclaimer

While every attempt was made to ensure that the information published in this report is accurate, no responsibility is accepted for any loss or damage that may arise out of the reliance of any person or entity upon any of the information this report contains.

Copyright © GreenCape 2015

This document may be downloaded at no charge from www.greencape.co.za. All rights reserved.

Subscribe to receive e-mail alerts or GreenCape news, events and publications by sending an e-mail to: communications@greencape.co.za



18 Roeland Street
Cape Town
8001
South Africa

GreenCape would like to acknowledge and thank **Quinton Williams, Kirsten Barnes, Gracia Munganga** and **Lauren Basson** for the time and effort that went into compiling this Market Intelligence Report. We also thank **Tawanda Sango** and **Sarah O'Carroll** for their contributions.

Contents

List of figures	5
List of tables	5
List of acronyms	7
1. Introduction and purpose	8
2. Executive summary	10
3. Market overview	12
3.1. Solid waste in South Africa: a focus on the Western Cape	12
3.2. Analysis of the waste market and commodities (commercial and industrial wastes)	15
3.3. Performance by waste stream	18
3.4. Overview of the waste to energy industry	30
3.5. Major waste industry developments and trends	34
3.5.1. Regulatory	34
3.5.2. Industry trends and highlights	35
4. Opportunities and barriers	37
4.1. Municipal	37
4.2. Private (commercial and industrial) wastes	39
5. Investment incentives	40
6. Overview of GreenCape's activities in this sector	42
6.1. Waste Sector Desk	42
6.2. The Western Cape Industrial Symbiosis Programme (WISP)	43
6.3. Waste Economy Project	45
7. References	46
8. Appendix	48
8.1. Workshops and seminars 2014-2015	48
8.2. List of WtE licence applications in the Western Cape	49
8.3. Overview of environmental impact assessment of WtE projects	49
8.4. Methodology	52
8.4.1. Value of recyclables in the Western Cape	52
8.4.2. Biogas potential in the Western Cape	54

List of figures & tables

Figure 1: Total waste generation percentage (%) in Western Cape municipalities in 2010	13
Figure 2: Volume of paper, plastic, metals and glass landfilled in Western Cape municipalities in 2010	14
Figure 3: Source of recyclable waste in South Africa in 2010, 2011 and 2012	16
Figure 4: Biogas value chain	40
Table 1: Composition of general waste in the Western Cape 2010 (tons)	13
Table 2: Market value of secondary materials	15
Table 3: Recycling tonnages and rates of packaging wastes in South Africa	16
Table 4: Source of recyclables collected in South Africa	17
Table 5: Packaging/non-packaging tonnages recovered for plastic wastes	21
Table 6: Factors that determine the condition of C&DW waste	29
Table 7: Overview of organic waste quantities	31
Table 8: Potential of the Western Cape recycling industry	39
Table 9: Benefits WISP achieved from August 2013 to February 2015	43
Table 10: Maximum recycling rates achievable in the next five years	52
Table 11: Value of waste quantities being disposed of, based on market value	53

The Department of Science and Technology reported in the National Waste Roadmap 2013 that the local waste sector currently employs approximately 29 000 people and is worth approximately R15 billion.

That is around 0.51% of the country's gross domestic product.

—

**National Waste Roadmap
(DST), 2013**

List of acronyms

C&DW	construction and demolition waste
CCT	City of Cape Town
CSIR	Council for Scientific and Industrial Research
DBSA	Development Bank of South Africa
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DEDAT	Department of Economic Development and Tourism
DoE	Department of Energy
EAP	environmental assessment practitioner
EDM	Eden District Municipality
EPC	engineering and procurement contractor
EPR	extended producer responsibility
GDP	gross domestic product
GIZ	German government organisation
H:h landfill	Low-Moderate Hazardous Landfill (in terms of the DWA minimum requirements, 1998)
HDPE	high-density polyethylene
IDC	Industrial Development Corporation
IndWMP	Industry Waste Management Plan
JICA	Japanese International Co-operation Agency
kW/h	kilowatt hours
LLDPE	low-density polyethylene
MFMA	Municipal Finance Management Act, Act 56 of 2003
MIR	market intelligence report
MSA	Municipal System's Act, Act 32 of 2000
MSW	municipal solid waste
MW	megawatts
NEM:WA	National Environmental Management: Waste Act, Act 59 of 2008
NPO	non-profit organisation
NPSWM	National Pricing Strategy for Waste Management
NWMS	National Waste Management Strategy
OFMSW	organic fraction of municipal solid waste
PACSA	Packaging Council of South Africa
PAMSA	Paper Manufacturers Association of South Africa
PCB	polychlorinated biphenyl
PE	polyethylene
PET	polyethylene terephthalate
POLYCO	Polyolefin Recycling Company
PP	polypropylene
PP	public-private partnerships
PRO	producer responsibility organisation
PS	polystyrene
PSPC	Polystyrene Packaging Council
PVC	polyvinyl chloride
REIPPPP/REI4P	Renewable Energy Independent Power Producer Procurement Programme
RFP	request for proposals
RFQ	request for qualifications
SABIA	Southern African Biogas Industry Association
SALGA	South African Local Government Association
SAPRO	Southern African Plastics Recyclers Organisation
SEZ	special economic zone
SME	small and medium enterprises
TA	transactional advisor
TGRC	The Glass Recycling Company
UNEP	United Nations Environment Programme
WCG	Western Cape Government
WMB	Waste Management Bureau

1 – Introduction and purpose

This market intelligence report was compiled by GreenCape’s waste economy sector desk. It is aimed at investors and businesses who are currently active or interested in entering the waste economy sector in South Africa, and the Western Cape specifically. It provides an overview of the market, including the key players, legislation and regulation, opportunities and challenges, key developments and achievements.

GreenCape is a not-for-profit organisation that was established in 2010 by the Western Cape Government and the City of Cape Town to support the accelerated development of the green economy. The vision is for the Western Cape to be the green economy hub for Sub-Saharan Africa – the investment destination of choice, regional headquarters and manufacturing centre for leading companies in this space.

GreenCape’s aim is to help unlock the investment and employment potential of green business, technologies and manufacturing. This, in turn, also contributes to improving the resource efficiency, carbon intensity and resilience of the regional economy.

We do this this by assisting viable green businesses across a range of sectors, including energy, waste and resources, to remove barriers to their establishment and growth – working with our partners in government, the private sector and academia.

Our business support activities range from helping potential investors to understand the local market and connect with the right people; providing policy and regulatory advocacy and support; facilitating access to funding; facilitating market access; establishing skills development partnerships; networking and information-sharing events; and publications.

For more information see www.greencape.co.za or email waste@greencape.co.za

South Africa generated about 108 million tons of waste in 2011 in total:

59 million tons of general waste –

48 million tons of unclassified waste –

1 million tons of hazardous waste –

**–
National Waste Roadmap (DST), 2013**

2– Executive summary

This waste economy market intelligence report focuses specifically on the waste economy sector in the Western Cape. The purpose of the document is to provide a brief overview of the waste economy's opportunities and challenges while taking note of key developments and achievements within the sector.

The South African waste sector is defined as any economic activity derived from waste. The Department of Science and Technology (DST) (2013) reported in the National Waste Roadmap that the sector currently employs approximately 29 000 people and is worth approximately R15 billion. That is around 0.51% of the country's gross domestic product (GDP). South Africa generated about 108 million tons of waste in 2011 in total: 59 million tons of general waste; 48 million tons of unclassified waste; and 1 million tons of hazardous waste (Department of Environmental Affairs, DEA, 2012).

Landfilling is the most common method of waste management in South Africa. An estimated 90.1% of all general and hazardous waste generated in the country is still landfilled. Recycling rates are generally higher in the Western Cape compared to the rest of the country at around 14% versus around 9.8% (Department of Environmental Affairs and Development Planning, DEA&DP, 2013). The City of Cape Town (CCT) generates about 70% of waste in the Western Cape, where 60% of the waste generated is handled by the private sector and the remaining 40% is handled by the municipality (Conversation with Coetzee, B; 2014). There are around 193 landfill sites across the Western Cape, with landfill gate fees ranging between R200 and R450 on average.

To date, the recycling industry has operated for over two decades and is well established in the Western Cape. This MIR discusses trends in dry recyclables such as plastics, paper, metal, electric; electronic waste (e-waste), construction

and demolition waste (C&DW) as well as organic waste.

On average, the glass recycling rate is 40%, where 100% of the glass bottles recovered in South Africa are recycled into glass bottles, maintaining the material in its most valuable form (The Glass Recycling Company, TGRC, 2013). This is set to increase even further since SAB Miller and Distell now run successful deposit schemes, where the company pays its traders anything between R0.80c-R1.50 for each bottle returned.

C&DW constitutes up to 22% by mass and 10% by volume in Western Cape landfills. It is more than likely that this figure is an underestimate, with illegal dumping rife in the industry.

E-waste recycling is estimated at 11%, and constitutes the fastest growing waste stream globally due to modern lifestyles. The metal recovery rate is estimated at 80%, with the bulk of the scrap metal recovered exported. E-waste recycling is more established in many developed countries, where recycling operations are typically funded through a mandated EPR scheme. The lighting and e-waste industry submitted a voluntary industry waste management plan to the DEA in 2014, and it is still waiting for approval.

The range of organic content in MSW in the Western Cape is between 14% and 39%. Other organic wastes are generated from agricultural and agri-processing wastes associated with animal husbandry, including abattoirs.

This report highlights the fact that in the South African context:

- The largest volumes of dry recyclables available to the recycling economy remain in the post-consumer stream
- Most waste – especially glass and plastic – is collected by the informal sector, specifically 90% of polyethylene terephthalate (PET) and 68% of other plastics
- PET is the best performing polymer with the highest recycling rates.

The key challenges faced by the industry include:

- (i) a complex legislation and regulatory framework, specifically around compliance with environmental authorisations;
- (ii) access to waste, especially MSW, as municipalities are required to abide by municipal processes such as the Municipal Finance Management Act (MFMA), Act 56 of 2003, and the MSA.

Other challenges associated with waste to energy (WtE) projects include being able to secure long-term contracts beyond the usual three-year period with municipalities, as well as being able to secure off-take agreements for the sale of electricity.

For these reasons, the main WtE projects undertaken by the private sector so far revolve around: small 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; landfill gas to electricity; small-scale pyrolysis plants generating biodiesel; biodiesel from waste oils; and fuel replacement in industrial boilers using biomass. This report also gives an overview of the main steps required to develop a WtE project, as well as the list of licences required for project developers.

Large-scale alternative projects in municipalities are likely to be limited to large municipalities and/or metropolitan areas. This is primarily because such projects require large budgets and access to specialised skills and expertise that small municipalities cannot always secure. In the Western Cape, the municipalities currently developing or considering alternative

waste treatment projects, such as WtE, are the CCT, Stellenbosch Municipality, Drakenstein Municipality and Eden District Municipality. The main driver has been the lack of available landfill airspace.

Recent developments in South African waste-related legislation are presented in the National Environmental Management: Waste Amendment Act, Act 26 of 2014. This proposes the establishment of a Waste Management Bureau (WMB) and a National Pricing Strategy for waste management to raise funds that will boost and develop a recycling economy through collection of fees and/or taxes along with the development of industry waste management plans.

The waste economy currently offers exciting opportunities in small-scale WtE, such as biogas, and increased collection of dry recyclables as well as their absorption back into a manufacturing process to produce high-value secondary materials. This is supported by the DEA's vision, which is reflected in the first goal of the National Waste Management Strategy (NWMS).

However, these opportunities need to be re-considered in the wider context of creating a circular economy in South Africa. They can only be exploited with the support of a clear and enabling regulatory environment, as well as innovative partnerships between all three spheres of government and the private sector

3 – Market overview

The South African waste sector is defined as any economic activity derived from waste. The Department of Science and Technology (DST 2012) reported in the National Waste Roadmap (2013) that the sector currently employs approximately 29 000 people and is worth around R15 billion. That is approximately 0.51% of the country's gross domestic product (GDP).

South Africa's waste industry can be divided into two main categories according to who owns the waste. The first category comprises waste handled by municipalities, and mostly collected from residential areas. Municipalities own the waste and can provide the collection service themselves directly and/or through a private contractor, generally appointed for a period of three years.

The second category comprises waste generated from the commercial and industrial sectors. While there are exceptions across the country, it is common for private sector organisations to appoint a private waste collector to ensure safe disposal as they are liable for their own waste.

3.1. Solid waste in South Africa: a focus on the Western Cape

South Africa generated a total of about 108 million tons of waste in 2011, broken down as follows:

- 59 million tons of general waste;
- 48 million tons of unclassified waste;
- 1 million tons of hazardous waste

(Department of Environmental Affairs, DEA, 2012).

