2023 SUSTAINABLE AGRICULTURE MARKET INTELLIGENCE REPORT

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Agriculture

GreenCape

2023 SUSTAINABLE AGRICULTURE MARKET INTELLIGENCE REPORT

GREENCAPE

GreenCape is a non-profit organisation that works at the interface of business, government, and academia to identify and remove barriers to economically viable green economy infrastructure solutions. Working in developing countries, GreenCape catalyses the replication and large-scale uptake of these solutions to enable each country and its citizens to prosper.

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS AND ACRONYMS

AAMP	Agriculture and Agro-processing Master Plan
ACDI	African Climate and Development Initiative
ACZ	Agro-climatic zone
AfCFTA	African Continental Free Trade Area
AFOLU	Agriculture, Forestry and Other Land Use
Agtech	Agricultural technology
BFAP	Bureau for Food and Agricultural Policy
CA	Conservation agriculture
COAS	Carbon Offset Administration System
COP27	27th Conference of the Parties to the United Nations Framework Convention on Climate Change
CSA	Climate smart agriculture
CSIR	Council for Scientific and Industrial Research
CTA	Carbon Tax Act
DALRRD	Department of Agriculture, Land Reform and Rural Development
DEFF	Department of Environment, Forestry and Fisheries
DoT	Department of Transport
DSE	Department of State-owned Enterprises
dtic	Department of Trade, Industry and Competition
DWS	Department of Water and Sanitation
FAO	UN Food and Agriculture Organization
FPSU	Farmer Produce Support Unit
FSC	Full Storage Capacity
GHG	Greenhouse Gas
GTI	Guided Trade Initiative
GVA	Gross value-added

IOT	Internet of things
JCRC	Joint Constitutional Review Committee
JET	Just Energy Transition
JT	Just Transition
MIR	Market Intelligence Report
NA	National Assembly
NAMC	National Agricultural Marketing Council
NDP	National Development Plan
PCC	Presidential Climate Commission
PPA	Power Purchase Agreement
PLAS	Proactive Land Acquisition Strategy
PPP	Public Private Partnership
RA	Regenerative agriculture
RHFA	Relatively homogenous farming area
SABIA	South African Biogas Industry Association
SMME	Small, medium and micro enterprise
SOE	State-owned enterprise
SONA	State of the Nation Address
UNFCCC	United Nations Framework Convention on Climate Change
VCRT	Value Chain Roundtable
WC	Western Cape
WCG: Agriculture	Western Cape Department of Agriculture
WCG: EADP	Western Cape Department of Environmental Affairs and Development Planning

EXECUTIVE SUMMARY

The South African agricultural sector offers numerous opportunities for investors, agricultural and green technology manufacturers, service providers, distributors, and others in the value chain.

CLICK TO WATCH A SUMMARY OF THE MIR OPPORTUNITIES

The agriculture sector has continued to be one of the few sectors of the South African economy that has experienced continued expansion over the last two years (14.9% y/y in 2020 and 8.8% in 2021)[1]. Additionally, the number of jobs in the sector has grown, up by 1% y/y with a total of 874 000 people working in primary agriculture by the end of 2021. This is significant, especially when juxtaposed against other sectors, which have experienced significant job losses in the last two years. The indicators for confidence in the agriculture sector are also positive, aided by weather forecasts predicting good rains for the next planting season. This has led to strong machinery sales figures, indicating that farmers are confident enough in the sector to make long-term investments in movable assets.

However, the confidence in the sector does not mitigate against some significant threats to agriculture. One of the most pressing is climate change. Increasing average temperatures, weather volatilities and water scarcity could reshape the way South Africa's agricultural sector continues to produce. Moreover, geo-political issues such as the Russia-Ukraine war, supply disruptions to global logistics, and increased protectionism by trade partners are causing input costs for the agricultural sector to rise steeply.

However, these threats can also be considered as opportunities for investment and development, as agricultural producers invest increasingly in sustainable agricultural production methods.

These opportunities lie in:

- renewable energy applications
- regenerative agriculture
- smart farming
- circular agriculture

While the transition seems daunting, the agricultural sector has shown a number of green shoots, indicating that that the sector is ready to make the shift to more sustainable agriculture. The completion of the Agriculture and Agro-processing Master Plan is an exciting development, as it fosters co-ordination and collaboration between all stakeholders – government, business, industry associations, and academia – and lays the foundation for a thriving sustainable agricultural sector in South Africa.

