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MAT19ZA05: Market Study for the Circular Economy of South Africa



Final Desk and Field Study Report

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List of acronyms

APTT	Anti-pollution Task Team
BW	Bid Windows
CCTC	Cape Town Clothing and Textile Cluster
CE	Circular Economy
CoCT	City of Cape Town
COD	Chemical Oxygen Demand
COP 17	17 th Conference of the Parties
CSIR	Council for Scientific and Industrial Research
CTC	KwaZulu-Natal Clothing and Textile Cluster
DAFF	Department of Agriculture, Forestry and Fisheries
DEA&DP	Western Cape Department of Environmental Affairs and Development Planning
DEFF	Department of Environment, Forestry and Fisheries
DHSWS	Department of Human Settlements, Water and Sanitation
DiBiCoo	Digital Global Biogas Cooperation
DMRE	Department Mineral Resources and Energy
DSI	Department of Science and Innovation
DST	Department of Science and Technology
DWS	Department of Water and Sanitation
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Greenhouse gases
GISP	Gauteng Industrial Symbiosis Programme
GW	Gigawatt
IFC	International Finance Corporation
IndWMP	Industry Waste Management Plan
IPP	Independent Power Producers
IPPO	Independent Power Producers Office
IRP	Integrated Resource Plan
KISP	KwaZulu-Natal Industrial Symbiosis Programme
KW	Kilowatt
MIR	Market Intelligence Report
MLD	Millions of litres per day
MSW	Municipal Solid Waste
Mt	Megatons
MW	Megawatt
NBI	National Business Initiative
NERSA	National Energy Regulator
NWA	National Water Act
ORASA	Organic Recycling Association of South Africa
PET	Polyethylene Terephthalate

PPA	Power Purchase Agreement
PPP	Public-private partnership
Solar PV	Solar photovoltaic
RE	Renewable Energy
REIPPP	Renewable Energy Independent Power Producers Procurement
RSA	Republic of South Africa
SABIA	Southern Africa Biogas Industry Association
SANS	South African National Standard
SEZ	Special Economic Zone
SMME	Small, medium and micro enterprise
SSEG	Small Scale Embedded Generation
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Diversification
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
WCM	World Class Manufacturing
WEF	World Economic Forum
WISP	Western Cape Industrial Symbiosis Programme
WRRF	Water resource recovery facility
WTO	World Trade Organisation
WWTP	Wastewater treatment plant
ZAR	South African Rand

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1. State of the South Africa Circular Economy Space

The Republic of South Africa (RSA) has a highly developed and diversified economy. The country's economy is characterised by a wide range of industries producing goods for both local and export markets. Out of the total products traded, there are 80 products which account for 75% of South Africa's export market which is significantly higher than nearly all countries in Africa¹. RSA is a major trading economy. During 2015, the country imported and exported a total of over US\$167 billion of goods. South Africa is the dominant destination for foreign direct investment (FDI) in sub-Saharan Africa: a testament to the underlying strength of its economy, businesses, institutions, and regulatory landscape. South Africa has attracted a total of US\$2.8 billion of FDI during 2016 and was ranked 74th within the World Bank Doing Business Report.

To obtain an understanding of the RSA Circular Economy (CE) journey, a review into the country's development history would provide such insight – focusing on sustainable development and the Green Economy. With RSA's democratic transition in the early 1990's came with it policies and plans that aimed to realign the governance of matters influencing the environment, the economy and society. To illustrate this new intent, new legislative acts focusing on resource management, conservation and preservation were promulgated (e.g. National Water Act (NWA) (1998) and the National Environmental Management Act (2008)). This was followed by signing international accords; such as inter alia, the United Nation's conventions to fight desertification (UNCCD), biodiversity loss (UNCBD), atmospheric pollution (Montreal Protocol), wetland destruction (Ramsar Convention) and climate change (UNFCCC).

Although the focus of sustainability has permeated the RSA economy, alignment and coordination only started in 2011. This was after RSA hosted the 17th Conference of the Parties (COP 17), in Durban. Post 2011, a number of green economy-focused policies, plans and strategies have been developed such as:

- **New Growth Path**
 - Targets the growth of a green economy, resulting in green jobs.
- **Integrated Resource Plan 2010- 2030**
 - Limits emissions from electricity generation to 275 megatons (mt) per year, expects renewable energy to make up 42%.
- **National Climate Change Response**
 - Endorses and quantifies South Africa's GHG's limits/commitments
- **National Strategy for Sustainable Development**
 - A large variety of indicators and goals spanning social, economic, environmental issues
- **National Development Plan**
 - This is a vision document for South Africa that sets a long term development trajectory for South Africa

Transitioning towards a CE is highly likely to be the next step in RSA's development phase, with the Department of Science and Technology (DST), now known as Department of Science and Innovation (DSI), highlighting CE in its Research, Development and Innovation policy and two of the ministries departments (Climate Change and Chemicals & Waste) mandated to investigate CE's opportunities and impacts.

¹ except for Morocco which is ranked first

1.1. South Africa's global competitiveness

The World Economic Forum (WEF) reported that RSA's competitiveness has regained momentum after the recent political landscape shift and has since climbed 7 places to 60th in WEF's 2019 Global Competitiveness Report. In addition, it was reported that the country is a regional financial hub (83.2, 19th), with well-developed equity, insurance and credit markets, all achieving a score of 100. South Africa has also developed one of the most advanced transport infrastructures in the region (58.7, 45th) and is among the top countries in Africa for market size (68.6, 35th). Beyond these established strengths, health conditions—though starting from a low base (118th)—are better, adding 3.3 years to the average healthy life expectancy since the last assessment.

Institutional quality has also improved (+3.3 points, 55th), but unevenly. Some aspects of this category have achieved remarkable progress, including restored balance of powers across different state entities (+7.7 points, 16th), enhanced administrative efficiency of the public sector (+6.3, 39th) and corporate governance (+3.3, 26th). By contrast, other aspects continue to perform poorly: security (42.7, 135th) remains one of the main restraints to South Africa's competitiveness, while transparency (43.0, 62nd) and government adaptability to change (39.6, 100th) are also below par. Furthermore, South Africa's competitiveness is being hampered by relatively low business dynamism (61.9, 60th), which is inhibited by insolvency regulation and administrative burdens to initiate a business, and a persistently insufficient labour market flexibility (52.1, 111th). For instance, flexibility of wage determination is limited (41.1, 134th) and hiring foreign labour is difficult (40.6, 123rd). South Africa's sensitivity to exports of mineral resources is likely to adversely affect the country's economic outlook and will make unemployment reduction efforts (projected above 27%) challenging.

1.2. Circular Economy in South Africa Overview

Circular economy is one of the many concepts featured in the sustainable development field, but often misunderstood in RSA and elsewhere. The DST's Circular Economy Needs Assessment illustrated that, in RSA alone, there are at least 30 concepts that are used interchangeably with the term CE. This could be one of the reasons for possible misinterpretations.

The CE within RSA is still a nascent research area and is not yet embedded in the South African economy. The CE approach within RSA can reasonably be interpreted as a subset of the green economy because of the resource efficiency applications and mechanisms which are overarching principles of the green economy. These CE mechanisms are typically evident within the waste sector. Businesses are moving waste up the hierarchy by focusing on increasing recycling, increased waste prevention, a greater focus on waste reuse; setting zero waste to landfill targets; and energy recovery. Such business interventions may qualify for support offered by industry associations in the form of; loans, incentives and voluntary agreements² and by government in the form of enabling legislation and strategy.

RSA's economy does not operate in isolation – it is intricately linked to global markets and their dynamics. The beneficial outcomes of CE in practice has influenced the international drive towards adapt CE approaches within economies, particularly in regions and countries with a strong influence and a competitive advantage on global material and financial flows, such as the European Union (EU) and China. This may, however, bring both economic opportunities whilst posing risks for RSA's economy.

² Currently each substrate (paper, glass, plastic etc.) has an industry association supporting the sector

1.3. Potential sectors for circular economy adoption in South Africa

Traditionally, RSA follows international trends and the adoption of circular economy principles appears to be no different thus far. The CE is a systematic approach that is seen in practice across some of the industries operating within RSA. The DST's research into the CE and its uptake within RSA industries point to the plastics manufacturing, food value chain sectors, with more CE influence featuring in the construction, logistics and fashion industries. The latter industries are often interpreted as "low hanging fruit" value chains for CE adoption. However, other industries may hold even greater potential in the event of a CE business model adaptation. If RSA is to truly reap the socio-economic benefits of a CE transition, the metabolism of the country's economic sectors (i.e. material, energy and financial flows) in relation to local and global market dynamics and shifts towards a CE needs to be analysed.

There have been limited research efforts and subsequent insights into understanding how RSA might benefit from a transition to a circular economy. Much of the CE research conducted thus far has been in the realm of recycling and does not include other aspects of the CE concept such as design, re-use, repair, remanufacturing etc.

1.4. Opportunities in the circular economy for South Africa

The Kingdom of the Netherlands has demonstrated the importance of policy as an enabler for the CE and highlights the contributions of a CE to the future import-export capacity earnings of a country. Although, the structure of the RSA economy and context is vastly different to that from The Netherlands, The Netherlands are viewed as market leaders and influencers, specifically in the EU as well as globally. The Netherlands have displayed an increasing trend towards CE and resource efficiency which is of strategic importance as the country has (and will continue to) put increased pressure on global supply chains, including RSA exports. It would be important for RSA policy makers to be attentive to changing EU regulations, and if necessary, to develop policies that incentivise South African businesses to adopt CE principles.

During the transition towards a CE, both private and public sector will require CE-specialist knowledge and insights, in terms of the regulatory and policy landscape that supports CE in RSA, the mechanisms, tools and technologies to guide a CE model application, and the financial viability of adopting and applying CE principles within industry value chains.

GreenCape's Market Intelligence Reports³ (MIRs) for 2019 reported on a number of opportunities currently available in the green economy alongside their barriers within the renewable energy (utilities and energy services), waste, water and agriculture sectors. The green economy opportunities highlighted within the GreenCape MIRs provide useful insights on the potential for industries to shift from a linear economy model to a CE model within RSA by identifying the following insights and short, medium and long opportunities:

- The lack of a policy and regulatory framework to make the CE standard practice within RSA is a limiting factor for the adoption of CE practises. There is an opportunity for RSA's private and public sectors to learn from The Netherlands on how to drive and implement an enabling environment with appropriate legislation.
- There is a definite opportunity to tackle the issue of the 90% landfill disposal rate through legislation. This can be overcome by introducing policies and plans that would effectively encourage the private sector to not only divert their waste from landfill, but also develop innovative and profitable, remodelled uses for under-utilised products. Although, the

³ <https://www.greencape.co.za/market-intelligence/>

development of, and gazetted legislation for diversion of selected waste streams (liquids, abattoir waste, organics) has already been promulgated, assistance is still required for meeting the legislative requirements and compliance standards to drive the uptake of viable waste value-add business cases.

- In order for legislation to be effective and drive innovation, it needs to be accompanied by financial incentives and proven business cases and financing models. An opportunity exists for the private sector within The Netherlands to share knowledge, skills and services with followed up support to the RSA private sector which could influence and support the growth and development of new and nascent markets within South Africa.
- Skills development and transfer is critical for the adoption of a CE model in RSA. The lack of technical skills for CE and awareness surrounding the topic is exacerbated by an industry stigma linked to the use of secondary products further limiting uptake.
- Funding programmes like the industrial symbiosis programmes in the Western Cape, Gauteng and Kwa-Zulu Natal (WISP, GISP and KISP) to offer free facilitation and support services to businesses. This can demonstrate the value of CE principle-based programmes by encouraging reduced consumption of virgin, non-renewable materials, water and energy within businesses assisted. These programmes often highlight where opportunities lie for small, medium and micro enterprises (SMMEs).