Hazardous waste comprises a combination of inorganic wastes, including those without halogens/sulphur, tarry and bituminous wastes, waste oils, healthcare risk wastes and other miscellaneous materials.

Landfilling is the most common method of waste management in South Africa. An estimated 90.1% of all general and hazardous waste generated in the country is still landfilled. In the case of general waste: in many parts of the country, disposal often happens on uncontrolled open dumpsites.

Average recycling rates are still generally low at just 9.8%, with an additional 0.1% treated thermally (DEA, 2012). Currently, the only portion of hazardous waste recycled primarily comprises waste oils and batteries (DEA, 2012). Generally, recycling rates are higher in the Western Cape compared to the rest of the country at around 14% versus around 9.8% (Department of Environmental Affairs and Development Planning, DEA&DP, 2013).

In the Western Cape, a total of 3.8 million tons of waste was generated in 2010. Projections indicate that the waste generation will reach 4.7 million tons and 5.2 million tons per annum in 2015 and 2020 respectively (DEA&DP, 2013). Table 1 and Figure 1 present an overview of the amount and composition of waste generated in the Western Cape in 2010.

Table 1: Composition of general waste in the Western Cape 2010 (tons)

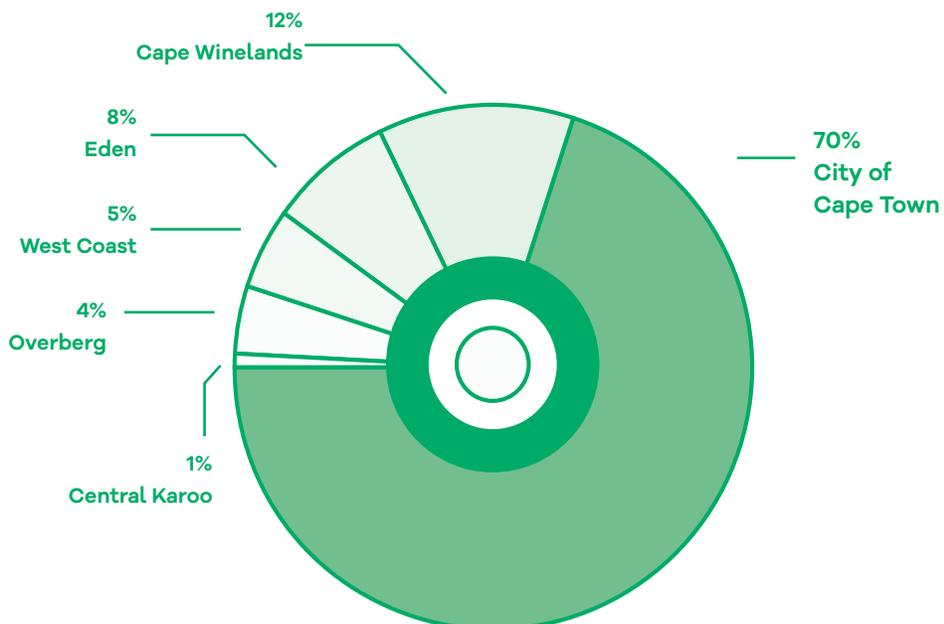
Waste categories	CCT	Cape Winelands	Eden	West Coast	Overberg	Central Karoo	Total
Paper	534 077	117 911	39 357	36 289	33 356	10 658	398 376 102
Plastic	480 669	81 631	99 906	51 568	15 162	10 658	1 500 207 265
Metals	186 927	27 210	30 275	13 370	9 097	4 187	424 595 401
Glass	293 742	36 280	30 275	11 460	7 581	4 949	144 318 092
Organic Waste	1 041 451	131 516	96 878	34 379	36 388	5 329	197 794 757
Builders' rubble	133 519			43 929	50 034	2 284	11 912 705
Miscellaneous		58 956	6 055				65 011
Total	2 670 386	453 505	302 745	190 994	151 618	38 066	3 807 314

(Source: DEA&DP, 2013).

As Figure 1 indicates, the CCT generates about 70% of waste in the Western Cape. Furthermore, 60% of the waste generated in Cape Town is handled by the private sector, while the remaining 40% is handled by the municipality (Conversation with Coetzee, B; 2014).

There are around 193 landfill sites across the Western Cape. Most of these are municipal facilities with a few privately owned sites, where the average gate fee varies between around R250-R450 per ton for general waste.

Figure 1: Total waste generation percentage (%) in Western Cape municipalities in 2010

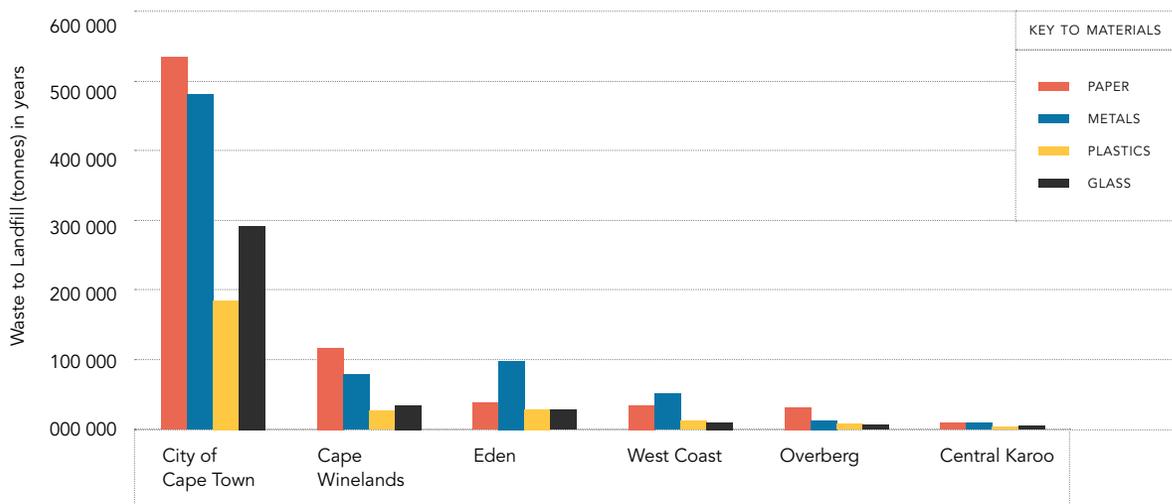


(Source: DEA&DP, 2013)

Figure 2 presents the amount of potentially recyclable material currently being landfilled. These figures were calculated for the purposes of this report based on waste composition and the total amount of waste landfilled across the province. With the growing recognition that wastes are valuable resources, these tonnages could be interpreted as an indication of lost financial

and social/ job creation opportunities in the waste sector. That said, it should be recognised that not all materials making up these waste streams are currently recyclable (for example: all types of plastics). Therefore, these figures are only indicative of the potential and not an indication of the total mass of material available to the waste economy (see Section 3 for more details).

Figure 2: Volume of paper, plastic, metals and glass landfilled in Western Cape municipalities in 2010



(Source: Adapted from DEA&DP, 2013)

The CCT's Solid Waste Management Department spends between R200-R250 million on capital expenditure and approximately R2.1 billion on operations annually. It is estimated that about 25-30% of its operational expenditure goes to private companies as service providers and/or contractors (DEDAT, 2014). To put these costs into perspective, they are equivalent to 0.8% of the provincial GDP in 2010. According to figures published in 2014 by WESGRO, the Western Cape Investment Trade and Promotion Agency, that is a total of R282.65 billion.

We have established that there is material within the waste stream that could potentially be used to derive economic value. And this may well reduce some of the costs spent by municipalities on disposal.

Determining the exact financial and overall economic value of using materials that are currently being disposed of is complicated. This is because some costs would be incurred for collection and processing for re-use or recycling; selling prices for materials can be quite variable; and jobs created in this process may have different economic multipliers across a range of sectors.

That said, taking steps to determine the value of the waste economy in the Western Cape would be an exercise worth attempting (see Section 3, Table 9). Some municipalities, such as the CCT, have undertaken such studies (Nahman et al; 2010). They have revealed the scale of unaccounted external factors (environmental and social costs) on waste management costs per ton, giving an indication of what the gate fees should be.

3.2. Analysis of the waste market and commodities (commercial and industrial wastes)

Increasingly, waste materials in South Africa are being recognised as resources that produce value chains with associated commodity prices.

The NWMS, (2011) is evidence that the DEA has identified the waste sector as a sector that can contribute to creating green jobs and achieving equitable economic growth. In response, it has set a target of creating 69 000 additional jobs and 2 600 small and medium enterprises (SMEs) by 2016 within in the waste sector.

This change in mindset is reflected in growing markets for secondary materials.

The estimated market value of these secondary materials is presented in Table 2 (below) and is based on a preliminary document detailing the economic value of South Africa's waste (Council for Scientific and Industrial Research, CSIR, 2014).

Table 2: Market value of secondary materials

Waste categories	R/ton
Metals	2270
Glass	490
Paper	744
Plastics	3120
E-waste	1000
Tyres	367
Batteries	Not available
Used lubricating oil	2778
Construction and demolition waste	88
Biomass waste from industry	189
Organic component of MSW	189
Non-recyclable MSW	367

(Source: CSIR 2014).

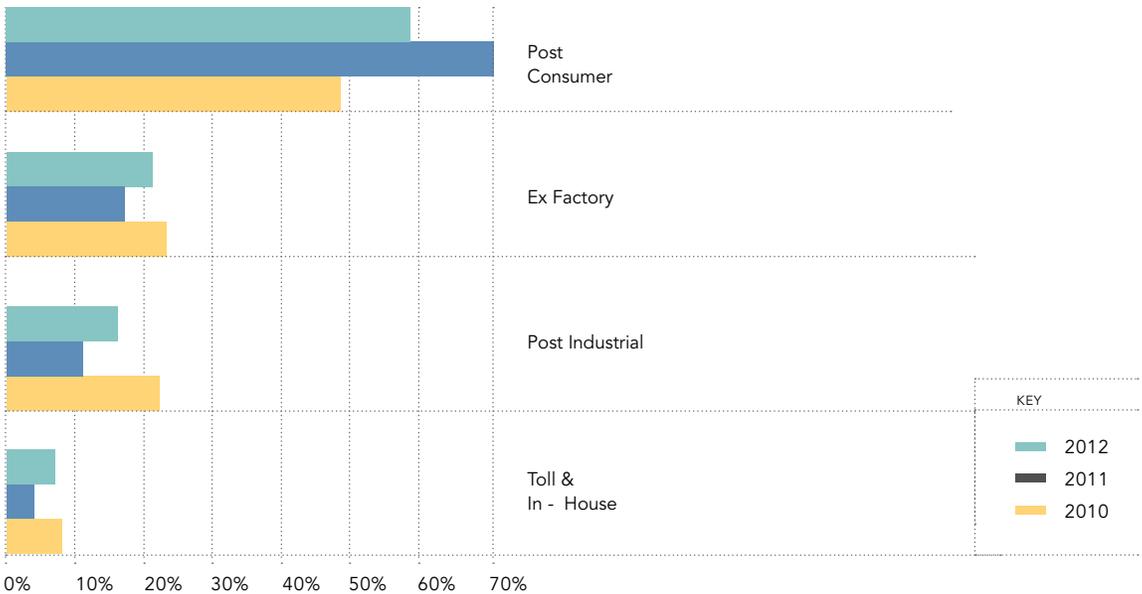
Note: although various methods are used to determine the unit value of waste, in Table 2 the CSIR (2014) used the average gate fee, understood here as price paid by the recycler, to give a more accurate indication of the materials' value.

These were average prices based on data from multiple sources and multiple geographic regions over the 2013 calendar year. As such, they should not be seen as the current market price that could be obtained for a waste.

The recycling industry, an important part of the South African waste economy, has operated for over two decades and is well established in the Western Cape. In the South African context, the largest volumes of dry recyclables available to the recycling economy remain in the post-consumer stream, as indicated in Figure 4.

This figure presents the percentage of plastic wastes that are recovered according to source. Although the volume of pre-consumer streams is significantly lower than the volume of post-consumer materials, the quality of the pre-consumer streams is generally far greater because the streams tend to be relatively homogeneous.

Figure 3: Source of recyclable waste in South Africa in 2010, 2011 and 2012



(Source: PlasticsSA, 2013).

The value of South Africa's packaging market is around R73 billion, with a projected value of around R80 billion by 2016 (Nampak, 2014). Within the recycling industry, dry recyclables from packaging waste have established collecting, handling and processing entities, with established markets

mostly supported through existing voluntary extended producer responsibility (EPR) schemes. These EPR schemes support the current quantities being recycled, as presented in Table 3.