[1] Source : https://www.businesslive.co.za/amp/bd/opinion/columnists/2022-09-07-wandile-sihlobo-agricultures-quarterly-contraction-in-context/

Table 1: Summary of market opportunities in the sustainable agriculture market

Opportunity			
Renewable energy applications			
Solar applications			
Technology	**Western Cape market size**	**Drivers**	**Barriers**
Solar dryer	R372 million	• High electricity and diesel prices • Policy-level push for greater on-farm processing / beneficiation	• Lack of technical expertise • Lack of financing (outside of government grants)
Opportunity			
Regenerative agriculture			
Soil remediation			
Technology	**Western Cape market size**	**Drivers**	**Barriers**
No-till tractors	R1.3 billion	• Increased water use efficiency • Reduced diesel usage • Greater weed control • Increase in conservation agriculture (CA) farmers in the Western Cape will likely drive more farmers to CA • Increased number of CA farmer = increased demand for no-till machinery • Opportunities to generate carbon credits through carbon sequestration	• Retrain farm workers to operate no-till tractor • High capital cost in comparison to conventional till tractors
Bio stimulants	R217 – 435 million	• Reduced yield dip timeframe associated with shifting to regenerative agriculture • Improved quality, quantity and consistency of yield • Effective treatment for transplant shock of fruit trees	• Commercial product ranges remain limited • Biostimulants fall under the subcategory of fertiliser by definition; therefore, subject to administrative red-tape for certifying products for commercial use • Lack of industry standards in South Africa
Opportunity			
Smart farming			
Internet of things (IoT)			
Technology	**Western Cape market size**	**Drivers**	**Barriers**
Farm management apps	R1.3 million/ annum	• Greater efficiency at production level • Need for greater traceability from retail and export markets	• Low levels of digital literacy at farm management/owner level • Low internet bandwidth in rural areas

Table 1 continued...

Opportunity			
Smart farming cont.			
Precision farming			
Technology	**Western Cape market size**	**Drivers**	**Barriers**
Precision spray via drones	R10 million/ season (for wheat) R1.8 million/ season (for fruit trees)	• Reduced use of pesticides • Reduced runoff into rivers/streams, limiting pollution into local water systems • Cheaper alternative to spraying by aircraft • More efficient than conventional manned spraying, particularly with tall crops such as wheat	• Minimal viable size > 10 ha • High capital investment in drones • Tight regulations and licensing requirements for drone pilots
Drip irrigation	R302 – 1.5 billion	• Greater irrigation efficacies – water delivered directly to roots • Lower water usages (~10 kL/ha water reduction)	• Higher capital cost than other irrigation systems
Opportunity			
Circular agriculture			
Waste-to-soil			
Technology	**Western Cape market size**	**Drivers**	**Barriers**
Anaerobic digestion	R435 million (for crop production) R2.6 billion (for dairy sector) R237 million (for piggery sector) R4.0 billion (for poultry sector)	• Legislative and market pushes for lower carbon emissions on farms • Ability to generate energy for heating • Increasing number of reliable technology suppliers • Provincial ban of organic waste at landfills • Anticipated second phase of Carbon Tax Act (CTA) which will affect the agricultural sector	• Most applicable for feedlots – requires initial infrastructure investment of feedlot before installation • High capital cost • Restrictive waste management and energy legislation

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WHAT'S NEW

The 2022 Sustainable Agriculture Market Intellegence Report (MIR) described the notable investment opportunities in sustainable agriculture in energy efficiency, renewable energy, regenerative agriculture, smart farming, and electric equipment. The MIR also covered some of the notable technologies within each investment opportunity, such as drones, solar-powered irrigation systems, and electric tractors, which have potential in the Western Cape agricultural market.

This year's MIR highlights new emerging technologies in some of the opportunities already discussed in previous MIRs, and introduces circular agriculture as a new emerging opportunity.


CLICK HERE TO ACCESS PREVIOUS AGRICULTURE MIRS
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INTRODUCTION AND PURPOSE

This MIR highlights opportunities for greening agriculture production and is written for investors, particularly new investors, exploring the South African agtech market.