1.5. Sectors most suited for circular economy adoption within South Africa

GreenCape gathers information and generates insights in a number of sectors through multiple stakeholder engagements with both private and public sectors. The information and insights gained indicates that the sectors that hold the highest potential for CE adoption are as follows:

- Organic waste management (collecting, sorting & treating)
- Wastewater management (sewage sludge and organic effluents from agro-processing like food, beverage and abattoirs)
- Biogas
- Liquid biofuels
- Plastic waste (collecting, sorting and recycling)
- Sustainable packaging (paper and plastics)
- Renewable energy (solar/wind, off-grid, small-scale to large-scale)

These sectors will be unpacked further in terms of how the sector is defined in RSA; current and potential market sizes of products and services; potential leads; and recent developments encouraging market growth. Two additional opportunity sectors (Construction and Demolition and Textiles) are included in Annexure A with a full SWOT analysis for all sectors highlighted provided in Annexure B.

2. Market analysis: Organic waste management

2.1. Background

Resource recovery from urban organics is growing in focus in South Africa. The national Department of Environ, Forestry and Fisheries is driving the implementation of 20 initiatives to fast track waste diversion through a multi-stakeholder initiative called Operation Phakisa. There are three initiatives that focus specifically on organic waste:

1. Zero sewage sludge to land and landfill by 2023
2. Zero meat production waste to landfill by 2023
3. 50% Household organic separation at source by 2023

However, the current business case for organic waste value add is reliant on a gate fee as opposed to the sale of end products (compost, digestate, electricity, heat).

Despite the national focus on organics, the most viable business case currently is in the province of the Western Cape, and will grow stronger in the next decade. The key driver is the high cost of landfilling in the Western Cape, especially Cape Town, which continues to increase well above inflation. This has resulted in a number of not just traditional (composting, vermiculture, and biogas) organics waste solutions establishing operation in predominately Cape Town, but also innovative solutions that compete with world leaders.

Currently, the majority of the focus has been on the low hanging fruits of large commercial and industrial organics; where quality, quantity and low contamination levels ensures a strong business case. Further to this, private sector waste is the responsibility of the generator, and as such, access to this stream is relatively easy.

However, gaining access and extracting value from household / MSW Organics and small commercial organics is still quite difficult, as these streams are low in quality and quantity, and are collected by the municipality. As such access to MSW cannot be guaranteed due to short procurement periods.

Furthermore, as of 01 June 2019, the Carbon Tax Act was ratified to ensure sustainable economic growth and to meet a number of carbon emission reduction targets, most notably South Africa's obligation to the Paris Agreement. This act makes provisions for sale of carbon credits as one of the mechanisms that have been available through the Carbon Tax Act. This should strengthen the business case for certain waste solutions, including organic waste. The Act provides offset allowances for heavy GHG emitters. Heavy emitters are provided an opportunity to reduce their carbon tax liability by purchasing carbon credits from approved carbon credit projects rather than paying the carbon tax.

Future business cases for organic waste solutions in the Western Cape will be predominantly driven by the provincial landfill ban of organics. The Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) have implemented an organic waste strategy. The strategy requires all Western Cape based municipalities to divert 50% of organics from landfill by 2022, and 100% by 2027. This would also involve Western Cape municipalities implementing stronger separation at source of household organics as well.

2.2. Market summary

Table 1: Organic waste management market summary

Scale	Commercial and Industrial
Current market size / installed capacity	<p>NATIONAL:</p> <p>Generation: South Africa generates approximately 30m tonnes of organic waste a year⁴. This excludes MSW organics which is estimated at around 3.3m tonnes⁵. Unfortunately, the confidence of these numbers is quite low due to poor reporting. The finalised State of Waste Report should provide clarity, and is expected to be released in the next few months.</p> <p>WESTERN CAPE:</p> <p>Generation: 3.5 million tonnes of organic waste in 2015. If projected to 2019, this includes ~533,750 tonnes of MSW organics, and ~326,940 tonnes of Commercial and industrial organics. The City of Cape Town makes up ~70%: ~375,720 tonnes of MSW organics, and ~237,740 tonnes of commercial and industrial organics.</p> <p>Processing: Three facilities process >10 t/day of mixed organics: Okran38, Agriprotein, and Athlone integrated waste management facility (not operational). Together these facilities can handle ~204 765 tonnes per year or 91% of the total process capacity. The remaining 9% processing capacity is handled by the ~fourteen organic waste solutions that process < 10t/day. The overall processing capacity is expected to increase to ~300,000 tonnes per year by 2027 (this excludes the proposed City of Cape Town mechanical biological treatment facility of which no details have been made public yet).</p>
Legislative framework applicable	<p>The following legislation and considerations may be applicable to the development and implementation of an organic waste value add projects:</p> <p>General Legislation:</p> <ul style="list-style-type: none"> ▪ The National Environmental Management Act (107 of 1998) ▪ National Environmental Management Waste Act (Act 59 of 2008) ▪ National Environmental Management Air Quality Act (Act 39 of 2004) ▪ Municipal waste management by-laws <p>Organic Specific:</p> <ul style="list-style-type: none"> ▪ Western Cape Organic Waste Landfill Restriction (Ban) (50% by 2022; 100% by 2027) – Increase demand for projects / solutions for organic waste landfill diversion ▪ National Carbon Tax Act (Act 15 of 2019) – Additional revenue stream ▪ National Norms and Standards for the disposal of waste to Landfill (R. 636 of 23 August 2013) – As of August 2019, all liquids are banned from landfill. ▪ National Norms and Standards for the Sorting, Shredding, Grinding, Crushing, Screening, or Bailing of General Waste (GN1093 of 2017) - Reduces the onerous licensing requirements for certain waste processing activities with a footprint of more than 1000m². ▪ Draft National Norms and Standards for Organic Waste Composting (GN 1135 of 2019) – Reduces the onerous licensing requirements for composting facilities. ▪ Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act: Regulations Relating to Fertilizers (GN972 of 2017) – Regulates the registration of fertilizers, including composts, for sale.
Development in the sector	<ul style="list-style-type: none"> ▪ Organic Recycling Association of South Africa (ORASA) – Focused on market development and growth of organic waste recyclers

⁴ Draft State of Waste Report: <http://sawic.environment.gov.za/documents/9066.pdf>

⁵ 2016 projections from National 2011 waste baseline

	<ul style="list-style-type: none"> Development of a Food Loss and Waste Voluntary Agreement for Brand owners to reduce food loss / waste by 50% by 2030. Launch is early 2020. The Green Building Council of South Africa launched “net zero certification” for operating buildings. This certification covers net zero carbon, water and waste. Red tape reduction for organic waste solutions (e.g. norms and standards for composting to replace onerous licensing and environmental impact assessment requirements).
Opportunities within the sector	<ul style="list-style-type: none"> Solutions to high organic liquids / high moisture content Western Cape organic waste landfill ban (50% by 2022 and 100% by 2027) strengthen business case for organic solutions Few industrial / large scale (>10 tonnes a day) organic waste solutions across the country. De-packaging / de-contamination tech to reduce contamination / increase quality of both MSW and commercial and industrial organic feedstock. Tech to reduce contamination / increase quality of MSW organic feedstocks Value add technology to process MBT processed MSW organics that may potentially be heavily contaminated. Further value-add to the CoCT's dry digestate from its three Biosolid beneficiation facilities.

2.3. Potential leads

Description
Private Sector
AgriProtein [Click]: Agriprotein is a global leader in waste-to-protein. The company uses black soldier fly larvae to process organic waste into: MagMeal (complete high-protein alternative to fishmeal for the animal feed industry; MagOil (insect oil additive to animal feed); and MagSoil (nutrient rich soil conditioner). Research has shown the farming process produces less greenhouse gasses than conventional composting operations of the same processing capacity. The Cape Town flagship / research facility has the capacity to process 200 tonnes a day. AgriProtein has partnered with the engineering group Christof Industries to develop a 300 tonne a day blueprint. The goal is to establish 25 facilities a year, 200 facilities around the world by 2027.
Reliance / Okran 38 [Click] Reliance compost is South Africa's largest composter of garden greens. It has various municipal contracts for garden greens. It recently launched its non-greens, urban organics composting subsidiary, Okran 38. The Okran 38 facility is the only large (>10 tonnes a day) scale composting facility in the Western Cape that is licensed to process a wide spectrum of pre- and post-consumer organics. Reliance / Okran38 also has a waste license to develop biogas and indoor composting facilities. The Okran38 facility has the capacity to process 500 tonnes of organics per day. Currently the facility is looking to secure feedstocks before establishing biogas and indoor composting. This should be achieved in the medium to long term with the organic waste ban in 2027. They will no doubt be interested in engaging about technologies to pre-process / de-packaging organics, treatment of organics, and further value add to processed organics.
GCX Africa [Click] GCX Africa is one of South Africa's leading organic waste project developers /consultancies. They have been involved in some of the largest organic waste diversion solutions in the Western Cape. They are likely to continue to lead the organic waste industry with various large future and innovative projects that focus on specifically organic waste, mixed MSW and private waste with an organic component. They will no doubt be interested in engaging value add solutions.
Averda [Click] Averda is one of South Africa's / Western Cape's largest waste management and handling companies. In 2015, Averda acquired the already large waste company, WasteMan. They are contracted as one of the City of Cape Town's household waste collectors. They are also one of the contracted companies to collect dry recyclables as part of the City of Cape Town's two bin kerb side collection programme. They have various material recovery facilities and landfills across the country. With the organic waste ban in 2027, they are investigating organic solutions for clients.
Interwaste [Click] Interwaste is one of South Africa's / Western Cape's largest waste management and handling companies. Their focus is specially on commercial and industrial waste streams. They have invested in a number of large infrastructure projects, most notably landfills and Refuse Derived Fuel (RDF) plants. In 2019 the company was acquired by the French-based Séché Environment. With the organic waste ban in 2027, they are investigating organic solutions for clients. It is expected that the

acquisition will unlock a cash injection that will include organic waste value add. They will no doubt be interested in engaging about technologies to pre-process / de-packaging organics, treatment of organics.

Wasteplan [\[Click\]](#)

Wasteplan is one of South Africa's / Western Cape's largest waste management and handling companies. The focus of Wasteplan is specifically on dry recyclables. However, there are medium term intentions to expand service offerings into organic waste solutions. They are contracted as one of the City of Cape Town's dry recyclables collectors as part of the City of Cape Town's two bin kerb side collection programme.

WasteMart [\[Click\]](#)

Wastemart is one of the Western Cape's largest waste management handlers. They are contracted as one of the City of Cape Town's household waste collectors. They are also one of the contracted companies to collect dry recyclables as part of the City of Cape Town's two bin kerb side collection programme. They were one of the investors and feedstock suppliers for the 600 tonne a day dirty MRF and biogas facility. This facility is currently not operational, but it is expected to be operational in 2020.

Public Sector

City of Cape Town: Solid Waste

City of Cape Town is the largest municipality in the Western Cape. According to the City of Cape Town's medium term budget, the Solid Waste Department has secured funding for the development of one small material recovery facility (MRF) and two large dirty MRF's to complement the existing 50-100 tonne a day Kraaifontein clean MRF and a two bin kerbside collection campaign. Although much focus is on extracting dry recyclables, phase two of the future Athlone dirty MRF includes the expansion of the MRF to a large scale mechanical biological treatment facility to process mixed municipal / household waste. Due to the organic waste landfill ban in 2027, there are expectations that the City of Cape Town may expand collections to include organic waste in the medium to long term. Further details have not been made public.

City of Cape Town: Water and Sanitation

City of Cape Town is the largest municipality in the Western. According to the City of Cape Town's medium term budget, the Water and Sanitation Department has secured funding for the development of three centralised Biosolid Beneficiation Facilities (BBF). These three facilities will concentrate the City of Cape Town's total waste water treatment work (WWTW) sludges for biogas extraction. The combined heat and power solutions will provide supplementary electricity to the WWTW, whilst the heat will be used to dry the biogas digestate. Dried digestate will be made available to private sector. Further details are not public at present.