Table 3: Recycling tonnages and rates of packaging wastes in South Africa

Packaging material	Packaging and paper waste recycled	Total industry tonnes	(Imports added, exports subtracted) % Recycled
Recycled			
Glass	331 216	897 790	36.9%
Metal	148 282	247 706	59.9%
Paper (pack and print)	1 080 841	1 897 674	59.9%
Plastic	196 760	629 474	31.3%
Total	1 757 099	3 672 644	47.8%

(Source: BMI, 2013).

Table 4 indicates that in South Africa, according to statistics collated by BMI(2013), most waste – especially glass and plastic – is collected by the informal sector, specifically 90% of polyethylene terephthalate (PET) and 68% of other plastics. After this, only 5% of PET and 2% of other plastics are sourced from recycling banks, while a further 5% of PET and 20% of other plastics are recycled through the formal economy.

The equivalent collection statistics for the Western Cape are not known and may differ from the South African average for a number of reasons. These include bylaws in municipalities, such as the CCT, which govern informal collection.

Table 4: Source of recyclables collected in South Africa

Category	– Source of materials –					
	TetraPak	Paper	Metal	Glass	PETCO	Plastics
Informal trade		Mostly informal	30-40%	80%	90%	68%
Recycle banks		Most of it already established buy-back centres		10%	5%vvc	2%
Formal market	Gayatri does all collections	Mpact collectors and Sappi	Scrap dealers and recycling companies 60-70%	10%	5%	20%
Other		Pre-consumer				10%
– Informal trade is responsible for most collection –						

(BMI, 2013, Recycle Assessment Report – prepared for the Recovery Action Group/RAG members).

The National Recycling Forum is a non-profit organisation (NPO) that was created to promote the recovery and recycling of all materials at a national level. Its principal members are industry associations such as PlasticSA.

Its key objectives are to:

- Provide a national communication forum for key players in the recycling field.
- Interact with central and provincial government to encourage the recycling of glass, paper, plastics, tinsplate steel, used oil, and electrical and electronic waste.
- Facilitate the formation of regional forums, such as the Recovery Action Group (RAG), which draw their members from enthusiastic and interested volunteers as well as small recyclers in South Africa’s major centres.
- Encourage the establishment of buy-back centres and drop-off points through the activities of its members in various centres.

3.3 – Performance by waste stream: This section presents an overview of the performance of different waste streams such as paper, glass and metals.

Paper recycling market

The Paper Manufacturers Association of South Africa (PAMSA) represents more than 90% of paper manufacturers in the country. PAMSA members Gayatri Paper Mills, Huhtamaki South Africa, Kimberly-Clark, Lothlorien, Mpact (previously Mondi Recycling), Nampak Recycling, Sappi ReFibre and Tetra Pak account for more than 90% of the paper recovered in South Africa (PACSA, 2011).

Any company involved in the manufacture of pulp, paper, board and tissue may become a member of PAMSA (<http://www.thepaperstory.co.za/about-pamsa/>).

The Paper Recycling Association of South Africa (PRASA) is a subsidiary of PAMSA and was formed to increase the recovery of recyclable and reusable paper products in South Africa. Principal PRASA members are currently Gayatri Paper Mills, Huhtamaki South Africa, Mpact, Nampak Recycling, Sappi ReFibre and TetraPak. Other paper recycling industry players are encouraged to register on <http://www.prasa.co.za/node/52>.

A total of 2 202 655 tons of paper were produced in SA in 2011, and 2 318 183 tons in 2013 (PRASA, 2012; PRASA, 2014). The complete value chain for forestry-to-paper products generated R18.2 billion in 2013, or 0.6% of South Africa's GDP (PAMSA, 2013), up from R5.9 billion in 2003. Similarly, the industry's recycling rate increased from 57% to 62.1% of recoverable paper between 2011 and 2013, 988 614 and 1 439 592 tons respectively (PRASA, 2012; PRASA, 2014).

According to PRASA, 75% of paper consumed is recyclable; 8% is lost, primarily through the export of agricultural products; and the remaining 17%, such as tissue and wax paper, is unsuitable for recovery.

Plastics recycling market

The combined turnover of South Africa's plastics industry is R50 billion annually, contributing 1.6% to the national GDP and 14.2% to the country's manufacturing economy (PlasticsSA, 2013).

In 2012, around 1.370 million tons of plastic were produced and 272 691 tons were recycled, resulting in a 19.9% recovery rate. It is expected that consumption of packaging plastics will continue to rise as it is linked to the increasing demand for consumer goods.

However, the weak rand continues to favour plastic exports, resulting in an increasing loss of valuable plastic resources from the South African economy (PlasticsSA, 2014). In 2012, 12 532 tons of recycled plastics were exported, equivalent to around 5% of the total volume of waste plastics collected for recycling (South African Vinyl Association, SAVA, 2013). The upward trend in plastics exports is accelerating, with an increase of over 51% between 2011 (8 294 tons) and 2012 (12 532 tons), with a further 19 000 tons exported in 2013. Overall, a 129% increase in plastics exports has been recorded since 2011 (PlasticsSA, 2014).

PlasticsSA represents key players in plastics industry – from polymer producers and importers to converters, machinery suppliers and recyclers.

The SA Plastics Recycling Organisation (SAPRO) is the official representative body of plastic recyclers and re-processors. As an NPO, SAPRO is funded by its members. The Recovery Action Group (RAG) is organised at regional level and run quarterly between industry and provincial departments of Environmental Affairs. RAG comprises PETCO, PlasticsSA, SAPRO, POLYCO and the Polystyrene Packaging Council (PSPC). (http://www.plasticsinfo.co.za/default.asp?CPH_ID=1232).

The Plastics Sustainability Council, led by PlasticsSA, provides strategic leadership on sustainability measures beyond recyclers and manufacturers. It includes the polymer groups PETCO, Polyco, PSPC, and SAVA; the recycling organisation SAPRO; and the retailers Massmart, Pick n Pay, Shoprite and Woolworths (http://www.plasticsinfo.co.za/default.asp?CPH_ID=1292).

Table 5 indicates that the main source of recycled polymers is packaging waste compared to non-packaging sources, with low-density polyethylene (LDPE) the most common polymer found in waste. The other most common polymers in packaging waste are PET, high-density polyethylene (HDPE) and polypropylene (PP).

Table 5: Packaging/non-packaging tonnages recovered for plastic wastes.

Material	2010		2011		2012	
	Packaging	Non-packaging	Packaging	Non-packaging	Packaging	Non-packaging
LDPE/LLDPE	90 149	11 305	89 493	6 359	93 464	5 507
PET	39 855		46 276		54 424	
HDPE	27 907	11 825	27 108	11 871	36 316	9 633
PP	20 869	17 744	21 549	18 734	21 716	25 365
PVC	798	15 032	587	16 117	631	16 181
PS and PS-E	2 038	1 218	1 636	1 578	1 621	1 774
ABS	376	805	550	605	311	644
Other	40	1 891	1 267	1 967	60	5 045
Waste tonnages exported	7 969	1 358	8 294	1 464	12 532	2 212
Total tons recovered	189 728	61 178	196 760	58 695	221 078	66 360
Total plastics Packaging	605 000		629 570		647 544	
Packaging recovery rate	31.4%		31.3%		34.2%	
Total tons recovered		250 906		255 455		287 435
Total tons recycled locally		241 852		245 697		272 691

(Source: BMI, 2013).

Recycling performance of different polymers

This section provides a brief overview of the performance of different polymers in the recycling market and the relevant key players where the information is readily available. There are different types of plastics, organised in seven main groups, as follows:

Polyethylene terephthalate (PET)



PETCO has four contracted recyclers: **Extrupet** (Wadeville-Germiston, Gauteng), which recycles PET bottles to fibre and also operates the first food-grade PET bottle-to-bottle plant; **Sen Li Da**, Newcastle (KZN), which produces fibre from PET bottles; **Kaytech Engineered Fibres** (Western Cape), which produces fibre from bottles; **SAFrePET** (Western Cape), which focuses on bottle- to food-grade PET. **Hosaf Fibres** (Milnerton, Western Cape) also operates a bottle-to-fibre plant.

PET is the best performing plastic in terms of recycling. Post-consumer PET has a 48% recovery rate.

Of this:
16% was recycled bottle-to-bottle in 2013,
13% was flake/bottle export,
64% was processed bottle-to-fibre locally
7% was bottle-to-fibre for export

(PETCO, 2014).

High-density polyethylene (HDPE), Polypropylene (PP) Linear/Low-density polyethylene (LLDPE/LDPE)



Among the main converters of PP, HDPE, LDPE and LLDPE in South Africa are **Afripack Packaging** (Kwa-Zulu Natal), **Astrapak** (Gauteng), **Bowler Plastics** (Kwa-Zulu Natal), **Boxmore Packaging** (Western Cape), **Huhtamaki** (Western Cape), **Mpact** (Gauteng), **MCG Industries** (Western Cape), **Nampak** (Western Cape) and **Polyoak** (Western Cape), **Polyco**(2014).

Nampak is the market leader in the manufacture of HDPE milk and juice bottles (Nampak, 2014).

Atlantic Plastic Recycling is one of the larger PE recyclers in the Western Cape. The company recycles LDPE (LD film) into refuse bags and pellets, as well as both LDPE and HDPE into pellets.





Polyvinyl chloride (PVC)

PVC can be categorised into plasticised (flexible) and un-plasticised (rigid) PVC. The main uses of recycled PVC in South Africa are for the production of pipes and cables, heat stabiliser, resin and flooring materials. PVC recycling rates are quite low at around just 5% (PlasticSA, 2014).

The Southern African Vinyls Association (SAVA) has around 25 members including converters, manufacturers, traders and recyclers. For more details, visit <http://www.savinyls.co.za/pages/9-members-list-benefits>.

The removal of the MAT-7 PVC minimisation clause from the Green Building Council's Green Star Rating Tools has stimulated the market for PVC products, particularly in construction, due to the material's low density and durability. However, the tools can only rate the material neutral if the supplier has committed to and can provide evidence of best practice in manufacturing and recycling. Best practice standards for the industry have been published and are being overseen by SAVA (SAVA, Infrastructure News, 2013).



Polystyrene (PS)

The primary market for recycled polystyrene is picture frame manufacturers. Other uses include WonderBag (www.wonderbag.com) and some construction materials.

Visit the PSPC's website for more about some of the key players in the polystyrene industry <http://www.polystyrenepackaging.co.za/members.html>

The Polystyrene Packaging Council (PSPC) of South Africa was formed in 2007 to enhance the industry's capacity and support recycling activities, mainly through research, educating and engaging the public. It currently has 10 full members and 9 associates.

Other plastic wastes

This group comprises multi-layered plastics, composites, laminates and some e-waste components. Most plastics in this category are considered residual waste. In South Africa, they are currently landfilled except for Tetrapak, which is collected and recycled into fibre by Gayatri Mill (Gauteng) in partnership with TetraPak South Africa.

The other recycled plastics in this category are used to produce plastic timber. A multi-layer packaging forum was established in 2010 and founded by AstraPakin response to the increasing quantities of multi-layer packaging and laminates.



Glass recycling market

There is an existing market for returnable glass bottles. Both the national bottling companies, SAB Miller and Distell, now run successful deposit schemes, where the company pays its traders anything between R0.80c-R1.50 for each bottle returned (Nampak, 2014). Generally, 100% of the glass bottles recovered in South Africa are recycled into glass bottles, maintaining the material in its most valuable form (The Glass Recycling Company, TGRC, 2013).

TGRC is an NPO committed to increasing glass recovery rates in South Africa. It is funded by its 22 shareholders, which include 20 fillers and two glass producers, Consol and Nampak Wiegand (www.theglassrecyclingcompany.co.za/our-partners/). TGRC reported a 40.6% recycling rate for 2013, up from 36.9% in 2011 and 39.2% in 2012.

According to BMI (2013), the informal sector supplies 80% of the glass feedstock to the recycling industry, with 10% sourced from formal waste management companies and a further 10% sourced from recycling banks (Table 4). These are national statistics and the figures for the Western Cape specifically are not currently known.

TGRC is committed to developing small business and engages with the informal and formal sectors to achieve this aim. By March 2013, the number of entrepreneurs on its books had increased to 502 from 255 in the previous year (Infrastructure News, 2013). TGRC also partners with the National Recycling Forum and the RAG to achieve their common recycling goals.

The 20 fillers represent the majority of new glass containers purchased in the country (PACSA, 2011). TGRC provides advice and support for collectors, entrepreneurs and buy-back centres in the form of training, wheelie bins, gloves, goggles and collection bags. To sell glass to manufacturers, collectors must be registered as vendors. TGRC will provide the relevant contact details.