GreenCape's Agriculture Sector Desk was established in 2014 in partnership with the Western Cape Department of Agriculture (WCG: Agriculture). The desk aims to support the development of a sustainable and competitive agricultural value chain through the uptake of agricultural technology (agtech[2]) and sustainable production practices. This is achieved by raising awareness of the benefits of agtech uptake (i.e. driving demand within agriculture) and highlighting opportunities for agtech investors, manufacturers and service providers (i.e. supporting supply). This MIR provides updates on key issues and opportunities identified in previous MIRs, and highlights new opportunities related to technologies and practices that:

- increase input resource efficiency in primary production;
- benefit the environment, primarily by conserving resources, reducing negative impacts such as soil degradation and pollution;
- increase resilience to climate change; and
- have the potential to attract international investment.

In what follows, there is a sector overview (Section 2) that provides a provincial economic overview of agriculture with the focus on macro-economic trends. This is followed by an overview of policies and regulations (Section 3) that guide and affect investment in the agriculture sector. Key opportunities, trends and barriers are highlighted in Section 4. The final sections provide information on available finance and incentives (Section 5), present the case for the Western Cape as Africa's emerging greentech hub (Section 6) and explain GreenCape's work in the green economy (Section 7).

For any assistance, or if you have any questions after reading this MIR, please contact the agriculture team at agri@green-cape.co.za

CONTACT THE AGRICULTURAL TEAM HERE

[2] Agtech represents the application of technology, especially software and hardware technology, to the field of farming.


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SECTOR OVERVIEW

This section provides an overview of the South African and Western Cape commercial agricultural sectors. It includes an overview of the sector's structure, macro-economic trends, key players, and drivers of green technology and practices in agriculture.


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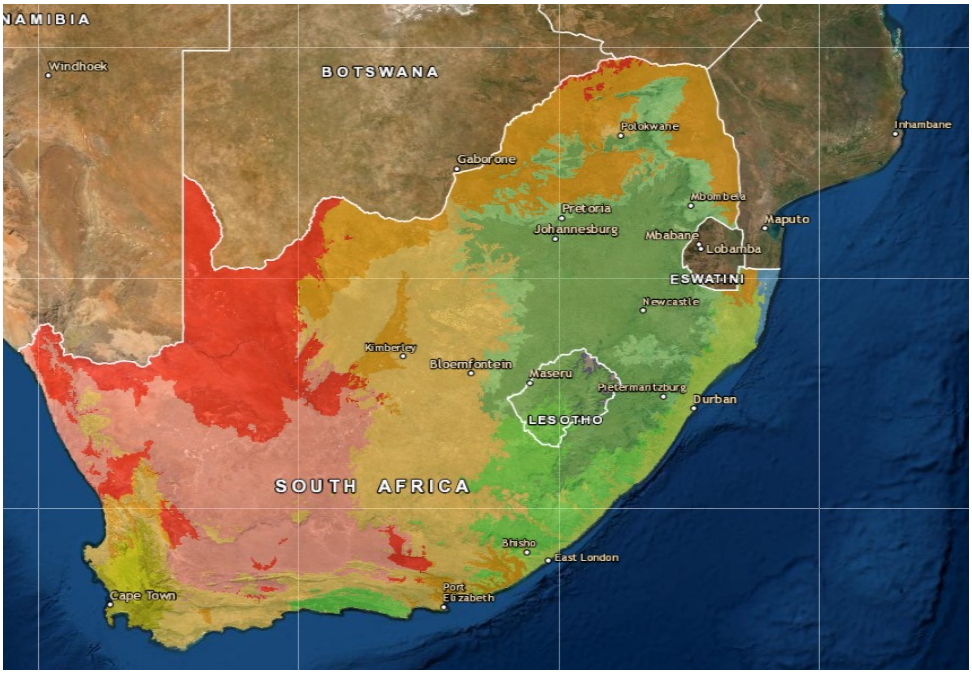
The continued growth of the agricultural (and agro-processing) sector in South Africa has shown that the agriculture sector is robust. However, the increase in temperature volatilities, environmental disasters and population growth is resulting in increased competition for key resources, constraining an already overburdened agricultural sector.