Drakenstein Local Municipality: Solid Waste

Drakenstein is one of the larger municipalities in the Western Cape. It will be establishing dry recyclable extraction through the development of a drop-offs and MRFs. The municipality intends on establishing a biogas facility in the medium to long term. It is likely that this biogas operation will include household organics due to the 2027 organic waste landfill ban.

Stellenbosch Local Municipality: Solid Waste

As of early 2019, Stellenbosch municipality has run out of landfill airspace. Although the intention is to expand the existing landfill to add capacity, concerted effort has been made towards specifically organic waste diversion. According to the medium term budget, Stellenbosch municipality will be establishing an organic waste aggregation and pre-processing facility. The processed organics will then be made available for the private sector to add value. The municipality has also implemented an organic waste collection service for restaurants and the hospitality industry. This service is cheaper than conventional general collection.

3. Market analysis: Wastewater management

3.1. Background

In light of the water and energy supply-demand gap widening and the associated utility costs, traditional wastewater treatment plants (WWTPs) are increasingly regarded as water resource recovery facilities (WRRFs) worldwide. Advanced treatment technologies are developing rapidly internationally, and are readily available at competitive rates that strengthen the business case. RSA remains one of the top contributors to biochemical, physical and physico-chemical process technologies that promote the reuse of water and recovery of value-add products (Naidoo, 2019). Resource recovery from wastewater using advanced treatment technologies is becoming increasingly understood and adopted in SA, especially by water-intensive industrial businesses that produce organic effluents such as the agro-processing sector (food, beverage and abattoirs). The most common value-adds from organic effluents are biogas that is mostly used onsite, composting material, and a few organic products such as whey and starch. Although, the recovery of classic targets such as phosphorus (struvite), nitrogen and hydrogen from wastewater have been proven feasible at local WWTPs, it is not yet implemented and a number of other value-adds (emerging pollutants like pharmacs, enzymes, hormones and bioplastics) are primarily at research stage (Sikosana et al, 2016).

Conversely, the application of treatment technologies for the recovery of resources such as sulphur and metals from industrial inorganic effluents particularly from mineral beneficiation is limited by ineffectiveness, costs and generation of hazardous sludge. Currently, WWTPs at mines recover process water for reuse and the search for cheaper, effective and efficient metals and sulphur recovery techniques from mining effluents is ongoing.

Main Barriers

One of the prominent barriers in resource recovery at industrial scale is limited effluent availability while the availability of higher effluent volumes (6 500 MLD) at publicly owned municipal WWTPs nationwide presents a better business case. However, the lack of capital investment, ageing infrastructure, technical capacity and political support at RSA municipalities and impediments to public private partnerships (PPPs) have led to the poor adoption rate of resource recovery initiatives at municipal WWTPs (NBI, 2019). There is a lack of scientifically defensible assessment of available technology readiness and hence, scepticism in adopting new technologies by municipal WWTPs. Furthermore, legal frameworks governing the use and disposal of wastewater in RSA, particularly mining effluents, is onerous.

Main drivers

The main driver is the legal requirement and corporate social responsibility to treat effluents to compliance standards for disposal. The eutrophication of RSA water resources is one of the major threats and the Department of Water and Sanitation⁶ (DWS) is in the process of establishing an Anti-pollution Task Team (APTT) which will deal with escalating incidents of pollution across the country. There are punitive measures such as fines for non-compliance by industrial businesses while DWS is mandated to take all the necessary steps before taking any legal action against noncompliant municipalities. The recent ban on the landfilling of liquid and 100% biodegradable waste in 2027 (50% to be realised in 2022) has unlocked the potential for biogas and resource recovery projects at WWTPs. The national quest for water security has further unlocked the potential for investment in advanced wastewater treatment and/or water reclamation at different municipalities. Such

⁶ Now renamed the Department of Human Settlements, Water and Sanitation (DHSWS)

technologies will also likely pave way for resource recovery. Conversely, RSA remains one of the top importers of fertilisers and natural gas globally.

3.2. Market summary

The food and beverage sector (mainly fruit and vegetable, dairy, animal slaughtering, wine, malting and brewing) plays an important role in RSA's economy, contributing $\pm 4.3\%$ of the country's gross domestic product (GDP) and $\pm 11\%$ of the total exports (DAFF 2017). The sector is earmarked for national growth and development in various policies and mandates. It is dominated by large companies that reportedly contributed 74% of the total fixed investments in 2015 and is mainly located in the water scarce metropolitans (eThekweni, Cape Town, Port Elizabeth & Johannesburg). However, the sector's growth is threatened by water and energy security, and levels of waste and wastewater management. Depending on the facility, between 70-95% of the feed water ends up as organic laden wastewater which attracts disposal costs, fines and possibly corporate brand damage if not meeting the discharge standards. It is thus, highly susceptible to financial and operational losses, cut-backs, retrenchments and closures. Accordingly, wastewater and organic waste (including sewage sludge) treatment and resource recovery is becoming increasingly adopted across RSA. The treated wastewater can either be reused onsite for non-potable purposes, or further treated (e.g. using reverse osmosis) for potable purposes and any resultant biogas produced can be used for electricity generation to offset costs.

Table 2: Organic wastewater and sewage sludge management market summary

Scale	Food and beverage
Current market size / installed capacity	<p>Total market size = 43 800 kW of which 36.3 % (15 886 kW) is commercial and industrial application. Renewable Energy Independent Power Producers Procurement (REIPPP) program has awarded 34 MW to biogas projects and the United Nations Industrial Development Organization (UNIDO) is currently supporting 3-6 MW of projects</p> <p>± 1600 (secondary) and ± 900 (primary) tonnes (dry mass)/month of sewage sludge is used for composting material and landfilling, respectively in the City of Cape Town</p> <p>The value-add recovery market and energy recovery from sewage sludge is currently limited country wide</p>
Legislative framework applicable	<p>The following legislation and considerations may be applicable to the development and implementation of sewage sludge and organic wastewater management:</p> <ul style="list-style-type: none"> ▪ National Environmental Management: Waste Act (107 of 1998) and Air Quality Act (39 of 2004) which are relevant to environmental authorisations ▪ National Water Act (36 of 1998) - relevant to the use of water (licenses and authorisations) ▪ Agricultural Consents & Regulations (Subdivision of Agricultural Land Act, Conservation of Agricultural Resources Act, Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act) ▪ Water Services Act (108 of 1997) relevant to the regulation of water and sanitation services ▪ South African National Standard for Drinking Water (SANS 241: 2015) ▪ Preferential Procurement Framework Act (5 of 2000) makes provision to designate certain areas for local production and content. Electricity Regulation Act, No 4 of 2006 ▪ National Heritage Resources Act ▪ Biodiversity consents (National Forest Act, NEM: Biodiversity Act, NEM: Protected Areas Act, Outeniqua Sensitive Coastal Areas, Integrated Coastal Management Act)
Development in the sector	<ul style="list-style-type: none"> ▪ Southern African Biogas Industry Association (SABIA) project – Market development and growth ▪ UNIDO waste-to-energy project – Component 4.1 of this project focused on identifying the success conditions for bankable biogas projects within RSA ▪ IFC project - Stakeholder Mapping and Needs Assessment in the Agri-Processing Sector in RSA ▪ National 100% landfill ban of organic waste by 2027 with 50% realisable by 2022 ▪ City of Cape Town implementing biogas, phosphate (struvite) and ammonia (nitrogen) recovery projects from sewage sludge in the short term ▪ Winetech reports that effluent treatment and reuse is a key focus area for the majority of RSA cellars

Opportunities within the sector	<ul style="list-style-type: none"> Improved monitoring and metering systems Wastewater reuse schemes with/without energy (biogas) recovery Biogas projects for onsite use (heating and/or electricity generation) Recovery of phosphate (struvite), ammonia/nitrogen and compost/fertiliser material Digestate value add technology/processes, water and energy efficient equipment Improving feedstock quality – source separation, removal of contaminants such as packaging
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3.3. Potential leads

The following effluent generators and technology providers may invest, partner and/or engage a third player to invest in resource recovery (water, nutrients, biogas, metals or sulphate) business.

Generally, most of the activities for resource recovery may be covered under general authorisation given that they are conducted at licenced WWTPs (RSA, 2013). However, in special cases there may be a need to apply for a water user licence.

Description
Organic effluent generators
Municipal WWTPs: These municipalities own and operate large WWTPs that are a source of waste water. However, this opportunity is available in most municipalities with large WWTPs, preferably >0.5MLD. Although there is better business case at metropolitans; Tshwane, City of Cape Town, eThekweni, Ekurhuleni, City of Johannesburg, Buffalo City, Nelson Mandela and Mangaung.
Illovo Sugar Africa [Click] The group is Africa's biggest sugar producer and has extensive agricultural and manufacturing operations in KwaZulu-Natal. The group produces raw, refined sugar and various grades of alcohol for local, regional African, and overseas market from sugar cane supplied by its own agricultural operations and independent out growers. The company produces large volumes of effluents and organic solid waste that may be used to produce biogas, compost/fertiliser and/or recover nutrients.
Langeberg and Ashton [Click] Langeberg and Ashton Foods is a division of Tiger Consumer Brands and is RSA's largest fruit canning facility. Due to their involvement with fruit processing, they have effluents that have very high COD levels and are at times have to pay fines to the local municipality.
Fair Cape Dairies [Click] Fair Cape Dairies is a major producer of dairy products in the Western Cape and throughout South Africa. They consume approximately 0.25MLD and their effluent has a COD concentration above the regulatory standards. Similar dairies country wide such as Clover, Parmalat, Lausanne, Honeydew, Darling and etc. present an opportunity for resource recovery.
Rhodes Food Group [Click] Rhodes Food Group produce fresh, frozen and long-life convenience meal solutions for customers and consumers throughout South Africa. They produce effluent that has COD concentrations above the regulatory standards.
Robertson Winery [Click] Robertson Winery is a wine processing company located in the town of Robertson in the Western Cape. They are the biggest water consumers and effluent producers in the town. Similarly, this opportunity is available at other wineries as well.
Inorganic effluent generators
Anglo American [Click] Anglo American is one of the largest producers of platinum and a major producer of nickel, diamonds, metallurgical and thermal coal, copper, and iron ore. The mining company has a high level of integrity and corporate social responsibility and thus thrives to implement processes that support a sustainable future. Its mining operations consume and produce large amounts of inorganic effluent laden with recoverable metals.
Palabora [Click] Is the only RSA producer of refined copper and other useful by-product metals and minerals such as zirconium chemicals, magnetite and nickel sulphate as well as small quantities of gold, silver and platinum. phosphates, vermiculite, phlogopite, magnetite, nickel, gold, silver, platinum and palladium also occur. The mining operations consume and produce large volumes of waste and wastewater, respectively.

Exxaro resources [\[Click\]](#)

The company produces coal and owns numerous other mining operations in SA that produce titanium ore, titanium oxide, iron ore, and zinc. The produced effluents from mineral beneficiation contain recoverable metals and contaminants that are detrimental to the environment if not removed.

Solution / technology providers

Proxa Water [\[Click\]](#)

Proxa is a specialised water solution provider of sustainable water services within the municipal, industrial and commercial sectors. Their industrial unit focuses on advanced wastewater treatment and resource recovery in the food and beverage, petrochemical, oil and gas, mining, and energy generation sectors.

Veolia Water Technologies South Africa [\[Click\]](#)

Veolia Water Technologies provide customised water and wastewater treatment solutions for municipalities and industries including phosphate recovery. They implement water solution across different industrial sectors some of which include the food and beverage, mining, oil and gas sectors.

Memcon [\[Click\]](#)

Provide wastewater treatment solutions for industrial companies and design and manufacture specialised membrane filters. They implement solutions for different industrial sectors and have worked with companies e.g. Parmalat in implementing a water treatment and value add solutions.

Grundfos [\[Click\]](#)

Grundfos offers a broad range of equipment designed specifically for water and wastewater handling and treatment for various industries. Grundfos has a proven phosphate recovery technology that is in operation in Denmark. The company also provides a wide range of components for a complete mechanical, biological, and chemical wastewater treatment plant.