PFG Building Glass, a member of the PG Group, is one of the leading manufacturers and suppliers of non-bottle glass in the country (<http://www.pfg.co.za/services.aspx>). Other producers in this category based in the Western Cape are Compass Glass Manufacturer, Cover Frameless Glass and Glass South Africa. The PFG group also accepts windscreen waste for recycling, with windscreens recovered nationally for processing at its Springs plant. Recycling rates for building, windscreen and other flat glass are not known.

Nelson Glass in Cape Town recently began accepting float glass for recycling, producing glass 'pebbles' for landscaping and fish tanks. There are plans to accept laminated and tempered glass as the business grows.

Metals recycling market

A total of 3 121 000 tons of metals were produced in South Africa in 2011 according to DEA's National Draft Waste Baseline (2012). The production split between ferrous metals and non-ferrous metals was about 2.64 million tons and 0.4 million tons respectively. The estimated general recycling rate for metals is 80%, or around 2 497 000 tons of metal.

ArcelorMittal is the primary producer of steel in South Africa, having produced 6.5 million tons of liquid steel in 2013, more than 60% of South Africa's production (ArcelorMittal, 2013).

The Metal Recyclers' Association of South Africa estimates that there are more than 400 000 informal scrap collectors countrywide (Maguire, 2012). The association promotes best practice in safety and quality in the metal processing industry, and has a membership base that accounts for 80% of the scrap metal recycled in SA. Membership forms are available at <http://www.mra.co.za/index.php>.

Nampak is the market leader in producing beverage, food and aerosol cans in South Africa (Nampak, 2014). The NPO Collect-a-Can (<http://www.collectacan.co.za/>) was founded by ArcelorMittal and Nampak to stimulate the recycling of cans in the country, including beverage, aerosol, food, oil and paint cans (ArcelorMittal, 2014). The recovery rate of metal cans was 72% in 2013, a substantial increase from 18% in 1993. In 2013, Collect-a-Can paid almost R20 million to an estimated 100 000 collectors, many of whom have no formal employment.

Alert for the scrap metal industry:

Regulations to phase-out the use of polychlorinated biphenyl (PCB) materials and materials contaminated by polychlorinated biphenyl (PCB) were published under National Environmental Management Act, Act 107 of 1998, Government Gazette No. 37818. The use of PCB-containing equipment or materials will be prohibited after 2023, and the possession of any such materials or wastes will be banned after 2026.

These regulations affect the use of PCB-containing dielectric fluid, dielectric fluid containers, electrical equipment or other equipment or materials as well as equipment such as capacitors, transformers, electrical motors, circuit breakers, voltage regulators, re-closers, switchgears, switches, electromagnets, rectifier or other equipment that contain a dielectric fluid that contains PCBs.

Eskom maintains an inventory and has a phase-out plan in place for all PCB-containing fluids and PCB-contaminated materials. However, wastes from other electrical installations, lighting ballasts (used to start and regulate fluorescent lighting), X-ray machines and some laboratory equipment may contain PCBs. Scrap metal dealers are likely to handle increasing volumes of PCB-containing waste as the ban date approaches. Please see the attached report for guidelines on identifying PCB-containing materials (UNEP, 1999).

E-waste recycling market

According to the DEA (2012), 64 045 tons of electrical and electronic waste were generated in 2011; and the reported recycling rate during the same year was 11% or approximately 6 884 tons).

E-waste is currently the fastest growing waste globally, mostly due to modern lifestyles. E-waste can easily be mismanaged if it is not properly dealt with through a clear regulatory framework that supports recycling and/or recovery and safe disposal.

Currently, there are two industry bodies that support South Africa's e-waste industry: the e-Waste Association of South Africa (eWASA, <http://www.ewasa.org/>); and the Southern African E-Waste Alliance (SAEWA, <http://sa.ewastealliance.co.za/>).

Typical e-waste components recycled in South Africa include computers/laptops, server units, CRT/LCD/TFT screens, printers, mobile phones, televisions, cabling and networking equipment. SAEWA has developed a number of documents to support SMEs working in this area.

Available on the SAEWA's website, they are:

- [Pocket Guide for South African E-waste Collectors](#)
- [Environment Management Guidelines for SMEs](#)
- [Best Practice Information Guide for Small African E-waste Businesses](#)

E-waste recycling is more established in many developed countries, where recycling operations are typically funded through a mandated EPR scheme. This is not the case in South Africa because formal EPR schemes have not been called into law as yet. The lighting and e-waste industry submitted a voluntary industry waste management plan to the DEA in 2014, and it is still waiting for approval.

One of the biggest challenge SMEs face is the fact that any waste containing a hazardous substance is classified as hazardous under the National Environmental Management: Waste Amendment Act (NEM:WA), Act 26 of 2014. This triggers a full environmental impact assessment (EIA), which most SMEs are unlikely to afford. Moreover, the Second-Hand Goods Act, Act 6 of 2009: Regulations for Dealers and Recyclers was promulgated in 2014. It aims to regulate the second-hand goods trade, including restricting the flow of stolen electronic goods in the economy.

Second-hand goods recyclers are required to register with the South African Police Services (SAPS), and to record particulars of all collectors selling e-waste, including their ID numbers, as well as details of the goods they supply, such as serial numbers and method of obtaining the goods. Acquisition and disposal registers must be kept on-hand for inspection, which places a considerable administrative burden on SMEs.

Examples of e-waste recyclers in the Western Cape are: Desco (based in Gauteng, with collection facilities nationwide), Just PCs, Cape E-Waste, Computers Unlimited, Computer Universe, Microcomp Electronic Recyclers and Table Bay Recycling.

Organic waste recycling market

In the Western Cape, MSW typically has an organic content of between 14% and 39% (DEA&DP, 2012) and most organic waste is still generally landfilled. Garden waste has been collected separately for a number of years nationally. It is usually chipped and then composted by a private contractor appointed by the municipality. The bulk of other organic wastes, apart from MSW in the Western Cape, is generated from agricultural and agri-processing wastes associated with animal husbandry, including abattoirs.

The average disposal costs for organics is estimated at close to R190 per ton according to the CSIR's preliminary document on the economic value of South Africa's waste, 2014 (Table 1). However this value may vary depending on landfill gate fees, which can be significantly higher depending on the region. Stellenbosch Municipality, for example, charges around R450 per ton.

There are composting facilities for garden waste and a number of small- to medium-scale anaerobic digestion facilities in the Western Cape, as discussed in Section 3 of this report. The biggest composting companies in South Africa include Interwaste at national level, and Reliance Compost, which is the biggest player in the Western Cape. Other industry players in the Western Cape include Ywaste, ZTL Organics and Green Genie.

The Southern African Biogas Industry Association (SABIA) was established in 2012 to support the growth of the biogas market in South Africa. It contributed towards establishing the National Biogas Platform, which is co-ordinated by the German government organisation GIZ with support from the Industrial Development Corporation (IDC), the Development Bank of South Africa (DBSA), DoE and DEA. A list of biogas project developers is available on the SABIA's website (<http://biogasassociation.co.za/>).

Waste oils from restaurants across the city are often collected by independent collectors. Generally, they are resold for export or used by small manufacturing biodiesel plants for local consumption. Western Cape producers in this area include Envirodiesel, Green Diesel and Skoon Biodiesel.

Oils and hydraulic fluids draining from electrical installations, vacuum pumps and compressors may contain PCB. These are hazardous substances harmful to both humans and the environment (UNEP, 1999). So, where necessary, oil collectors and recyclers must conduct tests on any oil they receive to ensure safe handling and disposal. See section D for new legislation requiring the phasing out of all PCB materials and those materials contaminated by PCBs. As the date for complete banning of PCB materials approaches (2023), and all wastes by 2026, recyclers are likely to encounter greater volumes of these wastes.

Construction and demolition wastes recycling market

Construction and demolition waste (C&DW) comprises a diverse range of materials from various activities. These include road construction and repair; residential and commercial projects; public works funded by government; as well as small-scale excavation and building projects, including swimming pool construction and landscaping.

The NEM:WA, Act 26 of 2014, defines building and demolition waste as waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition, which include:

- discarded concrete, bricks, tiles and ceramics
- discarded wood, glass and plastics
- discarded metals
- discarded soil, stones and dredging spoil
- other discarded building and demolition wastes.

Under hazardous wastes, the Act defines construction wastes as:

- wastes from bituminous mixtures, coal tar and tarred products
- discarded metals (including their alloys) waste soil (including excavated soil from contaminated sites), stones and dredging spoil
- wastes from insulation materials and asbestos-containing construction materials
- wastes from gypsum-based construction material
- wastes from other construction and demolition wastes.

Generation of C&DW

According to the DEA (2012), 4 725 542 tons of C&DW were generated in 2011. C&DW constitutes up to 22% by mass and 10% by volume of Western Cape landfills (DEA&DP, 2012). It is more than likely that this figure is an underestimate, with illegal dumping rife in the industry.

Furthermore, current C&DW data does not include waste produced during the manufacture of building materials. Wastes generated in the extraction and manufacture of building materials are not formally included in the definition of building and demolition waste or construction wastes in NEM:WA. However, these wastes are often more homogeneous and can be re-used easily.

Closed loop material cycles must integrate across the full value chain of the materials in question. For example, wastes generated in the extraction and manufacture of building materials are mainly the same materials generated during construction and demolition.

Therefore, handling and beneficiation of such pre-consumer materials will take a similar route towards end-use markets, and might even be more valuable because they are uncontaminated with other materials post-demolition or construction.

C&DW composition

The composition of mixed construction wastes varies widely between activities. In addition, information about tonnages and composition of construction wastes in SA is currently not captured or reported.

In the absence South African waste characterisation studies on the types of activities presented in Table 7, it will be assumed that road maintenance and demolition will generate a high proportion of asphalt and/or concrete; the demolition of houses will result in a high percentage of rubble including tiles, concrete and bricks; whereas construction of large buildings would generate large amounts of packaging waste, wood, metal and dry wall waste (Macozya, 2006).

Table 6: Factors that determine the condition of C&DW waste

Factor	Description
Type of structure	House or office building, single or multi-story
	Local or national road
Type of activity	Construction, remodelling, repair or building removal
Method of generation	Explosives, mechanical or labour-based
Waste management process	Source separation or commingled handling
End-use scenario	Disposal at landfill site
On-site reuse or reuse elsewhere	Recycling

(Source: Macozoma, 2006)

Recovery and recycling

South Africa’s average C&DW recycling rate of 16% (756 087 tons) is well below international standards. In the Netherlands 90% and in Germany 86% of C&DW is diverted from landfill via recycling and incineration (Mulders, 2003) (Brennan et al., 2014). It should be noted that the Netherlands and Germany have highly developed C&DW recycling economies. The large amounts of valuable material available for recycling and reuse should be seen as an opportunity in the construction and cement industries.

Including wastes generated upstream from the construction site during the extraction and manufacture of building materials will impact on the recycling and recovery rate, with poor diversion from landfill expected at these points of the value chain. This is the subject of further research and analysis.

Furthermore, the construction industry worldwide accounts for 12-16% of fresh water consumption; 25% of wood harvested; 30-40% of energy consumption; 40% of virgin materials extracted; and 20-30% of greenhouse emissions (Macozoma, 2012).

Therefore, reuse of C&DW represents significant economic value in terms of water usage and energy consumption and in terms of virgin materials and timber used. After such expenditure, it is economically wise to extract maximum value from C&DW in South Africa.

Industry players

The following construction companies are key players in the industry:

Basil Read, Grinaker-LTA , Group Five, Murray & Roberts, Raubex , Stefanutti Stocks, Wilson Bayly Holmes-Ovcon (WBHO).

The PwC (2014) report on Trends in the South African Construction Industry included JSE-listed companies in two categories:

1. Heavy construction –

Aveng, Basil Read, Calgro, Esor Limited, Group Five, Murray & Roberts, Raubex, Steffanutti Stocks and WBHO

2. Construction materials and fixtures –

Afrimat, Warehouse Network (DAWN) Limited, Masonite, Mazor, PPC and Sephaku.

Drivers for C&DW recycling

In the Western Cape, the supply of mineral building materials is generally abundant, with stone aggregate (Malmesbury slate, Table Mountain sandstone), brick clay, plastic clay, and silica sand available. However, building sand and gravel (ferricrete) reserves have an estimated lifetime of 20 years (Cole, 2011).

Illegal sand mining due to demand for building sand from the construction industry is noted as an issue in the Western Cape's State of the Environment Report (DEA&DP, 2013). Given the limited lifespan of this resource, illegal sand mining, with its associated impact on water resources and soil stability, will only increase if there is no intervention.

Alternative building sand sources include excavations from swimming pool, road and building construction – material that is generally landfilled. It is possible that this material is transported and landfilled at a cost while local construction sites require sand. These local projects will then pay for sand that has been mined and transported into the area. These practices show the inefficiencies in the current system.