2.1. Climate and agricultural production

South Africa is a water-scarce country and is classified as semi-arid, with only ~11% of its land considered arable, of which only ~3% is truly fertile soil (Bormann, 2019). According to the Köppen-Geiger Climate classification[3] illustrated in Figure 1, South Africa is dominated by oceanic climate types, followed by hot and cold semi-arid climates.



Am	Tropical monsoon	**Csa**	Hot-summer Mediterranean	**Cfb**	Oceanic
Aw	Tropical savanna	**Csb**	Warm-summer Mediterranean	**Cfc**	Subpolar oceanic
BWh	Hot desert	**Cwa**	Humid subtropical	**Dwc**	Monsoon-influenced subartic
BWk	Cold desert	**Cwb**	Subtropical highland oceanic	**Dfc**	Subartic
BSh	Hot semi-arid	**Cwc**	Cold subtropical oceanic	**ET**	Tundra
BSk	Cold semi-arid	**Cfa**	Humid subtropical		

Figure 1: Köppen-Geiger Climate Zones of South Africa (1980 – 2016)

Source: Spatial Information and Mapping Services Unit, 2018.

[3] The Köppen-Geiger classification is based on a subdivision of terrestrial climates into five major types, which are represented by the capital letters A, B, C, D and E.

The Western Cape is the South-Western most province in South Africa. Its climate is markedly different from the rest of South Africa, with a mix of Mediterranean climatic regions along the coast and a semi-desert inland. It also experiences winter rainfall, which allows for the stable production of a unique mix of agricultural produce.

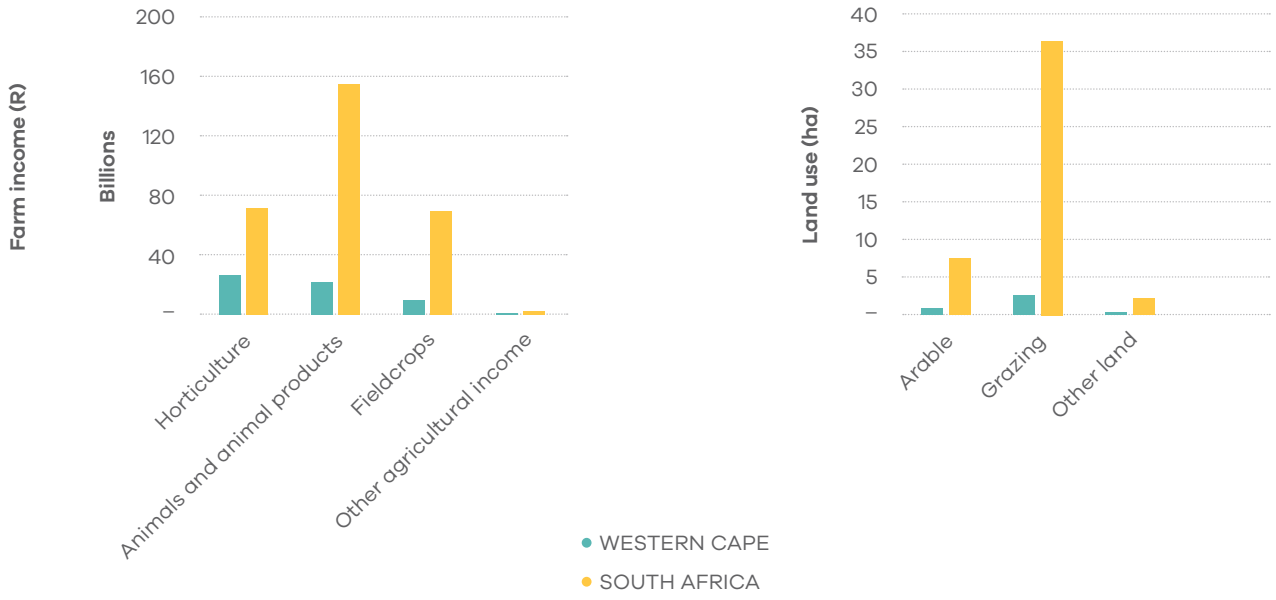


Figure 2: Breakdown of gross farm income and land use Western Cape vs rest of South Africa, 2017
Source: Statistics South Africa, 2020.

As can be seen from Figure 2, the Western Cape is a dominant player in the horticultural sector – 37% of South Africa's horticultural farm income is generated in the Western Cape (Statistics South Africa, 2020). This is notable since less than 10% of productive agricultural land is located in the Western Cape.