WEC Projects [\[Click\]](#)

WEC Projects provide solutions for biogas to energy from wastewater projects. The company targets food processing, breweries and industries which produce a high soluble COD waste stream. WEC Projects designed, built and operates the Northern Wastewater Treatment Works Biogas project under the ownership of Johannesburg Water.

Aquest Colson (a South African subsidiary of Colson BV) [\[Click\]](#)

Colson offers water and wastewater treatment technologies together with nutrient recovery and waste to energy solutions for industrial and municipal markets. The company recently developed a technology nitrogen recovery from poultry waste water.

3.4. References

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4. Market analysis: Biogas

4.1. Background

The South African biogas industry is considered to be in a nascent or infant state, as there is a low rate of uptake and general inexperience in designing, constructing and operating of biogas facilities. The drivers that support and assist the South African biogas industry in maturing include economic, environmental, social and legislative factors. The need for the management of organic waste, along with increasing costs of disposal and the recognition of the potential for on-site energy use, are some of the key drivers for the uptake of biogas technology (GreenCape, 2017).

GreenCape's market intelligence gained through stakeholder engagements showed that there is a large potential and opportunity for biogas project implementation. Much of the research to date to understand the viability of biogas in South Africa has been focused on the technical models used to develop biogas projects. However, due to the failure of a number of biogas projects that have been implemented, site owner and investors' confidence for biogas projects are considered to be low.

Recent focus and research being completed by the United Nations Industrial Development Organisation's (UNIDO) waste-to-energy project team, GreenCape and the Southern African Biogas Industry Association (SABIA) has been more on developing and understanding the conditions for bankable business cases and enabling markets for biogas projects. Overall, it can be shown that in the South African context, bankable biogas projects are highly site specific and only strong under certain conditions. These conditions include situations where large volumes of feedstock of good quality are available, waste management costs are high, and there are high energy requirements (electric or heat) on-site or in a close and viable proximity. Due to the relatively low energy costs in South Africa, increasing waste management costs may well be a stronger driver for biogas project bankability in the South African context (GreenCape, 2017).

4.2. Market summary

Table 3: Biogas market summary

Scale	Commercial and Industrial
Current market size / installed capacity	Total market size = 43 800 kW of which 36.3 % (15 886 kW) is commercial and industrial application. Renewable Energy Independent Power Producers Procurement (REIPPP) program has awarded 34 MW to biogas projects and UNIDO is currently supporting projects with an equivalent size of 3-6 MW.
Legislative framework applicable	<p>The following legislation and considerations may be applicable to the development and implementation of a biogas project:</p> <ul style="list-style-type: none"> ▪ National Environmental Management (NEM) Act - GN 983, 984 and 985 ▪ National Environmental Management: Waste Act - GN921 ▪ National Environmental Management: Air Quality Act - GN248 ▪ Biodiversity consents (National Forest Act, NEM: Biodiversity Act, NEM: Protected Areas Act, Outeniqua Sensitive Coastal Areas, Integrated Coastal Management Act) ▪ National Water Act - Water Use License ▪ National Heritage Resources Act ▪ Agricultural Consents & Regulations (Subdivision of Agricultural Land Act, Conservation of Agricultural Resources Act, Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act) ▪ Land Use Planning – Rezoning or subdivision ▪ Civil Aviation Authority – Height of facility and location within the vicinity of an airfield, airport or aerodrome

	<ul style="list-style-type: none"> Electricity Regulation Act, No 4 of 2006
Development in the sector	<ul style="list-style-type: none"> Southern African Biogas Industry Association (SABIA) – Focused on market development and growth UNIDO waste-to-energy project – Component 4.1 of this project focused on identifying the success conditions for bankable biogas projects within RSA Abattoir waste landfill restrictions Organic ban to landfill by 2027 within the Western Cape Digital Global Biogas Cooperation (DiBiCoo) – A project funded through the European Commission's Horizon 2020 Research and Innovation programme which focuses preparing and developing biogas markets in Latin America, Africa and south east Asia for established technologies and services that may be available in Europe.
Opportunities within the sector	<ul style="list-style-type: none"> Sites that hold the highest potential for biogas projects include abattoirs, feedlots, chicken farms, malls, piggeries, food processing, fruit and vegetable processing as they fit an ideal mini circular economy site model (feedstock generated on a site with high energy, water, soil quality requirement) Digestate value add technology and processes Improving feedstock quality – source separation, removal of contaminants such as packaging

4.3. Potential leads

Description
Project developers
Green Create [Click]: Green Create provides biological waste-to-value systems for application in industrial processes. They primarily work with anaerobic biological technology and specialise in poultry wastewaters.
Bio2Watt [Click] Waste to-energy company, responsible for developing, building, owning and operating industrial scale commercially-driven projects. Developed the Bronkhorstspuit biogas plant which is recognised as the first commercially operational biogas project in RSA.
GCX Africa [Click] GCX Africa is one of South Africa's leading organic waste project developers /consultancies. They have been involved in some of the largest organic waste diversion solutions in the Western Cape. They are likely to continue to lead the organic waste industry with various large future and innovative projects that focus on specifically organic waste and mixed MSW and private waste with an organic component. They will no doubt be interested in engaging value add solutions.
Agreenco [Click] Agreenco is a South African based company that offers new generation mine rehabilitation and environmental improvement services to mines. They have expanded their portfolio and do have experience in biogas projects with the potential for alternative fuel usage to current fossil fuels.
Botala Energy Solutions [Click] Botala Energy Solutions is one of the engineering companies in South Africa providing turnkey biogas plants of all sizes. With services ranging from initial feasibility studies, financing applications - through engineering and construction till final operation and after sales servicing of the plants and equipment.
Global Energy [Click] Global Energy is a South African based company that innovative renewable energy and waste disposal solutions with a specific focus on integrated biogas, biomass and solar PV applications. They have recently designed, constructed and commissioned a pilot biogas plant on a vegetable farm in Cape Town and have indicated that they have a few projects in mind that fit with the Energy Catalyst programme.
Technology suppliers
Cape Advanced Engineering (CAE) [Click] Involved in the development, design, construction and management of biogas projects in Southern Africa. A key project is the Uilenkraal biogas plant located on a private dairy farm near Darling in the Western Cape

Anaergia [\[Click\]](#)

Anaergia is the world leader in solving waste problems by recovering energy, water, and fertilizer from virtually any waste stream. While Anaergia was built on the foundations of highly capable and experienced acquisitions, focused investments on innovation and execution capabilities allow us to deliver facilities that divert waste, reduce life cycle costs, create new revenue streams, and maximize renewable energy output.

Logical Waste [\[Click\]](#)

Logical Waste is a technology supplier that also provides support and assist with process and plant design when required. The technology they supply includes a combination of their own designed and fabricated equipment and international equipment.

SustainPower [\[Click\]](#)

An African manufacturer of containerised solutions for sustainable power generation from biogas, landfill gas, natural gas and other sustainable and alternative energy sources such as solar and wind.

Fountain Green Energy (FGE) [\[Click\]](#)

FGE, a division of Fountain Civil Engineering (Pty) Ltd, has established itself as a leading landfill gas contractor in Southern Africa, specialising in anaerobic digestion, biogas to electricity and biogas upgrading for the production of biomethane and carbon dioxide.

4.4. References

GreenCape, 2017. "The business case for biogas from solid waste in the Western Cape". GreenCape, Cape Town. 2017

5. Market analysis: Liquid biofuels

5.1. Background

The strategy for the growth and development of the liquid biofuels economy within South Africa (RSA) has predominately been the production of liquid biofuels from energy crops. This has resulted in marginal growth of a very small liquid biofuels sector in RSA over time.

The majority of the active liquid biofuels market in the South African economy consists of biodiesel, manufactured from the transesterification of cooking oil, and their contribution to the fuels market is so small it's insignificant.

There has been a total of eight liquid biofuel projects that have applied for licensing to produce biofuel within the agricultural sector. However, there has not been any major investment in the growing of energy crops for biofuels production even though the draft strategy for biofuels was released in 2007. Twelve years later there is sentiment that the biofuels strategy will never be finalised, as the focus of the liquid biofuels off-take market has shifted from the usage of biofuels to battery powered transport mediums. Added to that the uncertainty around support mechanisms and legislation as well as the drive to move away from carbon based fuels which is increasingly becoming stronger has made investors sceptical about investing in that sector.

5.2. Market summary

Table 4: Biofuels market summary

Scale	Agricultural sector
Current market size / installed capacity	Current Total market size is 446 000 kL for the two plants that have been issued with licenses Potential market size 400,000,000L/a, and can be grown to 900,000,000L/a based on 2014 figures
Legislative framework applicable (and how they impact on the opportunities)	<p>The following legislation and considerations may be applicable to the development and implementation of a biofuels project:</p> <ul style="list-style-type: none"> ▪ National Environmental Management (NEM) Act - GN 983, 984 and 985 ▪ National Environmental Management: Waste Act - GN921 ▪ National Environmental Management: Air Quality Act - GN248 ▪ Biodiversity consents (National Forest Act, NEM: Biodiversity Act, NEM: Protected Areas Act, Outeniqua Sensitive Coastal Areas, Integrated Coastal Management Act) ▪ National Water Act - Water Use License ▪ National Heritage Resources Act ▪ Agricultural Consents & Regulations (Subdivision of Agricultural Land Act, Conservation of Agricultural Resources Act, Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act) ▪ Land Use Planning – Rezoning or subdivision ▪ Civil Aviation Authority – Height of facility and location within the vicinity of an airfield, airport or aerodrome. ▪ Licencing by the Petroleum Products Controller ▪ The Petroleum Products Amendment Act, (Act No. 58 of 2003)
Development in the sector	<ul style="list-style-type: none"> ▪ The White Paper on Energy Policy, 1998, set the energy policy direction for the country. It acknowledged that benefits could be derived from the use of alternate transport fuels. ▪ The Johannesburg Plan of Implementation (JPoI, 2002) committed the country to develop renewable energy technologies, which included transportation related renewable energy sources, such as biofuels. ▪ The Petroleum Products Amendment Act, (Act No. 58 of 2003), the Minister of Minerals and Energy could mandate licensed wholesalers and licensed producers to supply petroleum products made from “vegetable matter”, and complying to certain specifications before they

	<p>supply petroleum products made from other raw materials to allow for the utilisation of the biofuels.</p> <ul style="list-style-type: none"> ▪ In September 2005 National Treasury approved a Renewable Energy Subsidy Scheme, which was to be implemented by the DME. ▪ In December 2005 Cabinet (Cabinet Memo 14 of 2005) approved the development of a national biofuels industrial draft strategy. ▪ 2005 Draft Biofuels Strategy ▪ 2007 Biofuels Strategy finalised ▪ Waste-to-wing project investigating the feasibility of using various feedstocks, incl. alien invasive biomass, as a means to produce a renewable aviation fuel.
Opportunities within the sector	<ul style="list-style-type: none"> ▪ 1.4% of national arable land mostly in the former homelands, ensuring the use of this underutilised land ▪ Biofuels industry can enhance rural development and economic activities for landowners in the identified areas. ▪ Job creation in the energy crops and biofuels value chain ▪ Animal Feed: Biofuels production could also contribute to food security by increasing the availability of by-products that can be used for animal feed, some of which are currently being imported ▪ Addressing concerns like reduction of sulphur levels and octane boosting in fuels

5.3. Potential leads

Largely interest has died down across all sectors. University of Cape Town has set up a centre that is looking into biofuels. The group is researching rehabilitation and remedial options of extracting minerals from old mine dumps. The intention is to grow energy crops on these stockpiles so that the minerals can be drawn up or absorbed by the crops. The crops will then be used for biofuels production and the minerals can be recovered from the residues through energy recovery (combustion) and leaching the minerals from the ashes. The challenge is around off take of the biofuels as the appetite for biofuels is waning. In countries where introduction of biofuels has been introduced, mandatory blending enforced by government regulations has led to the success of the industry. The business case for biofuels completely collapses without a viable market and the growth of the e-mobility sector is a big challenge.