Currently, external push factors towards a circular economy for the construction industry are limited and variable. Some municipal bylaws required a detailed waste management plan for all construction activities (e.g. the CCT), but do not yet require diversion from landfill goals for those wastes. Furthermore, some landfills impose gate fees for C&DW and others allow dumping for free up to a certain volume and on condition it is pre-sorted. As local government moves towards alignment in the handling of wastes, these external factors are likely to be adopted more broadly, with plans on the table to strengthen the push drivers as the secondary materials economy grows.

GreenCape and its partners will be working towards a system where, to take this example, locally excavated material may be supplied to a local user, minimising the flow of waste to landfill and maximising value from our material resources.

3.4. Overview of the waste to energy industry

To date, the main (WtE) projects undertaken by the private sector revolve around: small-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; landfill gas to electricity; small-scale pyrolysis plants generating biodiesel; biodiesel from waste oils; and fuel replacement in industrial boilers using biomass.

The other market opportunity is the DoE's Renewable Energy Independent Power Producer Programme (REIPPP), which had allocation for biogas, biomass and landfill gas for large projects (those above 5 MW). However, the biogas allocation for the fourth round of the REIPPP was removed due to lack of industry uptake. However, one landfill gas project by EnerG Systems and one biomass project by Lesedi were selected as part allocation of the 12.5 MW and 25 MW allocated at R0.94 and

R1.4/kWh respectively during the third round of the REIPPP. (Refer to the renewable energy MIR for more details about REIPPP).

Table 8 (below) presents a list of potential organic wastes suitable for the production of energy biologically. Please refer to Appendix (Section 8.4.2) to see how these figures were derived. It can be seen from Table 8 that up to 500 MWe can be generated from available organic wastes in the province. While the WtE market in South Africa is growing, the growth remains slow compared to other renewable energy sources such as solar and wind.

Table 7: Overview of organic waste quantities.

Source/type of waste	Quantities (Mega litres/ Mega tonnes/ annum)	MWth	MWe
Abattoir waste waters	200	0.11-0.66	0.03-0.22
Broiler abattoirs	8 360	2.39-11.7	0.79-3.85
Pork production	8 170	1.72-3.51	0.57-1.16
Dairy production	6 460	2.37-11.49	0.78-3.79
Beef feedlot	2 970	74.38	24.54
Piggeries	6 340	317.55	104.79
Poultry	41 100	785,82	259,98
Wastewater/sewage	198 000	542	217

The business case for producing biogas from animal husbandry facilities such as abattoirs has emerged as the real short-term opportunity due to the fact that the energy (heat and electricity) generated can be used onsite, and due to the savings achieved by avoiding the high waste disposal costs.

The waste management classification legislation published last year requires safe disposal and the submission of a disposal certificate for all hazardous wastes, which will also lead to higher disposal costs for abattoirs. This is especially the case because any substance and/or material becomes hazardous if contaminated, as is the case for blood and some animal carcasses on site. This provides an additional incentive for installing biogas based on the cost savings achieved on disposal.

GreenCape is currently developing a web-based policy and legislation tool in collaboration with GIZ and the climate change department within the DEA. This tool will provide an overview of all

the potential applicable legislation when developing waste-related projects and give industry and municipalities indicative guidelines. The aim is to address the fact that legal compliance has been identified as a challenge and barrier to South Africa's waste economy. (Refer to Section 4 for more details.)

Therefore, GreenCape will continue to provide support to small- to medium-sized biogas project developers by removing barriers and ensuring these projects achieve financial close.

Many wastewater treatment works (WWTW) have installed biogas plants built in the early 1970s which are currently idle due to poor maintenance and inadequate training of WWTW's staff. Table 8 shows that reviving these digesters would generate an average of 50% of the total capacity identified. Active engagement with municipalities will be required to exploit this opportunity.

Steps/guidelines to develop a WtE project

This section discusses the main steps required when developing a WtE project, as well as the associated challenges. It is based on GreenCape's interactions with project developers as presented in Figure 4.



Phase 1 and 2:

Project feasibility – development of business plan and municipal processes

The main challenges experienced in phases one and two are linked to the security of feedstock supply (i.e. wastes). This is especially the case if the proposed business plan involves the use of MSW as feedstock. Access to MSW remains an obstacle to project developers because of the legislation that governs municipal procurement, such as the Municipal Systems Act (MSA), Act 32 of 2000. Sections 78 (1-4) of the MSA, require that a municipality undertakes a detailed feasibility study to identify the best value for money for any major infrastructure upgrades within any municipality. The main elements investigated during the Section 78 process are technology options; costs and/or affordability to the municipality (i.e. future budget implications); as well as associated risks.

Most WtE projects have a payback period of between 10 to 15 years and require a minimum security of waste supply for that period. Long-term contracts with a municipality are governed by Section 33 of the Municipal Finance Management Act (MFMA, Act 56 of 2003). Section 78 of the MSA and Section 33 of the MFMA can typically extend over a number of years. For example, the CCT completed its Section 78 process in two years.

Due to a legal battle, it has taken another three years to appoint a transactional advisor (TA) that will then develop request for proposals for alternative waste treatment projects, such as anaerobic digestion. Only then will private companies be able to bid on and be selected for any projects.

Submitting an unsolicited bid to municipal officials Submitting an unsolicited bid/project proposal directly to a municipal official and/or council does not guarantee shorter timeframes. The MSA requires unsolicited bids or proposals to undergo a public participation process before final approval of the service provider. The process can be highly contested and lead to bids being dismissed. For this reason, many municipalities have selected to avoid unsolicited bids.

The only condition required of unsolicited bids in the MSA is that bids prove they have unique points that are not offered on the market by competitors. Providing this proof can be difficult.

In conclusion, it is important to note that the MSA and MFMA would not apply to privately owned waste, such as waste generated from commercial and industrial operations. This is because these wastes are not 'owned' by the local municipality.



4

Authorisation for the use of energy

Phase 3:

Environmental authorisations

Obtaining an EIA and waste licence typically takes between nine to 24 months, depending of the additional types of licences and specialist studies required. WtE projects might trigger a list of other laws around areas such as water usage, land use and air quality, which can extend the project development phase by up to five years. Therefore, it is crucial to appoint a suitable environmental assessment practitioner (EAP) with previous experience in the waste sector and detailed knowledge of recent changes in legislation.

The lack of co-ordination between different government departments – such as the DEA and Department of Water and Sanitation (DWS) – on thresholds and timeframes can result in additional unplanned cost. Appendix (Section 8.3) provides an overview of the EIA process for a WtE project.

Phase 4:

Authorisations required for energy usage

The challenges experienced by project developers are directly linked to: the complexity of the process to secure a generator's licence and power purchase agreements from Eskom and/or municipalities. Also, every biogas project is now required to register and obtain a gas user licence in line with the Gas Act, Act 48 of 2001,



5

Reaching financial close

which adds an additional layer of administrative burden for project developers. cheap electricity tariffs from Eskom and other renewable energy sources, such as solar PV, which have enjoyed lower market prices due to the competitive REIPPP bidding process. Electricity generated from waste is currently produced at least 15-20c/kwh higher than the bulk electricity price from Eskom. Project developers struggle to compete with Eskom and sell directly to municipalities at a premium price.

Phase 5:

Reaching financial close

Financial close involves providing a full project information memorandum (PIM), which should include a detailed financial model and other supporting documents such as feasibility studies and EIA.

The Industrial Development Corporation (www.idc.co.za) is regarded as one of the main financial institutions that invests in WtE projects. It is difficult to secure funds from commercial banks due to the challenges cited above. They affect a project's ability to attract investment and funding from commercial financial institutions.

3.5. Major waste industry developments and trends

3.5.1. Regulatory

Changes in legislation

This section presents the amendments to the National Environmental Management: Waste Act, Act 59 of 2008, by the DEA. These are:

The National Environmental Management: Waste Amendment Act, Act 26 of 2014, has updated the definitions of waste to exclude all waste once recovered, reused or recycled. Recovery is now distanced from the manufacture of a product and is simply understood as the act of extracting material or another substance (including energy) from waste. This suggests that certain projects involving recovery and/or reuse would no longer require a waste licence as they are no longer recognised as waste.

The Waste Amendment Act now includes a definite end-of-waste status, which increases opportunities for the recycling market. Schedule 3 – dedicated to listing groups of defined waste – has also been added.

The DEA's National Environmental Management: Waste Amendment Act, Act 26 of 2014, also makes provision for the establishment of a National Waste Management Bureau (WMB). According to the DEA: 'The objectives of the WMB are mainly to (i) enable waste minimisation, reuse, recovery and recycling of waste materials; (ii) monitor and disburse revenue collected through economic instruments applied to achieve the WMB's first objective; (iii) implement, monitor and evaluate the effects of IndWMPs; (iv) build capacity in the WMB to be able to provide support for municipal waste management plan development and implementation, as well as (v) municipal capacity building programmes.' (Department of Environmental Affairs, 2014)

The DEA is currently drafting the advert to recruit the CEO of the WMB, who should be appointed during the course of the 2015-2016 financial year.

There is still a great deal of uncertainty around the exact mandate and role demarcation between the local authorities, existing voluntary EPR organisations, such as PETCO, which previously

performed some of the functions listed above, and the newly established WMB.

A number of stakeholders have expressed concerns about the potential administrative costs of a centralised body, such as the WMB, versus dedicated sector- and industry-driven managed schemes, such as product responsible organisations (PROs) in Europe, for example.

The draft NPSWM has been gazetted in line with section 13A of the National Environmental Management: Waste Amendment Act. The NPSWM's main aim is 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 recycling and reuse for activities generating specific waste streams.

The NPSWM will be open to comment until 2 April 2015. Once promulgated, the NPSWM will either be incorporated into a Money Bill, which will be developed with Treasury to collect and disburse revenue from waste charges and fund IndWMPs through the WMB; or employ the Customs and Excise Act, which provides the framework for the plastic bag levy, incandescent light bulbs, motor vehicle CO₂ emission tax and generation of electricity from non-renewable and/or hazardous sources.

R634 Waste Classification and Management Regulations allow for the submission of a motivation to the Minister to exempt specific waste management activities from requiring waste licences. The R634 regulations also promote the treatment of hazardous wastes before disposal, as co-disposal and dilution of hazardous wastes before disposal will no longer be allowed.

The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) has been adopted by DEA this will allow industries to classify their wastes according to a unified set of building blocks to determine health and environmental hazard levels.

R635 National Norms and Standards for Assessment of Waste for Landfill Disposal,

which modified the analyses required for assessing wastes, now includes total concentration as well as total leachable concentration. This means that wastes classified as needing disposal at an H:h site may be downgraded to a general waste landfill and vice versa. The costs of waste assessment are now much higher. This may have the positive impact of incentivising landfill diversion, or simply encourage illegal dumping, especially of hazardous wastes.

R636 National Norms and Standards for Disposal of Waste to Landfill

have changed the classification of landfills. They established stricter landfill containment barriers and also provided for the prohibition of certain wastes to landfill within specified timescales. The R636 regulations will act as an incentive to encourage the diversion of waste from landfill.

3.5.2. Industry trends and highlights

The waste hierarchy prioritises interventions that:

- (i) avoid and/reduce waste;
- (ii) reuse and recycle materials;
- (iii) recover the energy potential; and
- (iv) only dispose of the residual and low-value component of waste streams.

Here is a summary of key developments in South Africa's waste economy that align with the waste hierarchy:

The Department of Science and Technology

(DST) has awarded a R25 million grant over three years to Forestry SA as part of its innovation funding to improve, among other areas, the use of timber as a feedstock for bio-based products including bioenergy, biopolymers, biomaterials and other bio-products required for a diversified bio-economy (Forestry SA, 2014).

PETCO plans to increase the processing capacity of PET in the country, focusing on bottle-to-bottle recycling rather than in bottle-to-fibre recycling. In this way, the value of the material will be maintained rather than down-cycled to fibre.

PlasticsSA has committed to sending zero packaging plastics to landfill by 2030.

To achieve this target, its Sustainability Council currently has the following plans in place:

- Research and development on
 - (i) new products;
 - (ii) recycling of plastics currently not recyclable;
 - (iii) light weighting to acceptable levels
- Quality standard for recyclables
- Designing new products and packaging for recycling.

Nelson Glass and Mirrors in Killarney,

Cape Town, has recently launched a recycling operation which accepts float glass, specifically window panes, for crushing to supply landscapers and pet shops with glass pellets (R. Schincariol, pers. comm. 11 November 2014). Nelson Glass accepts float and tempered glass, but does not yet recycle laminate glass.

Spotlight on recycling/ closed loop recycling

AgriProtein

Based in the Western Cape, AgriProtein is currently developing the first large-scale fly larvae-to-animal feed plant in the world.