The well-maintained road network also plays a significant role in connecting various producers of high-value commodities to markets (particularly transportation of those commodities to ports facilitating international trade). The majority of the productive farms in the Western Cape are irrigated:

Figure 3 compares the farming practices in the Western Cape versus South Africa. The proportion of farms with irrigation is far higher than that at national level. Consequently, consistent water supply and an effective network from bulk water storage to farming communities is critical for sustaining the Western Cape agricultural sector.

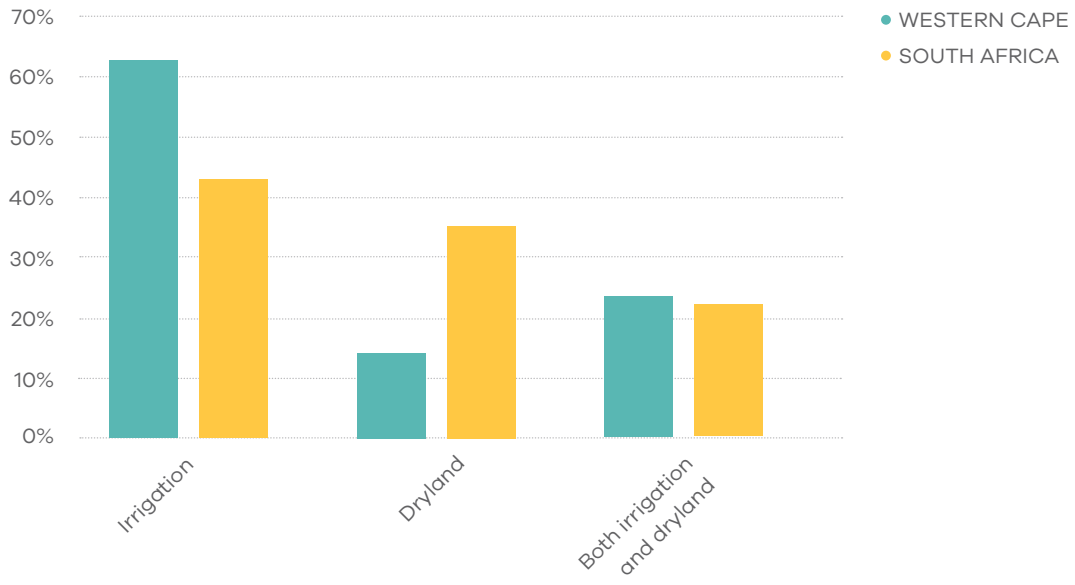


Figure 3: Farm types by farming practice for crop production

Source: Statistics South Africa, 2020.

By the end of October 2022, dam levels were at 71.1%, a drop from the previous year's end of October levels of 82.5% (Department of Water & Sanitation, 2022).

The Department of Water and Sanitation (DWS) noted with concern how below-normal rainfall and unseasonably warm temperatures experienced during the first half of the Western Cape's traditional rainy season led to the drop in dam levels (Engel, 2022).

Climate change modelling for the province does predict that most of the province will experience, on average, lower rainfall and higher temperatures in the coming few years. This will result in reduced water availability that can impact negatively on agricultural production, particularly productive land under irrigation.

2.2. Expected impact of climate change on agriculture in the Western Cape

As part of the development of the **Western Cape Climate Change Response Framework and Implementation Plan for the Agriculture Section – 2016 (the "SmartAgri Plan")**[4], which has set out to improve the readiness of the agricultural sector to adapt to and invest in resilience to climate change, spatial units or agro-climatic zones (ACZs) have been identified through the aggregation of more than 80 relatively homogenous farming areas (RHFAs) which are based on climatic, vegetative and productive attributes. These agro-ecological zones (illustrated in **Figure 5**) provide a spatial unit for representing the specific agricultural character, current enterprises, and climatic potential of a locality.