Opportunities for offtake agreements with private and public bodies. Partnering with a private entity that has a large fleet of vehicles e.g. logistics companies, bus companies, mines which can offset some of their fossil fuels for heating operations etc., or with municipalities and government departments that also own a large fleets of vehicles e.g. City of Cape Town which operates MyCiti or Rea Vaya in Johannesburg.

6. Market analysis: Plastic waste

6.1. Background

Inadequate waste management, particularly focusing on plastic waste and the (negative) environmental impact thereof has been the subject of more public discourse both in South Africa as well as globally over the past few years. This has increased pressure across the value chain to find solutions to managing plastic waste in a proper manner, or use of alternative materials that have a lower environmental burden.

Recycling has existed in South Africa for many years, with the primary drivers for recycling being financial sustainability, means of maintaining a livelihood as well as need for (environmental) sustainability – the last particularly driven by larger corporates with a global footprint. That said, growing the recycling sector has been steady, but slow – with the bulk of municipalities still focusing on waste disposal, and as such, the waste in South Africa still ending up in landfill.

Increased media coverage and public awareness of the impact of poorly managed (plastic) waste has led to an increased drive towards minimising the impact of waste to the environment, with potential strategies ranging from bans of certain types of plastics – primarily focusing on plastic bags and more recently straws and other food related containers- to substitution with biodegradable alternatives, specifically paper and bamboo bioplastics.

In addition to improving the management of plastic (and other) waste, opportunities also exist in improving the robustness of the recycling value chain by implementing measures such as reducing energy emissions intensity/impact (e.g. switching to renewables) and reducing water footprint by incorporating better value chain management strategies.

Many of the solutions in plastics are central, aggregated solutions and focus on "easier", single material, non-contaminated plastics. Opportunities therefore lie in smaller disaggregated solutions, addressing "difficult" materials such as multi-layered plastics and thermoforms.

6.2. Market summary

Table 5: Plastic waste market summary

Scale	Commercial and Industrial
Current market size / installed capacity	<p>South Africa's plastic market is still dominated by virgin polymers with ~1.49 million tonnes consumed in 2017. In the same year, 313 781 tonnes of recyclate were manufactured with an additional 20 947 tonnes exported.</p> <p>South Africa had 212 registered recyclers processing ~422 601 tonnes of plastic into 313 781 tonnes of recyclate.</p>
Legislative framework applicable	<p>The following legislation and considerations may be applicable to the development and implementation of a Plastic project:</p> <ul style="list-style-type: none"> ▪ National Environmental Management (NEM) Act - GN 983, 984 and 985 <ul style="list-style-type: none"> — General impact assessment legislation ▪ National Environmental Management: Waste Act - GN921 <ul style="list-style-type: none"> — Specific waste impact assessment legislation ▪ National Environmental Management: Air Quality Act - GN248 <ul style="list-style-type: none"> — Related to the thermal treatment of waste ▪ National Water Act - Water Use License ▪ Electricity Regulation Act, No 4 of 2006

	<ul style="list-style-type: none"> – The generation of electricity from waste
Development in the sector	<ul style="list-style-type: none"> ▪ Industry waste management plans (industry developed – government endorsed) <ul style="list-style-type: none"> – Further growth in the sector will more than likely be driven through the implementation of the paper and packaging Industry Waste Management Plans (IndWMPs) The call for IndWMPs was called for by the national Department of Environmental Affairs (DEA) in 2018 and this will hopefully result in IndWMP in promulgation in the next 1-2 years. These initiatives will support education and awareness, increase collection (supply), increase the market (demand) for recycle, and will ensure better quality feed stocks and subsequently lower processing overheads. ▪ South Africa will soon be launching a Plastic Pact. This will aim to achieve the following targets by 2025: <ul style="list-style-type: none"> – 100% of plastic packaging to be reusable, packaging recyclable or compostable – 70% of plastic packaging effectively recycled or composted – 30% average recycled content across all plastic packaging
Opportunities within the sector	<ul style="list-style-type: none"> ▪ The compostable/alternative packaging market is growing. Largely looking at bio-based biodegradables. <ul style="list-style-type: none"> – Resin sales, product manufacturing – Technology to process bio-based biodegradables. ▪ Recycling technology and products that can use high amounts of recycle ▪ More efficient recycling / separation technologies ▪ Marine litter collection / clean-up tech ▪ ITCS in circular logistics ▪ Potential for local solutions in reducing the logistics costs due the large geographic footprint of generation

6.3. Potential leads

Extrupet and PET Recycling Company (PETCO)

- Industry organisation driving recycling of Polyethylene Terephthalate (PET), as well as major partner responsible for bottle recycling
- Thermoforms make up a large percentage of PET packaging (after bottles), and are highly visible;
- Potential business partners include supermarkets (e.g. Woolworths, Pick and Pay, Shoprite-Checkers, etc.) looking for sustainable packaging;

National Department of Environment, Forestry and Fisheries (DEFF)/ Western Cape Department Environmental Affairs and Development Planning (DEA&DP) and municipalities

- Education and awareness campaigns – participation rates in areas with source separation are still low in South Africa (20-30%);
- Municipalities are primarily responsible for infrastructure development with regards to waste management. Many municipalities still use landfills but are in the process of developing stream specific waste diversion plans;
- Potential business partners include waste management companies (recyclers).

6.4. References

Plastics SA, 2019, National Plastics Recycling Survey 2018. [Online] Available at: <https://www.plasticsinfo.co.za/wp-content/uploads/2019/08/Plastics-Recycling-in-SA-July-2018-Executive-Summary-final.pdf> [Accessed 15 September 2019].

7. Market analysis: Sustainable packaging

7.1. Background

With South Africa, sustainable packaging sector and focus extends the discourse beyond the impacts of plastics (pollution), and looks at a more circular approach for addressing both the impacts as well as the benefits of different packaging options.

7.2. Market summary

Table 6: Sustainable packaging market summary

Scale	Commercial and Industrial
Current market size / installed capacity	<p>The South African Plastic Market is ZAR 50 billion, 55% of this is packaging (ZAR 27.5 billion), across the value chain. This is approximately 770,000 tonnes of packaging. Currently, although bioplastic exist in South Africa (imported), there is no official estimated size of the biopolymer market in South Africa. Looking at a modest estimate of 1%, we can assume that bio polymers have a market share of at least ZAR 275 million (7,700 tonnes). This can be attributed to consumer demand and brand awareness to move away from plastic packaging.</p> <p>Based on the global market (worth ZAR 84 billion, 2017), there is an expectation that the market will more than double in the next 4 years (ZAR 208 billion). This is a compound annual growth rate of 16%. Using this growth (high) rate we can expect a SA market of ZAR 497 million by 2023.</p>
Legislative framework applicable (and how they impact on the opportunities)	<p>The following legislation and considerations may be applicable to the development and implementation of a Plastic project:</p> <ul style="list-style-type: none"> ▪ National Environmental Management (NEM) Act - GN 983, 984 and 985 <ul style="list-style-type: none"> — General impact assessment legislation ▪ National Environmental Management: Waste Act - GN921 <ul style="list-style-type: none"> — Specific waste impact assessment legislation ▪ National Environmental Management: Air Quality Act - GN248 <ul style="list-style-type: none"> — Related to the thermal treatment of waste ▪ National Water Act - Water Use License ▪ Electricity Regulation Act, No 4 of 2006 <ul style="list-style-type: none"> — The generation of electricity from waste
Development in the sector	<ul style="list-style-type: none"> ▪ Council for Scientific and Industrial Research (CSIR) is working towards developing bioplastics that will be completely biodegradable and/or recyclable. The team of researchers is hoping to create plastic bags and crates that can be easily and totally recycled, or disintegrate when left in the environment. ▪ A large Italian resin producer is investigating the market to sell resin. It is expected that the resin will not require current polymer producers to change their production technology. ▪ South African retailers have begun moving away from plastic packaging (straws, carrier bags). ▪ The government of Japan and the United Nations Industrial Development Organization (UNIDO) have signed a funding agreement (ZAR 25 million) in a bid to boost South Africa's bio-plastic industry.
Opportunities within the sector (these are more drivers than opportunity)	<ul style="list-style-type: none"> ▪ Drivers <ul style="list-style-type: none"> — Increasing use of bioplastics in the packaging end-use industry — Increased focus on bio-based content rather than biodegradability (just breaking down) ▪ Opportunity directions <ul style="list-style-type: none"> — Feedstock availability: Focus on the sugar production potential in KZN. Sugar production market is dipping due to illegal cheaper sugar imported to SA. The sugarcane market needs to diversify outputs with bio polymers. — Bamboo production as a feedstock security option.

7.3. Potential leads

PlasticsSA and Institute of packaging of South Africa (IPSA)

- Industry organisation responsible for plastics manufacturing in South Africa;
- Potential business partners include supermarkets (e.g. Woolworths, Pick and Pay, Shoprite-Checkers etc) looking for sustainable packaging;

National Department of Environment, Forestry and Fisheries (DEFF)/ Western Cape Department Environmental Affairs and Development Planning (DEA&DP) and municipalities

- Education and awareness campaigns
- Potential business partners include waste management companies (recyclers) as well as manufacturers of packaging

8. Market analysis: Renewable energy

8.1. Background

South Africa's RE market has grown exponentially over the last nine years after the inauguration of the Independent Power Producers Office (IPPO) in 2010 with the support of the Department Mineral Resources and Energy (DMRE). This has been managed through six bid windows (BW) in the large Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) bid windows, and through two bid rounds in the small REIPPPP. Currently, the IPPs are the only vehicle through which SA has access to cleaner utility scale (> 10 MW) power.

The IPPO's primary mandate is to guide and support the Independent Power Producers (IPPs), i.e. renewable energy private generators through the bidding and awarding process that is merited on lowest tariff price (70%) and economic development (30%). The preferred bidders based are then awarded a 20-year Power Purchase Agreement (PPA) with Eskom – a state-owned entity that is South Africa's primary electricity generator.

As it stands, the REIPPPP has resulted in the procurement 6 422MW of electricity from 112 projects, of which 3 976 MW has been connected to the national grid as of December 2019. As a result, South Africa has successfully generated 38 184 GWh of clean energy from these projects as of December 2019. Moreover, investments attracted are valued at ZAR 209.7 billion with 20% attributed to foreign investments. Although, the REIPPPP has shown great success especially with the tariff price falling from an average tariff price of ZAR 2.90 per kWh down to ZAR 0.62 per kWh, in bid window round 4, the market continues to face regulatory uncertainty and delays in the expedition of additional bid rounds.

The Integrated Resource Plan (IRP) that informs the energy mix ministerial determinations was gazetted in October 2019. The report outlines a plan to install 20.4 GW of Utility Scale RE (>10 MW) and 4 GW of Distributed Generation (1-10MW) by 2030. The IRP's mandate includes selecting the least cost energy source for the country; without neglecting the support currently required for the local industry to grow sustainably. Therefore, the industry has remained optimistic with future prospects especially in light of the Eskom's Reform plan to unbundle the state owned utility. The unbundling aims to redirect key operations to specific units in order to increase operational efficiency and also allow IPPs to competitively participate in provision of energy to South Africans and the Southern African market.

Apart, from the utility and sub-utility scale RE market, there's a market for less than 1 MW. This is the fastest growing market segment due to the limited regulatory barriers, particularly within the solar PV market in the form of small scale embedded generation (SSEG). This market is rapidly growing because the end users do not need a deviation letter from the regulator - NERSA - to generate (renewable) energy for own use. The end-users include the commercial, industrial and households that install solar panels to power small industry, homes, or offices. The success of the SSEG market can be attributed to the 23 municipalities within the Western Cape and 40 municipalities nationally within South Africa, which have fostered an environment that promotes the growth of the embedded generation.