The plant is valued at ~R120 million and will be based in Philippi, Cape Town. It will be able to treat up to 200 tons of organic waste daily. Looking ahead, AgriProtein plans to develop 40 of these facilities across the world.

For more information see :
<http://www.agriprotein.com/technology.html>

PETCO

PETCO's aims to increase the recovery of pre- and post-consumer PET by more than 8 000 tons in 2015, with a recycling rate of 50% post-consumer beverage PET rate.

Two new bottle-to-bottle facilities will come onstream in 2015. One will be developed with Extrupet and the other with Mpact, both based in the Western Cape.

E-waste Africa

In October 2014, E-waste Africa became the first fluorescent tube recycler in southern Africa. The company is currently in talks with waste management companies, including those in the Western Cape, to establish a collection and transport network for the facilities at its home base in Pietermaritzburg, Kwa-Zulu Natal. Here, the tubes are crushed and the mercury is removed through activated carbon filters.

The process allows most components, including the glass, to be reused. Aluminium can be sold to scrap dealers while the white layer inside the tubes can be used in paints. The mercury and filters are disposed of in licensed hazardous waste landfills, although plans are in place to recover mercury in the future. The business is also talking to glass companies to secure off-take of the crushed glass.

For more information, visit
<http://ewasteafrica.net/>

Spotlight on Waste-to-Energy (WTE)

Overview

Based on current challenges created by the complex municipal procurement process (see Section 2.1), it is predicted that small-scale and decentralised WtE projects with direct supply of waste from a private party will keep growing because they require shorter project development processes. The growth in the private sector is anticipated to be faster and this has already been shown through a number of applications for waste licences for biogas projects.

Projects in the Western Cape include:

EnviroServ pilot biogas plant, Bellville

EnviroServ commissioned a pilot project at their Bellville office in the Western Cape, connected to a 50 kW generator. The main purpose of the pilot plant was to offer testing facilities for different waste streams to EnviroServ clients. The EnviroServ board of directors subsequently decided to cancel its activities in the WtE sector to pursue other activities across Africa. The plant is currently idle and might be up for sale in the near future.

CAE biogas digester, Klipheuwel (600-700 kW)

This project mainly uses animal husbandry. The capacity of the plant can be increased should there be a secured buyer for the additional electricity. For more information, see

<https://www.youtube.com/watch?v=vrnBAZVFNJO>.

Elgin Fruit and Juices, Grabouw (500kW)

The digester capacity is 500 kW, and runs on waste generated from fruits and juices.

See Appendix 8.2 for a list of current facilities and biogas projects under development, based on waste licence applications.

4– Opportunities and barriers

This section outlines some of the current and upcoming alternative waste treatment projects at municipal, commercial and industrial levels in the Western Cape.

4.1 Municipal

Stellenbosch Municipality

Stellenbosch Municipality has around three years of landfill airspace left, with no guarantee of securing a new landfill site within a 50km radius. Therefore, the municipality considers it essential to divert as much waste as possible from the landfill to extend its life and allow enough time to plan for a new facility. Accordingly, the municipality now diverts construction and demolition waste as well as garden waste away from landfill disposal. These waste streams are already collected separately.

WorleyParsons is also undertaking a feasibility study on behalf of the municipality into a WtE facility. The results of this study will be integrated into the third generation integrated waste management plan (IWMP), to be finalised by June 2015. The WtE feasibility study will feed into the Section 78 (3) process of the Municipal Systems Act, Act 33 of 2000, which will determine the feasibility (i.e. technical, financial and risk profile) of alternative approaches to solid waste management in Stellenbosch Municipality.

Through the Waste Economy Project (see Section 6.3), GreenCape is currently modelling scenarios for alternative treatment of waste in Stellenbosch Municipality to evaluate their relative financial and environmental implications. The information generated will feed into the Stellenbosch IWMP, the WtE feasibility study and the Section 78 (3-4) process.

Drakenstein Municipality

Drakenstein Municipality plans to develop a WtE facility. The project, which started in 2008, has secured approval from both from National Treasury and Drakenstein's council. Most likely, the facility will be located at an extension of the Wellington

landfill site. The appointed service provider is Interwaste, which has signed a primary agreement in the form of a memorandum of agreement (MoA) with the municipality.

The project is currently divided into

○ three main phases:

Phase 1: Running the existing landfill site as well as organising waste recycling and separation at source in Drakenstein Municipality. This is expected to achieve a 56% reduction in the amount of waste currently landfilled in Drakenstein.

○ **Phase 2:** Developing an anaerobic digestion (AD) facility with an installed capacity of 2 MW.

○ **Phase 3** Adding a direct combustion facility integrated into the AD with a total installed combined capacity of 12 MW, 10 MW generated from the incineration plant.

The total project value for all three phases is R450 million. Interwaste has started on the EIA for such a facility, and is also considering the Klapmuts facility in Stellenbosch Municipality as a possible location. The biggest threat to the implementation of phases two and three will be securing enough waste for the project because Drakenstein currently does not have the volumes required to make this WtE project financially viable.

A total of 300 tons of additional waste will have to be imported into Wellington or Klapmuts, depending on the site selected, to make the project financially viable. A key element of this project is the ability of the municipality to procure the electricity generated at a potentially higher price than current Eskom grid electricity.

City of Cape Town

In 2008, the CCT undertook a detailed technical feasibility study to identify opportunities for alternative waste management treatment processes. This took place as part of the Municipal Systems Act, Act 33 of 2000, Section 78 (1-4) study in 2008.

The report identified nine potential projects at eight different sites, as follows:

- Three potential landfill gas projects at three different locations (Visserhoek, Bellville South, Coastal Park). These have been registered under the Clean Development Mechanism (CDM) of the United Nations Framework Convention for Climate Change (UNFCCC) under the programme of activity (PoA), where the project boundaries are the national borders. This is an opportunity for other landfill projects across the country to also benefit from this registration. Project registration number: 10004. For more information, visit www.cdm.unfccc.in
- One wastewater sludge treatment project (Northern Works Biosolids Project)
- Two biomass, solid organic waste treatment such as AD, or a mechanical biological treatment facility (MBT)
- Three potential integrated waste management sites (IWM), with the recovery of high-value recyclables.

The next phase of the project would involve the appointment of a TA, whose main tasks would be to evaluate and structure these projects according to risks, costs and affordability to the municipality with the emphasis on delivering best value for money to the municipality.

Due to the expected scale of these projects, the need for public-private partnerships (PPP) would be one of the options under consideration, among others. If PPPs are under consideration, this will require the involvement of national and provincial treasury as commenting authorities.

The CCT has experienced significant delays in

appointing the TA, and had to cancel two previous tenders. The new approach has been to issue two tenders almost simultaneously: one for the appointment of the TA, which closed on the 5 February 2015; and the other to appoint a panel of experts with the capacity to implement these projects. The tender for the panel of experts was issued last year and is now closed. It is expected that successful bidders will be announced by the CCT in the first quarter of 2015.

The CCT has also received a donation from the Japanese International Co-operation Agency (JICA). It is a pyrolysis plant to be installed at the Kraaifontein Integrated Waste Management Facility. The plant will serve as a pilot project and enable the CCT to evaluate the viability of such waste-to-by-product projects within the city. The current waste streams that will be used are PP, PE and PS to produce diesel.

It is important to note that the landfill gas project at Coastal Park and the biosolids project have now been removed from the TA's scope of work. This is because enough background work was conducted to enable the CCT to issue the tender to appoint a service provider. These tenders have now closed, and the appointed service providers should be appointed in the course of 2015.

Eden District Municipality

The Eden District Municipality (EDM) is currently developing a regional landfill site as a PPP. The EDM issued a request for qualifications (RFQ), and four companies were shortlisted to (i) develop a regional landfill to service George, Knysna, Mossel Bay and Bitou municipalities; and to (ii) evaluate alternative waste treatment options. The request for proposals (RFP) was issued in March 2015, and will close in May 2015. It appears that preference will be given to a landfill gas project because this is the priority for Eden. The total amount that the appointed service provider will be required to raise to cover the capital expenditure is in the order of R170 million.

4.2.Private (commercial and industrial) wastes

Dry recyclables

The DEA has set municipalities a waste diversion rate target from landfill disposal of 15% by 2019, as stated by National Environmental Management: Waste Amendment Act, Act 26 of 2014, and the National Waste Management Strategy (2011). The industry voluntary waste management plan for packaging waste aims to achieve a zero landfilling of plastic waste by 2030.

It is estimated that the recycling industry could be worth an additional R98 million in income to companies and create 2 500 additional jobs in the Western Cape. Note, however, that the income is not the final revenue expected because it is not possible to estimate the costs of collection, sorting and basic processing (e.g .baling). These estimated figures were based on the market value of recyclables (mainly glass, plastic and paper, see Table 2) from the CSIR report (2014); the current and predicted waste industry revenues; waste volumes and recycling rates (see Table 9). The figures were based on a linear extrapolation of the previous and current recycling rates (see Appendix).

Table 8: Potential of the Western Cape recycling industry

	Current figures (2014)	Projected recycling figures (2019)
	Recycling rate (%)	
Glass	40	41
Paper	60	62
Plastic	18	21
Jobs	~18 000	~19 450
Industry income*	R300 million	R330 million

* Income i.e. sales value of recyclables excluding collection and treatment cost

WtE

It is expected that installation of biogas plants from small- to medium-sized facilities such as abattoirs will increase significantly in the near future. Many of these facilities are likely to be combined heat and power (CHP) units, where there is a direct need for heat and electricity/gas on site.

Some of the motivating factors that support the biogas industry include:

Higher electricity prices and the need for energy security due to imposed load shedding

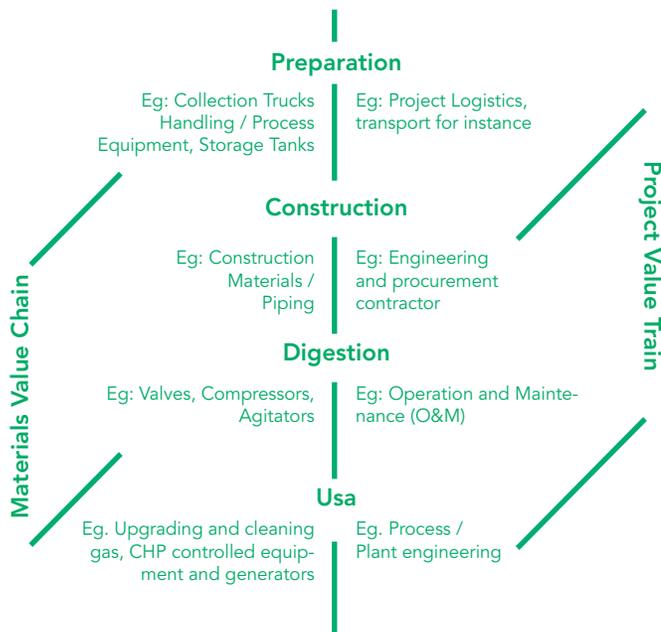
Higher waste disposal costs driven by NEM:WA, because disposing of animal carcasses is now a listed activity and would require a waste license, depending on waste thresholds. These wastes become hazardous and are classified as infectious animal wastes, which incur higher disposal costs at hazardous landfill sites such as Visserhoek in Cape Town

Limited landfill airspace at municipal level and increases in landfill disposal costs, encouraging the private sector to divert as much waste as possible away from municipal landfills.

Based on the amount of waste generated from animal husbandry and associated activities such as piggeries, poultry, beef feedlot and abattoirs, it is estimated that up to ~400MWe could be generated in the Western Cape (see Table 8), excluding MSW and sewage sludge. The average installation costs of electricity from biogas are estimated at between R15-30 million/MW (IDC, 2012), compared to, for example, R10 million/MW for solar PV and wind. Should all this capacity be built, it could translate into ~R12 billion invested by private companies in AD infrastructure in the Western Cape.

Figure 5 presents the value chain for the biogas industry, and potential spin-off enterprise development opportunities for the Western Cape. Discussions with biogas project developers – including Bio2watt and Anaergia, which are both currently commissioning plants – reveal that 70% of the total project costs is spent locally through contractors such as engineering and procurement contractors (EPC), consultants etc). This indicates the potential benefits that a thriving biogas industry would bring to the Western Cape economy.

Figure 4: Biogas value chain



5 – Investment incentives

There are a number of investment incentive programmes open to greentech manufacturing and service companies planning to set up in Cape Town and the Western Cape. They include:

Atlantis GreenTech Special Economic Zone (SEZ)

GreenCape is the project management office tasked with the preparation of an application for designation of the greentech Manufacturing Special Economic Zone (SEZ) in Atlantis, Cape Town (dti, 2015). As part of the national SEZ programme, the Atlantis SEZ will provide incentives for investments into greentech manufacturing (dti, 2015), which includes the manufacturing of energy efficiency, renewable energy and related technologies. These regulations are yet to be ratified by the dti. Some of the proposed incentives include a 15% company tax and building allowance.