[4] More information on the SmartAgri project can be found on the GreenAgri portal here

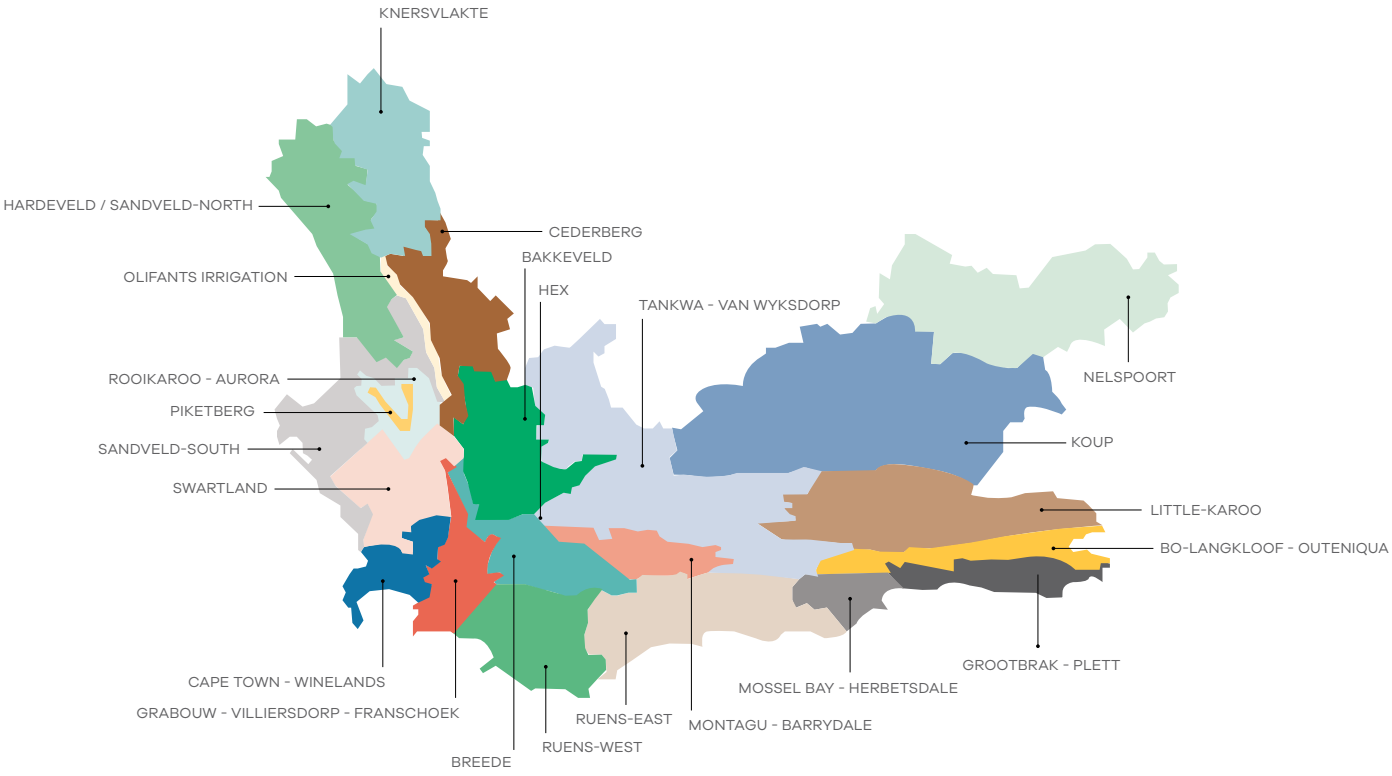


Figure 4: Merged relatively homogenous farming areas (RHFAs) in the Western Cape

Source: Western Cape Department of Agriculture

The biggest climate change threat to field crops identified was the changes in distribution and intensity of pest species, the spread of diseases and growth of weeds.

For irrigated horticultural crop, seasonal shifts in rainfall, temperature and humidity would give rise to production and quality problems – especially insufficient water supply for irrigation.

Dryland horticultural crops (such as rooibos) are under threat as areas with suitable production conditions such as temperature and rainfall are contracting. Table 2 provides more details to this effect for each agro-climatic zone.

Table 2: Summary table of climate change impacts and agriculture for each agro-climatic zone

	Relatively homogenous farming area (RHFA)	Main commodities	Future agricultural potential
1	Bokkeveld	• Pome fruit, wheat, stone fruit, onions, potatoes • Cattle	Remains high as long as dams fill up
2	Bo-Langkloof-Outeniqua	• Pome fruit, hops, wheat • Cattle, sheep, goats	Increasingly marginal, constrained by water availability and extremes
3	Breede	• Wine grapes, wheat, stone fruit, pome fruit, olives • Broilers, egg layers	Remains high as long as dams fill up
4	Cape Town-Winelands	• Wine and table grapes, wheat, stone fruit, vegetables, olives, canola, berries • Broilers, egg layers, pigs	Remains high as long as dams fill up

Table 2 continued...