Currently, the City of Cape Town (CoCT) is in court discussions with the DMRE for an application to buy power directly from IPPs. The CoCT, and other major metros co-own transmission distributions infrastructure with Eskom; that can support the wheeling of energy between IPPs, and municipalities. However, DMRE has delayed review of this application, and the reasons are unclear. Therefore, the CoCT cannot procure power from IPPs without the regulator's approval.

This is a prominent case that's indicative of unlocked opportunities within the sub-utility and small scale embedded generation capacity. Enabling regulatory framework is paramount to the growth and maturity of the renewable energy industry in South Africa.

8.2. Market summary

Table 7: Renewable energy market summary

Scale	Residential and Industrial (SSEG < 1 MW)	Mid-sized – Distribution market (1-10 MW)	Utility (> 10 MW)
Current market size / installed capacity	~700MWp installed	Undefined – This is newly defined market and the current size is still being assessed.	6.3 GW procured to date (3.9 GW connected to national grid) through Integrated Resource Plan (IRP)
Legislative framework applicable	<ul style="list-style-type: none"> Electricity Regulation Act, No 4 of 2006 establishes the national regulatory framework, and outlines the role of the national energy regulator (NERSA) Less than 1MW (no requirement for generation license) Wheeling framework – City of Cape Town court case with Department of Energy – appeal for municipality to procure power from IPPs Current interpretations of the Act require that any generation facility selling to a public entity requires a determination (permission) from the minister of energy¹ 		
Development in the sector	<ul style="list-style-type: none"> Driven by Feed in Tariffs in municipalities (allowed by 50 municipalities), at an average R0.60 per kWh 	<ul style="list-style-type: none"> 1 - 10MW, <u>waiting on generation license exemption</u> from NERSA – expected in next 12 months 1MW – 10MW now designated in IRP as Distributed Generation 	<ul style="list-style-type: none"> Gazetted IRP draft 2019 after 9 years' delays (Target – 20.4 GW by 2030) Eskom together with Public Enterprises office issued official Eskom Unbundling Roadmap Decommissioning schedule of 11 GW ~ drive uptake of RE, as a quicker energy source
Opportunities within the sector	<ul style="list-style-type: none"> Rooftop PV system bundling through bundling contract standardisation Secondary market for PV system components – panels, inverters² 	<ul style="list-style-type: none"> Industrial and agri-processing sites that have capacity / meet requirements for an installation. IRP made provisions for distributed generation – that will allow for power generation embedded within municipal distribution networks 	<ul style="list-style-type: none"> Local manufacturing of solar farm and wind farm components (inverters, solar panels, turbines, concrete towers), Atlantis SEZ tax incentives Bid window round 5 of the REIPPPP IRP 2019 made provision for 20.4 GW renewable energy available for procurement by 2030 Eskom battery storage battery 1.4 GWh per day flagship project Refinancing opportunities of early bid rounds (BW 1 and BW 2)
Potential market / buyers / clients	<ul style="list-style-type: none"> Potential clients include malls, industrial properties, pack houses with cooling requirements (daytime 	<ul style="list-style-type: none"> Municipalities – waiting on court case between NERSA and City of Cape Town (8 August) allowing public 	<ul style="list-style-type: none"> Eskom as an off-taker Excess of 10 MW, overseen by the Independent Power Procurement office –

	energy consumers with sufficient roof space)	entities to purchase from private generators <ul style="list-style-type: none"> Industrial and agri-processing – businesses with a large energy demand 	REIPPP programme, government guarantee
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8.3. Potential leads

Description
Private Sector
Enertrag SA ENERTRAG has a history in developing and operating high yield renewable energy projects. With an installed capacity of 760MW and over 500 employees, ENERTRAG is currently responsible for operating and managing 1000+ turbines around the world. A leading project developer, ENERTRAG have projects in Germany, United Kingdom, France, Poland, Bulgaria, Belarus, and now South Africa. Enertrag SA currently looking for business match making platform to develop its New Segments market focusing mainly on 1-10 MW hybrid, solar and wind market and opportunities within South Africa.
Levantine & Co Levantine & Co, is a financial services firm that offers personal and corporate finance advice to businesses looking to raise fiancé and investment opportunity. Looking to increase the presence in local renewable energy through raising capital. Have successfully raised capital for couple of solar PV projects, however, looking for business match making platform with a wider reach

8.4. References

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Annexure A: Other opportunity sectors

Market Analysis for Construction and Demolition Sector

Background

The focus for opportunities around construction and demolition sector within South Africa lies within builders' rubble. Builders' rubble is material comprising fired clay brick, concrete, and mortar, which is generated through both demolition activities and as wastage on construction sites. This material stream may be segregated and crushed at the point of generation. The recovered aggregate is a useful secondary construction material that can be used in road construction and various other civil applications.

Nationally, the potential market for the collection, processing and sale of recovered aggregate is presently 5.7 million tonnes/year⁷ (with an estimated G5 sub-base value of ZAR 422 million⁸). The Western Cape has 2.6 million tonnes of builders' rubble available, with only 30%-40% being currently processed and reused.

There are opportunities for both construction & demolition and rubble processing companies in the builders' rubble value chain.

The main drivers of this market are lower logistics and cheaper material costs for recovered aggregate. The main barriers are the lack of uptake of recovered aggregate for road building by private sector companies, due to the absence of material specifications for recovered aggregate (GreenCape, 2019).

Current applications by circular economy business model

Circular supplies model

- building sand, especially for founding pipes and paving – manufactured from recovered aggregate
- fill applications using recovered aggregate,
- in the foundations for fencing and of buildings,
- sub-base and base course in roads (where these roads remain under private sector authority),
- the manufacture of concrete blocks and other concrete products,
- rammed earth brick manufacturing

Resource recovery model

- Processing of 'waste' ready mix or other recovered concrete aggregate for re-entry into ready mix cement and concrete product manufacturing
- Processing of 'waste' asphalt for re-entry into asphalt plants for the manufacture of asphalt

Product life extension model

- bricks for low income residential builds – recovery of bricks through cleaning for re-use

⁷ Estimated based on the correlation between GDP associated with the construction sector and rubble tonnage. Builder's rubble generated in 2017 is reported as 5.3 million tons (DEA, 2018); however, this figure does not include the material processed in the private sector.

⁸ Calculated at an average prices of G5 (from processed builders' rubble) in Cape Town including VAT, collected of R74 per tonne or R118 per m³.

Technology and processing

Certain applications such as the use of recovered aggregate in farm or sand mine roads, are designed to limit processing required, with heavy machinery or trucks simply running over the material on the road bed to compact the recovered aggregate. Other applications require further processing through screens and crushing equipment, generally with a 'de-contamination' step of hand picking out of contaminants. Sometimes this process is facilitated through the use of a conveyor belt. Low quality fill applications generally require only 1 screen and crusher run, with the higher quality applications such as the use in roads or as aggregate in foundations, often require a secondary crusher and or screening run.

Unlocking opportunities

Short-term opportunities

Opportunities achievable within 5 years are presented in Table 8. Potential for Dutch expertise from the private sector is highlighted in green, and potential Dutch insights from the public sector or industry body perspective is highlighted in yellow.

Table 8: Opportunities to build a circular economy in builders' rubble achievable within 5 years

Opportunity	Intervention to unlock
<p>Uptake of recovered aggregate in local municipalities, other than in road layer works (lower performance requirements).</p> <ul style="list-style-type: none"> There is large potential for recovered aggregate to be used in Parks and Gardens departments (landscaping and fill), by Roads departments in construction of embankments, sidewalks and kerbs (and other associated road infrastructure), for departments responsible for urban infrastructure and non-motorised transport in construction of platforms, embankments, cycle paths etc., by departments building storm water and electricity infrastructure in the bedding of pipes and constructing of platforms. <p>Key opportunities will be in metropolitan areas and other areas experiencing growth in construction particularly in brownfields construction, and may be associated with municipal crushing contracts at landfill⁹.</p>	<p>Influence procurement policy and tender requirements to include secondary construction materials by</p> <ul style="list-style-type: none"> Understanding interventions and processes in more developed economies that utilise secondary materials, such as the Netherlands and communicating such. Engaging with local municipalities as an independent party (i.e. not an unsolicited bid from local construction or crushing companies) as to the potential and performance of recovered aggregate for application in local municipal construction. Supplying information on the local supply and quality of recovered aggregate as a substitution. Communicating the potential benefits in terms of job creation, cost savings and environmental savings (carbon emissions, landfill airspace).
<p>Road construction: inclusion of recovered aggregate in pilot sections and documenting of case studies nationally, including plans for visual inspections and in situ performance testing.</p>	<ul style="list-style-type: none"> Insights needed re embedding of sustainable practice, governance of, and monitoring and evaluation of progress towards sustainability in the roads/construction sector. Risk sharing and financing for inclusion of secondary materials in roads – expertise in process and financing required. Leverage off the draft National Road Policy which aims to embed sustainable practice at all levels and in all sectors of the road industry.

⁹ Current crushing contracts are in place in the Western Cape cities and towns: Cape Town and Stellenbosch, and soon to be implemented in Wellington, Vredenburg and Karwyderskraal. In other areas, a crushing contract in Ekurhuleni Municipality in Gauteng has recently come to an end, and awaiting a further municipal tender. Enquiries were made to GreenCape regarding crushing contracts at landfill in eThekweni, KwaZulu-Natal. GreenCape has focussed activity in the Western Cape; activity in other areas needs to be verified.

	<ul style="list-style-type: none"> Engage key construction industry players looking to be innovative in terms of environmental performance and cost-effectiveness to be partners in pilot sections. Document road sections including recovered aggregate and report on as built data and performance in situ.
Manufacturing of building sand: expansion of current opportunities for lower quality sands, especially where self-cementation of the material is beneficial, such as in bedding for paving.	<ul style="list-style-type: none"> Expertise re the manufacture of building sand from recovered aggregate for different applications Technology and equipment tailored for a developing setting.
Developing a quality governance process for the generation, handling and processing of recovered aggregate.	<ul style="list-style-type: none"> Access aggregate handling and processing expertise regarding the development and governance of quality assurance processes.

Medium- to long-term opportunities

Opportunities in builders' rubble achievable in 5 to 10 years are presented in Table 9. Potential for Dutch expertise from the private sector is highlighted in green, and potential Dutch insights from the public sector or industry body perspective is highlighted in yellow.

Table 9: Opportunities to build a circular economy in builders' rubble achievable in 5 to 10 years

Opportunity	Intervention to unlock
The largest opportunity in terms of volume of recovered aggregate: Inclusion of recovered aggregate in road layerworks (both sub-base and base course).	<ul style="list-style-type: none"> Expertise re the manufacture high quality road building materials from recovered aggregate. Technology and equipment tailored for a developing setting. Requires inclusion of recovered aggregate in specifications for road-building materials. Quality governance processes for builders' rubble management, processing and product testing
Integration of the virgin aggregate industry for rapid upscaling of recovered aggregate processing capacity, and logistical advantages for accessing large volumes of both virgin and secondary aggregates.	<ul style="list-style-type: none"> Requires feasibility upfront in terms of aggregate demand, and volumes of rubble feedstock available in which locations – expertise is required on the co-existence and strategic planning within aggregate industry from both a virgin and secondary perspective. Expertise regarding modifications to a virgin aggregate plant in terms of processes and equipment to handle both virgin and secondary aggregate. Possibly new technology and equipment required for effective integration.

Potential leads

Recovered aggregate in the construction industry

- Lead source: GreenCape industry surveys with the Western Cape crushing and construction companies, as well as limited engagement with Gauteng and KwaZulu-Natal stakeholders.
- Value proposition: The crushing industry in South Africa lacks good integration between the crushing industry and the construction industry requiring the higher value aggregate (such as for

the inclusion in private sector roads and other high(er) performance applications, in that quality governed processes for the production of recovered aggregate are not present, the construction industry in general has a poor perception of recovered aggregate as a construction material, and the crushing industry does not always produce material to the required specification.