Department of Trade & Industry (DTI) Incentives

The Department of Trade and Industry (dti) also offers a wide range of incentives across industries and sectors for businesses located anywhere in South Africa. Please refer to www.investmentincentives.co.za for more information on incentives that apply to your business.

6– Overview of GreenCape’s activities in this sector

GreenCape’s Waste Programme focuses on waste as a resource and on supporting the development of a thriving, legally compliant and labour absorptive secondary materials industry in the Western Cape that exemplifies and contributes to a resource efficient and low carbon economy.

Currently the majority of waste in the Western Cape still ends up in landfills, apart from recycling of packaging and post-consumer products – paper, cardboard, glass, cans, plastics – and composting of garden waste. Over time, the ambition is to move towards closed loop recycling, unlocking the high value opportunities that exist within manufacturing, industry and agriculture, and transitioning from a waste economy to a materials management economy.

A key focus of the Waste Programme is to support municipalities in their planning and investment decision-making by assisting them to critically assess the environmental and financial performance of alternative waste treatment options. To this end, GreenCape is developing an integrated waste management decision support tool. The aim is to move towards integrated waste management, streamlined processes and a systems-based approach – ultimately enabling investment in alternative waste treatment technologies.

Legislation has been identified as a significant stumbling block hampering the growth of the waste economy, and GreenCape is developing a tool that guides project developers through the relevant policy and legislation framework for different waste treatment technologies.

With these objectives in mind, GreenCape currently undertakes the following programmes:



6.1. Waste Sector Desk

The role of the Waste Sector Desk is to assist companies and potential investors in the waste sector to overcome challenges that prevent them from remaining financially viable, legally compliant, resource-efficient and environmentally responsible. The desk also acts as a facilitator for those interested in investment and further development of the sector. To this end, all companies/investors in the waste sector are encouraged to engage with the Waste Sector Desk for advice and support.

Furthermore, the Waste Sector Desk keeps track of the waste industry through investment mapping and market intelligence activities. In addition, the desk also hosts a range of events to disseminate information and promote discussion around particular challenges facing the sector to help identify interventions that can address these challenges.

For more information about the events that the desk hosted and co-hosted during the 2014-2015 financial year, see Appendix (Section 8.1).

The Waste Sector Manager is [Quinton Williams](mailto:Quinton@green-cape-co.za) (Quinton@green-cape-co.za)



6.2. The Western Cape Industrial Symbiosis Programme (WISP)

The Waste Programme's other key focus is to support private sector investment in building value chains that enable economic value to be derived from commercial, industrial and agricultural waste. This includes opportunities in small-scale biogas and construction and demolition waste.

Industrial symbiosis is a resource efficiency approach where one company's unused or residual resources are used by another, for mutual business benefit, leading to a more resource efficient and lower carbon economy. The Western Cape Industrial Symbiosis Programme (WISP) is a free facilitation service that networks companies wishing to trade their under-utilised resources, including materials, energy, assets, logistics and expertise.

Since its inception in 2013, WISP has developed a database of diverse businesses and resources and already enabled significant cost savings to its members and created new business opportunities and jobs. WISP has provided a range of environmental and economic benefits, as summarised in Table 10.

The programme is delivered with the support of International Synergies Limited (ISL), which pioneered the approach taken by the UK National Industrial Symbiosis Programme. WISP has also contributed towards identifying innovative waste management practices by creating new pathways for waste resources as well as creating the foundation for a National Industrial Symbiosis Programme (NISP) in South Africa. Catalysed by a British High Commission Prosperity Fund project managed by GreenCape, there are now similar programmes running in Gauteng and Kwa-Zulu Natal funded and delivered by local stakeholders in these provinces.



WISP has identified a number of key business opportunities, including:

- Large amounts of wood, plastics, food/agricultural waste and fabric (textiles and carpeting) are currently under-used; they go to landfill but could be readily diverted if there was available recycling capacity
- Technology development opportunities for materials that cannot be recycled locally, including polystyrene, and polyvinyl chloride (PVC) label backing, box strapping.

Table 9: Benefits WISP achieved from August 2013 to February 2015

Waste diversion	284 tonnes
Membership network	>150 companies
Additional revenue	R3.4 million
Cost savings	R3.21 million
Private investment	R100 000
Fossil GHG savings	2 579 tonnes of CO₂e
Direct job creation	10 permanent; 11 temporary

For more information about WISP, see <http://green-cape.co.za/wisp/> or contact Sarah O'Carroll, WISP Programme Manager (Sarah@green-cape.co.za).

6.3. Waste Economy Project

The Waste Economy Project has the following focus areas:

Map and demystify policy and regulatory landscape, consolidating information on the powers/functions of the three levels of government, as well as other key stakeholders.

This is being achieved by delivering a legal register of applicable waste-related legislation and regulations on a web-based platform to guide the public and private sectors. GreenCape collated the information into a spreadsheet, which was reviewed by the legal firm, ENS. The collated information formed the basis of the web-based platform, which is being developed in a partnership between the German co-operation agency GIZ; the DEA climate change team, as part of its mitigation framework; the South African Local Government Association (SALGA); and GreenCape. A service provider, Aurecon, was appointed in December 2014. The live platform is due for delivery in the first quarter of 2015.

To verify and demonstrate the value of the policy and regulation information collated as well as to make the experience of navigating this legislative space accessible to other potential project developers, GreenCape has compiled a report that documents the process followed by Drakenstein Municipality to develop its WtE project and secure approvals from Drakenstein Council, the Minister of Energy (presiding over the Department of Energy), as well as the National Treasury and Provincial Treasury.

More information on GreenCape's waste policy and regulatory activities can be obtained from waste@green-cape.co.za

Develop and demonstrate decision support tools to enable integrated municipal waste management through the adoption of a systems-based approach that will evaluate the environmental and financial feasibility of alternative waste management treatment options.

GreenCape has developed a first-draft integrated waste management model to help municipalities evaluate the environmental and financial performance of alternative waste treatment options.

The environmental performance is evaluated through a customised version of the Danish lifecycle-based tool EaseTech, while the financial evaluation is done through an MS Excel model developed in-house. These tools will assist municipalities to critically assess the different waste management options available and feed into the development of the next generation of IWMPs. In turn, this will inform the next level of planning – the Integrated Development Plans (IDP) – and ultimately lead to unlocking a streamlined process for developing a systems-based approach to the transformation municipal waste management.

Stellenbosch Municipality is the first case study municipality used to customise the tool and financial model for the South African context. The information generated will inform Stellenbosch's third generation IWMP while providing a foundation for the Section 78 (3) process the municipality will be undertaking.

More information about this project component can be obtained from waste@green-cape.co.za

Identify key supporting actions to enable the development of value chains for the use of secondary materials from commercial and industrial wastes.

Based on literature review and meetings with industry, two key focus areas have been identified: C&DW, as well as dry recyclables. The priority for 2015 will be demonstrable change in job creation and benefits associated with diverting these waste streams from landfill. The demonstrable change (i.e. waste diversion, investment in infrastructure, if required, and uptake of secondary materials) will be achieved by focusing on particular geographical areas. The demolition sector, smaller construction companies, rubble crushers and other recyclers are currently being sought as part of a stakeholder mapping process.

To be entered onto the database, please contact waste@green-cape.co.za

Note that GreenCape is also undertaking similar industry development activities associated with organic waste as part of its bioenergy project. This involves considering alternatives to WtE to extract maximum value from organic waste as an alternative or before energy recovery.

7– References

- ArcelorMittal. (2014). Annual report 2013. Available: <http://corporate.arcelormittal.com/~media/Files/A/ArcelorMittal/investors/annual-reports/2013/annual-report-2013.pdf>. Last accessed 10 January 2015.
- BMI Research (2013). Recycle assessment report: prepared for the Recycling Action Group (RAG).
- Brennan, J., Ding, G. Wonschik, R. and Vessalas, K. 2014. A closed-loop system of construction and demolition waste recycling. The 31st International Symposium on Automation and Robotics in Construction and Mining (ISARC 2014).
- Council for Scientific and Industrial Research (CSIR, 2014). Economic value of South Africa's waste (preliminary). A waste research, development and innovation (RDI) roadmap for South Africa. 1 (1), 11-12.
- Department of Environmental Affairs (DEA, 2012), National waste information baseline report.
- Department of Environmental Affairs and Development Planning (DEA&DP, 2012). Western Cape integrated waste management plan (IWMP).
- DEA&DP (2013). State of environment outlook report for the Western Cape Province: land chapter. Gillian Maree and Seshni Govender; Royal HaskoningDHV. Reference number: E02.CPT.00330.
- Department of Economic Development and Tourism (2014) green economic investment mapping audit: waste sector, Cape Town.
- Department of Trade and Industry (2014). Baseline study to inform the industrial policy development to grow the recycling industry in South Africa: South African sector analysis.
- Department of Science and Technology (2012). South African Waste Sector – 2012. An analysis of the formal private and public waste sector in South Africa. A national waste RDI roadmap for South Africa: Phase 1 status quo assessment. Department of Science and Technology: Pretoria.
- PlasticsSA annual report (2013). PlasticsSA annual report. South Africa
- Forestry South Africa (SA). (2014). Sector innovation fund to boost R&D in the forest sector. Available: <http://www.forestry.co.za/sector-innovation-fund-to-boost-R-and-D-in-the-forest-sector/>. Last accessed 11 January 2015.
- Goosen, Raoul (2012). Funding for biogas. Proceedings of the BiogasSA workshop, Johannesburg, South Africa. Available from: <http://www.slideshare.net/Afrisun/biogas-in-south-africa-ipc-finance-for-biogas>.
- Hanekom, E. (2014). NEM:WA amendments, impacts and consequences for the waste management industry. Proceedings of the GreenCape waste economy workshop, Cape Town, South Africa. Available from: <http://green-cape.co.za/what-we-do/sector-development/waste>.
- Infrastructure News. (2013). SA Vinyls Association highlights use of PVC in energy efficient buildings. Available: <http://www.neilstoolbox.com/bibliography-creator/reference-website.htm#>. Last accessed 05 February 2015.
- Macozoma, D.S., 2002. Construction site waste management and minimisation, CIB Publication, February 2002.
- Maguire, B. (2012) quoted in Botes (2012) Scrap metal recycling in South Africa, online at <http://urbanearth.co.za/articles/scrap-metal-recycling-south-africa>, accessed on 9 March 2015.
- Mulders, L., 2003. High quality recycling of construction and demolition waste in the Netherlands.
- Nampak, 2014 – ref to add (G was going to in her ref list)
- National Treasury (2011), Local government budget and expenditure review, chapter 11: waste management, page 186.
- Paper Recycling Association South Africa (PRASA). (2012), South African paper recycling statistics. Available: http://www.prasa.co.za/sites/default/files/PRASA_Recycling%20Statistics_2011.pdf. Last

accessed 25 February 2015.

Paper Recycling Association South Africa (PRASA), (2014), South African paper recycling statistics. Available: http://www.prasa.co.za/sites/default/files/LB410%202013%20PRASA%20statistics_1pager_Final.pdf. Last accessed 25 February 2015.

Packaging Council of South Africa (PACSA). (2011). PACSA annual report 2011. Available: <http://www.pacsa.org.za/images/docs/phoca/Reports/Annual%20report.pdf> Last accessed 17 December 2014.

PETCO. (2014). Review of the activities of PETCO 2013. Available: https://www.petcodb.co.za/ag3nt/media/media_items/2014//1409822215.pdf Last accessed 10 December 2014.

Pricewaterhouse Coopers (PwC). (2014). SA construction industry (2nd Edition). Highlighting trends in the South African construction industry. Available: http://www.pwc.co.za/en_ZA/za/assets/pdf/sa-construction-2014-v1.2.pdf. Last accessed 15 February 2015.

8– Appendix

8.1. Workshops and seminars 2014-2015

○ **Extended producer responsibility in South Africa – Where to from here?**

Date: July 2014
Location: Stellenbosch Graduate School of Business, Bellville (Cape Town)

A seminar hosted by the Waste Minimisation and Recycling Interest Group (WMRIG), in partnership with GreenCape, and facilitated by Sheryl Ozinsky, community activist and champion in establishing PETCO and Polyco.