- The industry is developing towards the supply of higher quality aggregates, and currently needs expertise and equipment for improved sorting of contaminated streams, at low costs (likely low tech) for this developing industry setting.
- Potential business partners and off-takers:
 - Martin and East is a Cape Town based road construction company, which takes on projects nationally. The company is an early adopter in the use of recovered aggregate for projects, including private sector roads. Recovered aggregate is seen as a competitive advantage in a constrained construction market, as well as providing benefits in terms of enhanced performance of the aggregate for certain applications.
 - SandOp in KwaZulu-Natal is an innovative company supplying the local construction market with recovered aggregate.
 - Aggreg8 is a Gauteng-based company with operations also in Cape Town. The company also handles virgin aggregate and has expanded into the secondary aggregates business.
 - The cidb (the Construction Industry Development Board as an agency of the National Department of Public Works) is planning to develop a quality governed process for the handling and processing of builders' rubble. The cidb will then require government contractors to be audited against the quality system, which is planned to satisfy end users of the quality of recovered aggregate produced in the construction value chain. Procurement in terms of expertise and guidance is very difficult through a government department, particularly with the private sector.

Manufacture of building sand

- Lead source: GreenCape industry surveys with Western Cape crushing and construction companies, as well as limited engagement with Gauteng and KwaZulu-Natal stakeholders.
- Value proposition: The Western Cape is predicted to run out of high quality, virgin building sand in 5 to 8 years (Cole, 2011), with the rest of the country likely to have limitations in supply due to the legislated protection of riverine and dune environments. Building sand of varying quality may be manufactured from secondary aggregate. To produce the higher quality sands, better 'de-contamination', washing and processing techniques and equipment are required.
- Potential business partners and off-takers:
 - Rubble Cycle in Cape Town produces a building sand from builders' rubble, mostly for the bedding of paving. The company has been investigating options for washing and other processing equipment, predominantly in northern Ireland.
 - SandOp in KwaZulu-Natal is reported to also be manufacturing secondary sand, as are Aggreg8 in Gauteng. GreenCape has not yet verified this information.

General comments

- Possible financing: The need to divert builders' rubble from landfill and use this secondary material in local economic development is recognised at all levels of government within waste and environmental departments, and increasingly in the private sector. The Chemicals and Waste Phakisa (quick survey and implementation project of the national Department of Environment, Forestry and Fisheries) has identified builders' rubble as a key stream for intervention. As such, (limited) government funding and other national and international environmental or LED-focussed funding may give priority to such identified streams within Phakisa.
- Local employment: Cape Town data indicates that for every 1 job in the standard construction industry using virgin materials, there are 5 jobs in the construction industry including secondary aggregates. Furthermore, an average of 9.7 jobs per 1000m³ of rubble processed was reported in

the Cape Town study, with the range from 1.2 jobs per 1000 m³ to produce aggregate for low quality fill applications, and 30 jobs per 1000 m³ to produce the higher quality aggregate for applications such as sub-base and base course in roads.

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Market Analysis for Textiles Sector

Background

The South African textile and clothing industry has a diverse (natural fibre, synthetic fibre, leather products, etc.) scope making it a highly labour intensive market and is ranked as the one of the largest value-added manufacturing sectors in South Africa. It employs approximately 95,000 workers and contributes roughly 8% to manufacturing GDP and 0.6% to the country's overall GDP. Over the past 20 years the industry has shed a lot of jobs and gone into survival mode due to the economic downturn, skills shortage and the inability to compete with cheap imports and lucrative labour offerings in the East. The industries are concentrated in two provinces namely Kwa-Zulu Natal and Western Cape. KwaZulu-Natal offers greater capacity and capability in terms of fabric production and finishing, which is a key area for future development.

South Africa's complex economic history with the textile industry has not fully comprehended the environmental impact the industry has due to the lack of investment and job losses in critical skilled positions. As a result, businesses still make use of outdated practices that are generally are environmentally sound compared to their competitors in other countries.

The Western Cape textile and clothing industry is a well-established (includes every step in the value chain, large and small retailers and small outsourced services) and matured industry, however it has also been the hardest hit when the free market policies of the World Trade Organisation (WTO) opened South Africa's economy to an influx of imported goods and competition from Asia in 1990. The Western Cape is home to the majority of the country's major retailers, which presents local manufacturers with a comparative advantage in terms of speed, flexibility and customer relationship.

Unlocking opportunities

The following are considered key for unlocking the opportunity for a thriving clothing and textile industry:

- Skills development: More focused courses on technical expertise
- Capital Investment for resource efficient interventions (technology): In order to stay competitive the industry needs to be supported benchmarked against World Class Manufacturing (WCM) standards. The uncertainty of resources is also a push to
- Investment for expansion: textile recycling and setting up of manufacturing plants for development of new materials.
- Market for recovered materials from textile recyclers.

A crucial and challenging stage in the development of a circular textile system is finding an answer to the question about how textile waste should be collected and sorted. For the process to be successful, recovery and reprocessing infrastructure is necessary, as well as effective communication across the supply chain. As it is, closing the loop in the textile and clothing industry is hindered by three main barriers namely; consumer behaviour and education on disposal practices, collection and sorting infrastructure and process recycling technologies. Skills development will be a useful tool to facilitate some of the technical and organisational barriers that purposely interface with tertiary education institutions to ensure consistent and continuous provision of various programmes for upgrading management and technical skills in the sector.

Potential leads

The role of government sponsored programmes, specifically South Africa's DTI's programme in 2010, and clustering organisations such as the KwaZulu-Natal Clothing and Textile Cluster (CTC) and Cape Town Clothing and Textile Cluster (CCTC), and CLOTEX have played a positive role in improving the competitiveness of South African firms. These organisations have achieved this through skills and technology development and a focus on instituting global best practices throughout the value chain, including lean manufacturing practices which enable constant improvement and evolution.

Also include at a high level, in addition to water and energy initiatives described above, TCI Apparel and ACA Threads have embraced other green building practices, including:

- environmentally sensitive ceiling boards and eco vinyl tiles;
- indoor plants and living walls;
- tinted windows, which retain heat in winter and expels it in summer;
- a vegetable garden utilised by the canteen; and
- locally produced furniture made of recycled plastic, wood and steel.
- Implemented water efficient measure – reverse osmosis

There are three textile recyclers (CSK Material handling, Rewoven Recycling and Architecture Trading) operating in the Western Cape. Two of the recyclers sort and separate whilst the third operates a manufacturing (shredding and cutting) plant. These recyclers are important in ensuring circularity in the clothing and textile industry. Although it's important to note that some companies adopting these circular practices manage to become profitable, many of them face difficulties, and not all of them are willing to sacrifice profits to gain in product quality and environmental quality.

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Annexure B: SWOT analysis of opportunity sectors

Sectors as defined by GreenCape	Sectors as defined by Dutch	Internal (attributes of the industry/sector)		External (attributes of the environment)	
		Strengths	Weaknesses	Opportunities	Threats
Biofuels		<ul style="list-style-type: none"> Improves the octane and cetane number of petrol and diesel fuels since it can be used as an oxygenate and burns cleaner. Can also assist refineries meet fuel specifications for sulphur etc. Renewable since the raw material can be grown and thus can be considered carbon neutral (CO₂ sequestered during growth equals CO₂ released during use as fuel) Biofuels industry, being agri-based, is low technology and job intensive, which suits participation by the 2nd economy (unskilled, low skill, marginalised), and as the 1st economy (skilled, advanced) is the major user of transport fuels, it provides an opportunity to link these two economies. Food security? No competition with food crops. Biofuels supply requires low cost, high yield and surplus agricultural production, most of which will not be food crops 	<ul style="list-style-type: none"> Growing of the crops could be water intensive considering SA is already a water stressed country. Low energy density compared to traditional fuels leading to less mileage per litre. 	<ul style="list-style-type: none"> Investment opportunities: Utilisation of under-utilised fertile marginalised land – previous homelands. These areas lack market access and infrastructure which biofuels plants together with agricultural and infrastructural support programmes should provide. Job creation opportunities in the energy crops and biofuels value chain especially for rural communities and boosting of the local economies, reduction in rural to urban migration which reduces pressure on urban infrastructure and resources The Department of Agriculture has a number of programmes to support development of local agricultural production and value addition, including programs for small scale farmers and emerging farmers. This would be able to be targeted to support farmers in crop selection, hedging, agricultural methods, research and development, and contract 	<ul style="list-style-type: none"> The viability of the biofuels industry will largely be dependent on the international oil price and the cost of agricultural feedstock (typically 70% of total costs). Competing with traditional fuels, subsidies needed when the price of crude oil falls below \$65/ barrel Uncertainty – lack of clear government policy, coupled with regulations and incentives which are a prerequisite for the development of a sustainable biofuels industry. The impact of biofuels production on water resources is as an important concern. Since the country is water stressed biofuels will have to compete for the scarce water resources. Biofuels now competing with e-mobility and there seems to be a pro electric powered vehicle sentiment at the moment Perceptions around biofuels, unless mandated by the

				<p>negotiations with biofuels manufacturers.</p> <ul style="list-style-type: none"> Reduced dependency on fossil fuels, though marginal. Residues could also be used for waste to energy initiatives and substitution of a fraction of transport fuels with biofuels 	<p>government there might be resistance to biofuels uptake</p>
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Sectors as defined by GreenCape	Sectors as defined by Dutch	Internal (attributes of the industry/sector)		External (attributes of the environment)	
		Strengths	Weaknesses	Opportunities	Threats
Urban Organic Waste		National: <ul style="list-style-type: none"> South Africa is a signatory to United Nations Sustainable Development Goals. Of relevance, Goal 12.3 to reduce food loss and waste by 50% by 2030. Well established food bank called Food Forward that are very active in redistributing food. Consumer Goods Council of South Africa and National Department of Trade and Industry are in the process of launching a Food Loss and Waste Voluntary Agreement for signatories to reduce food loss / waste by 50% by 2030. Launch is early 2020. Newly established industry body Organic Recycling Association of South Africa (ORASA) whose role is to facilitate the growth of the organics recycling industry. Red tape reduction for organic waste solutions (e.g. norms and standards for composting to replace onerous licensing and environmental impact assessment requirements). Established / regulated roadmap for national landfill 	National: <ul style="list-style-type: none"> Traditionally low value for end markets (onerous to register low value soil conditioner to a high value certified compost, difficult to sell electricity onto the energy grid, Waste licensing requirements for large (>10 tonnes per day) solutions require environmental Impact assessment that can be expensive (R100k without specialist studies) and take a minimum of between 8 to 18 months (depending on the size and impact of operation) to acquire. Current Carbon Tax Act excludes the taxation of waste facilities (such as landfills and waste water treatment works) for short to medium term. This is expected to change in the medium to long term. Low regulation enforcement of waste generators Cheap landfill gate fees across the country (between R153 – R508 excl. 15% VAT) Procuring municipal solid waste organics is much harder than private sector organics due to an onerous procurement process which usually only lasts 	National: <ul style="list-style-type: none"> National liquid (as defined) waste landfill ban by Aug 2019 strengthens business case for high organic liquids Technology to reduce contamination / increase quality of municipal solid waste organics feedstocks There are very few industrial / large scale (>10 tonnes a day) organic waste solutions across the country. De-packaging / de-contamination technology to reduce contamination / increase quality of both MSW and commercial and industrial organic feedstock. Carbon Tax Act launched in June 2019, and includes carbon offsetting measures such as carbon credit sales. This should increase the business case for organic waste solutions. Most municipalities, including metros, are running out of landfill airspace. Increase focus on separation at source by-laws (recyclables), most notably for metros. Expanded Producer Responsibility for paper and 	National: <ul style="list-style-type: none"> E.g. A lack of access to material when export prices are high i.e. material sold for export rather than re-manufacture Lack of Separation at Source regulations Municipal ownership of MSW Strong competition for private sector waste The higher value dry recyclables sector has more focus (EPR being developed for paper and packaging, development of a plastics pact, established associations for the major material types, major push by national government to support establishment of MRFs for dry recyclables and pelletizing plants) Western Cape: <ul style="list-style-type: none"> There is technically enough capacity to process all the commercial and industrial / private sector organics. City of Cape Town is investing in a large scale Mechanical Biological Treatment facility to process mixed MSW