The following speakers discussed extended producer responsibility in their industry sectors – the status quo and future regarding EPR:

Anben Pillay, Director: Waste Policy and Information Management, DEA, gave an insight into EPR in South Africa with the guidance of national legislation; followed by Charles Muller, Chairperson of PACSA; Susanne Kircher, Chairperson of SAEWA; Hermann Erdmann, CEO of REDISA; John Westermeyer, Marketing Manager Philips Lighting Africa; and Tom McLaughlin, Good Business Journey Project Manager – Woolworths Foods.

For speaker presentations please see:
<http://www.iwmsa.co.za/site-content/waste-minimisation-ig.html>.

For more information, please contact Kirsten Barnes (kirsten@green-cape.co.za)

○ **Construction and demolition waste workshop Held in partnership with DEA&DP and Vernon Collis and Associates Consulting Engineers and Architects.**

Date: October 2014
Location: Hotel Verde, Cape Town

C&DW is recognised as one of the main consumers of the increasingly limited landfill airspace in South Africa. With this in mind, the provincial DEA&DP, in collaboration with GreenCape, held a workshop on C&DW. Key strategic stakeholders from industry bodies, developers, suppliers, demolition companies, government, waste service providers, academia, as well as generators within the construction sector contributed insights from their sectors at the workshop.

There was spirited discussion and strategising on opportunities to grow our economy and create jobs by re-categorising C&DW as a valuable resource, as well as the barriers to closing the loop on construction and demolition wastes.

For more information, on this workshop and C&DW please contact Kirsten Barnes, kirsten@green-cape.co.za, and see the presentations at <http://www.green-cape.co.za/news/construction-and-demolition-waste-workshop-feedback/>.

Further workshops are planned in the first six months of 2015 in George and Saldanha to be led by the DEA&DP.

○ **Green economy workshop at WasteCon 2014**

Date: October 2014
Location: The Lord Charles Hotel, Somerset West

The workshop was held to consider the concept of a circular economy as a waste (resource) industry, and consider the role our industry will need to play in the transition towards our circular economy.

Alex Lemille, managing director of Wizeimpact, a South African-based consultancy aiming at changing linear wealth-focused businesses into circular value-centred ventures, spoke on the circular economy, why we need to look at ways to customise it for South Africa, and the main drivers behind it.

Linda Godfrey, principal scientist in the Pollution and Waste Group at the CSIR, presented on the development of waste policy in South Africa to enable the country's waste industry to flourish in support of a secondary materials economy.

Sarah O'Carroll of WISP spoke on transforming end-of-life materials into precious resources, using industrial symbiosis as a valuable instrument in enabling a circular economy.

Herman Huisman, senior advisor, international co-operation, RWS, agency of the Dutch Ministry of Infrastructure and the Environment, and Gracia Munganga, GreenCape's waste theme leader, also provided expert comment on questions from the attendees.

8.2. List of WtE licence applications in the Western Cape

Below is a list of WtE projects that have either been granted a waste license or have applied for one:

Projects with approved waste licences

- Anaerobic digester (AD) generation of electricity: piggery, Klipheuwel
- AD generation of electricity: fruit waste farm, Grabouw
- AD generation of electricity: bovine manure, farm, Darling
- AD generation of electricity: bovine manure, farm, Bonnievale
- Waste management licence (WML) application for a basic assessment (BA) for proposed construction of animal manure storage facility, Graafwater, Voorpaardeberg
- Tyre pyrolysis plant, Atlantis
Cape dairy biogas plant on portion 3 of farm number 589 (Morgenster), Malmesbury
- Proposed biogas development in Saldanha, phase 1.

Projects waiting for approval of waste licences

- Biomass fuel combustion: poultry litter, farm, Romance
- Biomass fuel combustion: poultry litter, farm, Doornekraal;
- Biomass fuel combustion: poultry litter, farm Blomvlei
- Bio-digestion facility: organic waste, Athlone Industria.

8.3. Overview of environmental impact assessment of WtE projects

Environmental impact assessments (EIA) are one of the cornerstones of responsible stewardship of our planet and its increasingly limited resources.

Before you undertake a WtE project, it is essential to first work out what the impacts will be; whether you should go ahead at all, or undertake the activity somewhere else, or in another way; and how to mitigate, remedy or compensate for the impacts that will occur.

The new EIA regulations that came into effect on 8 December 2014 make provision for a time-bound permitting process and aim to align several previously independent authorisation processes under the One Environmental Management System.

It should be noted that the One Environmental Management System is time-bound to a maximum of 247 days for a basic assessment and 350 days for a scoping and environmental impact report. This means that there should be a strong focus on planning your WtE project before initiating the authorisation process because a lapsed deadline could mean you need to start the process again.

Project planning should entail undertaking feasibility assessments (including assessing project alternatives); identifying opportunities and avoiding impacts; and knowing and engaging with your stakeholders.

The following process is recommended:

1. Undertake planning and feasibility assessments

- Find a site (and alternatives)
- Negotiate feedstock a
- Determine potential energy buyers
- Source funding and investors

2. Engage authorities on required authorisation

- Include discussion with Eskom and/or municipality

3. Identify stakeholders

4. Undertake environmental authorisation

The DEA recommends the following process should be undertaken in terms of the One Environmental Management System:

Basic Assessment

Basic assessment (NEMA)		Waste management licence (NEM:WA)	Air emissions licence (NEM:AQA)	Water use license (NWA)
1. Submit application		Follows NEMA process	Follows NEMA process	1. Submit notice of intent (10 days)
2. Undertake basic assessment report (BAR)				2. Authority (DWS) site inspection and obtain permission to proceed (30 days)
3. 30 days for public comment – incorporate comments in BAR				3. Compile and submit water use licence (100 days_
Non-substantive BAR	Substantive BAR			4.DWS recommendations (110 days)
4. Submit BAR (90 days from undertaking the BAR to submission)	4. Notify need of additional 50 days required.			5. DWS meeting (20 days)
5. Authority reviews BAR (107 days)	5. 30 days for public comment. Incorporate comments in BAR (20 days)			
	6. Authority reviews BAR (107 days)			
Decision		Decision	Decision (60 days)	Decision

Scoping and assessment

Scoping and EIR		Waste management licence (NEM:WA)	Air emissions licence (NEM:AQA)	Water use licence (NWA)
1. Submit application		Follows NEMA process	Follows NEMA process	1. Submit notice of intent (10 days)
2. Undertake Scoping Report (40 Days)				2. Authority (DWS) site inspection and obtain permission to proceed (30 days)
3. 30 days for public comment – incorporate comments in scoping report				3. Compile and submit water use licence (100 days_
4. Submit Scoping Report (43 days)				4.DWS recommendations (110 days)
5. Authority accept, reject or refuse				
Non-substantive EIR	Substantive EIR			
6. Develop EIR (106 days)	6. Notify need of additional 50 days required.			5. DWS meeting (20 days)
7. Submit EIR	7. 30 days for public comment. Incorporate comments in BAR (20 days)			
8. Authority reviews EIR (107 days)	8. Submit EIR			
	6. Authority reviews EIR (107 days)			
Decision	Decision	Decision	Decision (60 days)	Decision

8.4. Methodology

8.4.1. Value of recyclables in the Western Cape

Table 10: Maximum recycling rates achievable in the next five years.

	Current recycling rates, CSIR data	Recoverable/ recycling portion of waste (Myers and Pieterse, 2014)	Max recycling rates (%)	Period	2019 recycling rates
Paper	54	75	65	2050	0.62
Plastic	18	40	36	2050	0.21
Glass	40	86.3	0.82848	2050	0.46

Where, Recoverable portion of waste: literature values obtained from cited in Myers and Pieterse (2014).

Maximum recycling rates were estimated as follows:

Paper: ~90% of the maximum the European Union aims to achieve (i.e. 70%)

Plastic: 90% of the recyclable waste

Glass: 90% of the 80% EU is aiming to collect overall.

Example of 2019 recycling rate (where 2014 has been used as the baseline year):

2019 Paper recycling rate = $\frac{(2019-2014) \times \text{Max recycling rate} + 2014 \times \text{Current recycling rate}}{2019-2014}$

$\frac{(2019-2014) \times (0.75 \times 0.65) + 2014 \times 0.54}{2019-2014} = 0.617 = (0.617 \times 100) = 62\%$

The value of the dry recyclables being disposed of (mainly paper, glass and plastics) presented in **Section 2**, was calculated as presented in Table 12.

2019 additional income = $(2019 \text{ recycling rate} - 2014 \text{ recycling rate}) \times \text{current tonnage} \times \text{commodity price (R/t)}$
 $= (61.5 - 57) \times 1,734,411.00 \times 744 = \text{R}58,068,080$

Myers and Pieterse (2015). Possibilities for a resource-efficient and low-emissions waste management future in South African cities. BSc Chemical Engineering Thesis, University of Cape Town (UCT).

Table 11: Value of waste quantities being disposed of, based on market value.

Waste streams	Western Cape Numbers (tpa)	Total SA numbers (tpa)	Multiplication factor (WC/SA)	% currently recycled (industry figures from PRASA, Plastic SA and TGRC)		
Paper	769 275.76	1 734 411.00	0.44	57.00%		
Plastics	805 335.56	1 308 637.00	0.61	18.00%		
Glass	318 528.24	959 816.00	0.33	32.00%		
Current jobs in SA (direct & indirect)	Current Jobs in the Western Cape (direct and indirect)	% re-cycled in 5 years (2019)	2019 jobs No. if 5% additional diversion is achieved	New jobs	Current commodities prices ®	2019 additional income generated (if 5% additional diversion achieved in 5 years)
45 000	19959.172	61.50%	21534.90	1575.724178	R 744.00	R 58,068,080.28
31 350	19292.80	20.50%	21972.35	2679.555325	R 3,210.00	R 105,018,119.25
11 700	3882.81	45.56%	5527.61	1644.800258	R 490.00	R 63,753,111.64

These figures were re-adjusted using a fudge factor assuming the Western Cape contributes a maximum of 20% to the total South African economy (see Table 5).

Table 13: Numbers obtained by forcing a 20% maximum fraction of waste generated in the Western Cape relative to South Africa

Fudge factor	New multiplication factor			
0.450920488	0.2	9000	9710.526316	R 26,184,087.12
0.324991735	0.2	6270	7140.833333	R 34,130,020.75
0.602656763	0.2	2340	3331.25	R 38,421,243.91
		17610	20182.60965	R 98,735,351.78

8.4.2. Biogas potential in the Western Cape

Table 14:
Overview of organic waste quantities in the Western Cape (with references).

Source/type of waste	Quantities (ML/ Mton/annum)	MWth	MWe	References
Abattoir waste waters	200	0.11-0.66	0.03-0.22	Department of Agriculture, Forestry & Fisheries, A profile of South African beef market value chain, 2011
Broiler abattoirs	8 360	2.39-11.7	0.79-3.85	Department of Agriculture, Forestry & Fisheries, A profile of South African broiler market value chain, 2012
Pork production	8 170	1.72-3.51	0.57-1.16	Department of Agriculture, Forestry & Fisheries, A profile of South African pork market value chain, 2012
Dairy production	6 460	2.37-11.49	0.78-3.79	Department of Agriculture, Forestry & Fisheries, A profile of South African dairy market value chain, 2012
Beef feedlot	2 970	74.38	24.54	Department of Agriculture, Forestry & Fisheries, A profile of South African beef market value chain, 2011
Piggeries	6 340	317.55	104.79	Department of Agriculture, Forestry & Fisheries, A profile of South African pork market value chain, 2011
Poultry	41 100	785.82	259.98	Department of Agriculture, Forestry & Fisheries, A profile of South African pork market value chain, 2011
Wastewater/sewage	198 000	542	217	Water Research Commission (2009), Energy from wastewater – a feasibility study

Table 15: Example of calculation of the energy potential from a waste stream.

Beef production			
Number of cattle slaughtered in SA	3 200 000		
% in the Western Cape	5%		
Cattle slaughtered in WC	160 000	Cows	
Water usage in red meat abattoirs			
Water use per head	1 250 litres/head	litres/head	Gauteng Department of Agriculture & Rural Development, Guide-line for the management of abattoirs and other wastes of animal origin, 2009
Typical COD range for red meat abattoirs	2 380	mg/L	Gauteng Department of Agriculture & Rural Development, Guide-line for the management of abattoirs and other wastes of animal origin, 2009
	15 000	mg/L	
Methane yield	0.18	m ³ /kg COD	WRC (2009)
Amount of water disposed	2.00E+08	litres	
Total COD	4.76E+05	kg COD	
	3.00E+06	kg COD	
Amount of methane	8.57E+04	m ³ biogas	
	5.40E+05	m ³ biogas	
LHV methane	35	MJ/m ³	
	46	MJ/kg	
Estimated energy	3.00E+06	MJ	
	1.89E+07	MJ	
Power output	0.11	MW _{th}	
	0.03	MW _e	
	0.66	MW _{th}	
	0.22	MW _e	