		<p>bans which includes some organics components (liquid waste 2019, hazardous waste with phased calorific values, 50% garden greens diversion by 2023).</p> <ul style="list-style-type: none"> ■ Council for Scientific and Industrial Research (CSIR) strong research focus on high value add / chemical extraction for specialised organic streams. ■ The Green Building Council of South Africa launched its "net zero certification" for operating buildings. This certification covers net zero carbon, water and waste. <p>Western Cape:</p> <ul style="list-style-type: none"> ■ Established / regulated roadmap for provincial landfill ban for municipalities of organic waste (50% by 2022 and 100% by 2027) ■ Highly concentrated number of large waste management / handling companies, most seeking expanding service offering to organics. ■ Largest municipalities focusing on organic waste strategies to unlock post-consumer, pre-processing (de-contaminated), and post-processing (digestate) organics for private sector. ■ Proactive provincial waste authority. 	<p>three years (though there is a mechanism for longer-term procurement periods).</p> <ul style="list-style-type: none"> ■ Poor collaboration between public and private sector. ■ Most municipalities in the South Africa are not bankable. <p>Western Cape:</p> <ul style="list-style-type: none"> ■ Low regulation enforcement by municipalities on waste generators ■ Municipalities want to control municipal solid waste handling ■ No general separation at source by-law, and no separation at source programme for household organics ■ Business model for municipalities are still based on cost recovery, as such, landfill gate fees are still the major cost recovery mechanism for municipalities. As such, municipalities with landfills airspace still rely on disposal. 	<p>packaging industry should increase quality of MSW organics.</p> <ul style="list-style-type: none"> ■ Waste industry in the process of developing an industry position on biodegradable/ compostables packaging (including plastics). ■ Highly concentrated number of large waste management / handling companies, most seeking expanding service offering to organics. <p>Western Cape:</p> <ul style="list-style-type: none"> ■ Value add technology to process MBT processed MSW organics that may potentially be heavily contaminated. ■ Further value-add to the City of Cape Town's dry digestate from its three Bio-solid beneficiation facility. ■ Western Cape organic waste landfill ban (50% by 2022 and 100% by 2027) strengthen business case for organic solutions ■ The cost of landfilling is increasing above inflation and should increase the business case for alternative to landfill solutions ■ Technologies to extract and bottle methane and carbon dioxide, which there is a high demand for carbon dioxide in the Western Cape. 	
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		<ul style="list-style-type: none"> ▪ Highest landfill gate fees in South Africa ▪ Municipal gate fees increasing beyond CPI / Inflation. ▪ GreenCape as a Knowledge / insight sharing hub for investors ▪ Strong garden greens diversion across the province 		<ul style="list-style-type: none"> ▪ Most municipalities, including metros, are running out of landfill airspace. ▪ Most bankable municipalities are located in the Western Cape 	
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Sectors as defined by GreenCape	Sectors as defined by Dutch	Internal (attributes of the industry/sector)		External (attributes of the environment)	
		Strengths	Weaknesses	Opportunities	Threats
Water and Wastewater		<ul style="list-style-type: none"> Recovered resources can be utilised on site in a circular economy model instead of having to look for an external market Utilisation of wastewater for resource recovery is still a growing niche in SA and there is still room for more players in the field. Advanced treatment and resource recovery technologies are available locally A number of projects have been initiated and have proven feasibility Promotion of water and energy security Knowledge sharing: Local research institutes (CSIR, WRC and universities) have conducted research on wastewater bio-refineries and proved their techno economic feasibility 	<ul style="list-style-type: none"> Some industrial waste producers have inadequate organic concentration in their wastewater to recover anything substantial Small volumes of wastewater make it difficult to develop a good business case with logistics costs being high for transporting liquids Barriers to PPPs implementation at municipal WWTPs Lack of technical capacity locally 	<ul style="list-style-type: none"> Stricter regulation on the discharge of wastewater by industries and municipalities and ban on the landfilling of liquid waste and organic waste. Inefficiency of treatment works and increased pollution of water resources nationwide Establishment of an Anti-Pollution Task Team by DWS Drought has focussed attention on water security and there is an increasing interest in water reuse as an alternative source. This creates an opportunity for simultaneous consideration of value –add opportunities Knowledge sharing: Education and awareness on the possibility of resource recovery from organic wastewater SA is a large importer of fertilisers and natural gas Job creation and promotion of a greener economy 	<ul style="list-style-type: none"> Absence of a market for the recovered resource in the event that the resource cannot be used on site. SA markets for value add products may be small. Fertiliser market does not have import taxes subsidies which discourages the sales of locally manufactured fertilizers that may be more expensive Perception on quality and general quality of recovered products compared to other products in the market Infrastructure fund pledged by the SA government Cost of production may render the products more expensive compared to cheaper imports Regulations on the use of wastewater and disposal of by products

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Waste-to-Energy		<ul style="list-style-type: none"> High potential energy for many of the feedstock waste streams that could be used for waste-to-energy technologies. High value add products can be produced in addition to energy. Southern African Biogas Industry Association represents the biogas industry in skills, market and legislative development. Both successful and unsuccessful waste-to-energy projects implemented project great insights on what the success conditions for the sector. 	<ul style="list-style-type: none"> Lack of research of financial models that can be used for projects under the current market conditions (i.e. project finance versus private loans) Lack of understanding when matching financial models with the viable project models to encourage investment into the sector. Understanding the key risks of financial institutions and potential support to mitigate those risks. Highly disaggregated wastes especially for manure as often farmed extensively. Anaerobic digestion is an infant industry in South Africa. In most cases, a full environmental impact assessment would be required for a waste-to-energy project site with the possibility of triggering no less than 11 various legislative avenues. 	<ul style="list-style-type: none"> Development of code of conduct for biogas industry. This would only be effective if there is buy in from financing institutions or support from legislation Government legislation is driving a search for alternatives to landfill / better utilisation. If the agri-processing industries can be convinced that additional value can be gained they will be keen to engage as their margins are being put under pressure through cheap imports and international trade agreements not going their way. Government support for agri-processing through the dti's agro-processing support scheme and WCG DEDAT's Agri-processing Supplier Development Programme. 	<ul style="list-style-type: none"> Waste-to-energy sector needs to rebuild confidence with financing institutions (particularly debt lenders) in light of failed projects Mechanism for addressing disputes between project developers when projects are taken over due to the limited amount of stakeholders in the space The agri-processing industries is facing significant pressure and companies are thus not very open to collaboration. The stakeholders within the sector are generally reluctant to share information. Act 36 of 1947 (Fertilizer act) can create complexities when trying to monopolize products suitable for soil improvements. Most waste-to-energy projects are considered high risk and difficult to obtain development financing The strategies of various municipalities within South Africa is to remove recyclables and other value-add waste streams from municipal solid waste (MSW). This can result in lower quality RDFs produced from MSW.

Sectors as defined by GreenCape	Sectors as defined by Dutch	Internal (attributes of the industry/sector)		External (attributes of the environment)	
		Strengths	Weaknesses	Opportunities	Threats
Textiles		<ul style="list-style-type: none"> The textile industry has built resilience by being able to adapt to shocks and stresses related to resource scarcity. They have strong industry associations to support them and with benchmarking for world class manufacturing and best practises. Geographical clustering of textiles and clothing firms in the Western Cape 	<ul style="list-style-type: none"> A lack of capital expenditure has resulted in outdated equipment. Skills development: The textile industry steady decline has led to the departure of numerous technical expertise especially focused on lab technicians (for dye houses), textile technologists and machine operators. The training institution (CPUT) according to the industry is not producing the necessary technical expertise to grow the industry. Knowledge sharing: Co-operation and knowledge sharing amongst manufacturers in both industries, as well as along the value chain is not common due to competitiveness 	<ul style="list-style-type: none"> Investment in resource efficient interventions (technology): There is also an opportunity to look into more resource-efficient technology thus to foster a smarter approach to water scares countries. Investment for expansion: The textile recycling industry has seen a rapid uptake and currently, we have identified 3 prominent stakeholders of which 2 are sorting, separating and balling facility and the other is shredding and cutting facility. The major opportunity with manufacturing (shredding and cutting facility) is capacity and market for underfelt and pulled fluff. Funding: The government and institutions like the DTI have made it possible for the clothing and textile industry to have access to funding for expansion and innovation. 	<ul style="list-style-type: none"> The increased low-cost import of cheaper products has lead impacts the lack of competition due to trade liberalisation globally. Increased pricing and uncertain supply of utilities – water and electricity - has a negative impact on businesses bottom line. The quality of imported fabrics is decreasing (mostly affects dye houses).

Sectors as defined by GreenCape	Sectors as defined by Dutch	Internal (attributes of the industry/sector)		External (attributes of the environment)	
		Strengths	Weaknesses	Opportunities	Threats
Construction and Demolition		<ul style="list-style-type: none"> Opportunities are locally recognised and accessed: The crushing industry in the Western Cape, Gauteng and KZN has experienced growth over the last 5 years, with good uptake from small construction companies (GreenCape, 2019). Equipment: suitable equipment is locally available and affordable (high tech solutions are not currently necessary or affordable in the industry). 	<ul style="list-style-type: none"> Lack of governed quality assurance processes, including performance testing protocols¹⁰. Lack of understanding of requirements for road construction materials from some crushing companies. Limited compliance with local, provincial and national legislative and accreditation requirements, which limits opportunities in the public sector. 	<ul style="list-style-type: none"> Materials: The supply of building sand in the Western Cape is predicted to run out within 5-8 years (Cole, 2011). Supply of building sand is likely to be limited nationally due to legislation protecting riverine and dune environments. Reducing costs: The construction industry cites rising material costs as one of the main factors limiting business growth (Windapo & Cattell, 2013). Recovered aggregate as a construction material can often be produced and supplied more cheaply than virgin materials in urban centres (metropolitan areas are sites of large opportunities). Potential due to road construction practice: standard practice in the road construction industry is to survey locally available materials and design accordingly. This practice could be expanded to include secondary materials (including recovered aggregate). Road construction industry support: Road Pavement 	<ul style="list-style-type: none"> Construction industry as the supply of and main demand for the material is in a low growth phase, although this trend is expected to change in Q4 2019. Perceived bad quality of recovered aggregate for construction and the lack of good case studies illustrating otherwise. Poor segregation at source: Lack of governance of wastes generated, management of wastes at point of generation for maintaining highest material value, and lack of tracking of waste destination or disposal. Public sector ban on recovered aggregates in roads: the public sector is the biggest market as the client in local, provincial and national roads. Generally, the public sector policy (not always documented) is the banning of secondary materials from road layerworks. Road material specifications are largely exclusive of secondary materials: The specifications for road building materials in South Africa specifically exclude

¹⁰ The crushing companies producing higher value materials do have internal quality governance processes and testing regimes that comply with road industry guidelines and specifications.

				<p>Forum¹¹ resolution to develop guidelines for application of recovered aggregate in roads. The support specifically includes SANRAL (National Roads' Agency) and research/academic support and input from Stellenbosch University, Pavement Engineering.</p> <ul style="list-style-type: none"> ▪ Road industry policy and specifications: the draft National Road Policy aims to embed sustainability in the roads industry, and the draft COTO¹² national specifications for highways, includes reference to secondary road building materials. ▪ Industry body support in terms of developing quality assurance processes for the handling and processing of recovered aggregate: the cidb¹³ is funding a status quo study, which is planned as the foundation to develop quality assurance processes. 	secondary materials, particularly at the higher material quality for the base and sub-base courses
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¹¹ Industry group that includes the public and private sector across policy-making, regulatory, planning, construction materials, laboratory testing of materials, engineering consulting, construction and road safety stakeholders.

¹² Committee of Transport Officials

¹³ The Construction Industry Development Board, as an agency of the National Department of Public Works

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