	Relatively homogenous farming area (RHFA)	Main commodities	Future agricultural potential
5	Cederberg	• Rooibos, wheat, citrus, wine grapes, potatoes • Cattle	Increasingly less productive, particularly in the north
6	Grabouw-Villiersdorp-Franschhoek	• Pome fruit, wine grapes, wheat, barley, stone fruit, berries	Remains high as long as dams fill up, but apple become unviable due to warming
7	GrootBrak-Plett	• Wheat, barley, vegetables • Dairy, cattle, egg layers	Possibly less productive but depends on rainfall shifts
8	Hardeveld/Sandveld-North	• Wheat, wine grapes, rooibos, potatoes • Sheep, cattle	Increasingly marginal
9	Hex	• Table grapes, citrus	Remains high as long as dams fill up
10	Knersvlakte	• Wheat, wine and table grapes, rooibos • Sheep, cattle, goats	Already very marginal, becoming worse
11	Koup	• Olives, vegetables and vegetable seed • Sheep, cattle, goats, game	Slowly declining productivity, constrained by heat
12	Little Karoo	• Wheat, vegetables, wine grapes, stone fruit, olives • Dairy, ostriches, sheep, cattle, goats, pigs	Remains moderately high as long as dams fill up
13	Montagu-Barrydale	• Stone fruit, wheat, barley, wine grapes, pome fruit, citrus, olives • Sheep	Remains high as long as dams fill up
14	MosselBay-Herbertsdale	• Wheat, barley, canola, berries • Dairy, ostrich, pigs, cattle, sheep	Transition area, productivity could improve with more irrigation capacity
15	Nelspoort	• Cattle, sheep, goats, ostrich	Depends on rangeland changes, constrained by heat and water
16	Olifants Irrigation	• Citrus, wheat, wine and table grapes, rooibos, tomatoes	Remains high as long as river flows and dams fill up, but constrained by heat
17	Pikelberg	• Pears, fynbos flowers, stone fruit, wheat, citrus, herbs/essential oils, wine grapes, Cape rush • Sheep, cattle	Remains high as long as dams fill up, but changing due to warming
18	Rooikaroo-Aurora	• Wheat, canola, rooibos • Sheep, cattle	Increasingly marginal for wheat
19	Rûens-east	• Wheat, barley, canola • Sheep, cattle, dairy, pigs, ostrich	Currently becoming marginal for small grains but could improve given possible increases in rainfall
20	Rûens-west	• Wheat, barley, canola • Dairy, sheep, cattle	Remains high for small grains but with increasing yield variability
21	Sandveld-south	• Wheat, potatoes, rooibos • Sheep, cattle	Increasingly marginal

Table 2 continued...

	Relatively homogenous farming area (RHFA)	Main commodities	Future agricultural potential
22	Swartland	• Wheat, wine and table grapes, canola, olives • Dairy, pigs, sheep, cattle	Remains high for small grains but with increasing yield variability
23	Tankwa-van Wyksdorp	• Wheat, stone fruit, wine grapes • Sheep, goats, pigs, cattle, game, ostrich, dairy	Slowly declining productivity, constrained by heat and water availability

It is notable that 13 of the 23 RHFAs identified face increasingly marginal productivity, driven by changing rainfall patterns and increasing temperatures that can make the climate ill-suited for the commodities traditionally grown in the areas. Moreover, even in areas where production remains healthy, persistently low dam levels are a threat to continued production.

2.3. Overview of the agricultural economy in the Western Cape

2.3.1. Western Cape agricultural production

With ~ 2 million hectares of agricultural land under crop production in the Western Cape, the largest share of production is wheat (17%), followed by wine grapes, canola, barley, rooibos tea, apples, table grapes, pears and oranges. The most productive district is the West Coast, which is dominated by grain, oil seeds and lupine production (as seen in Figure 5) (Morokong, *et al.*, 2022).

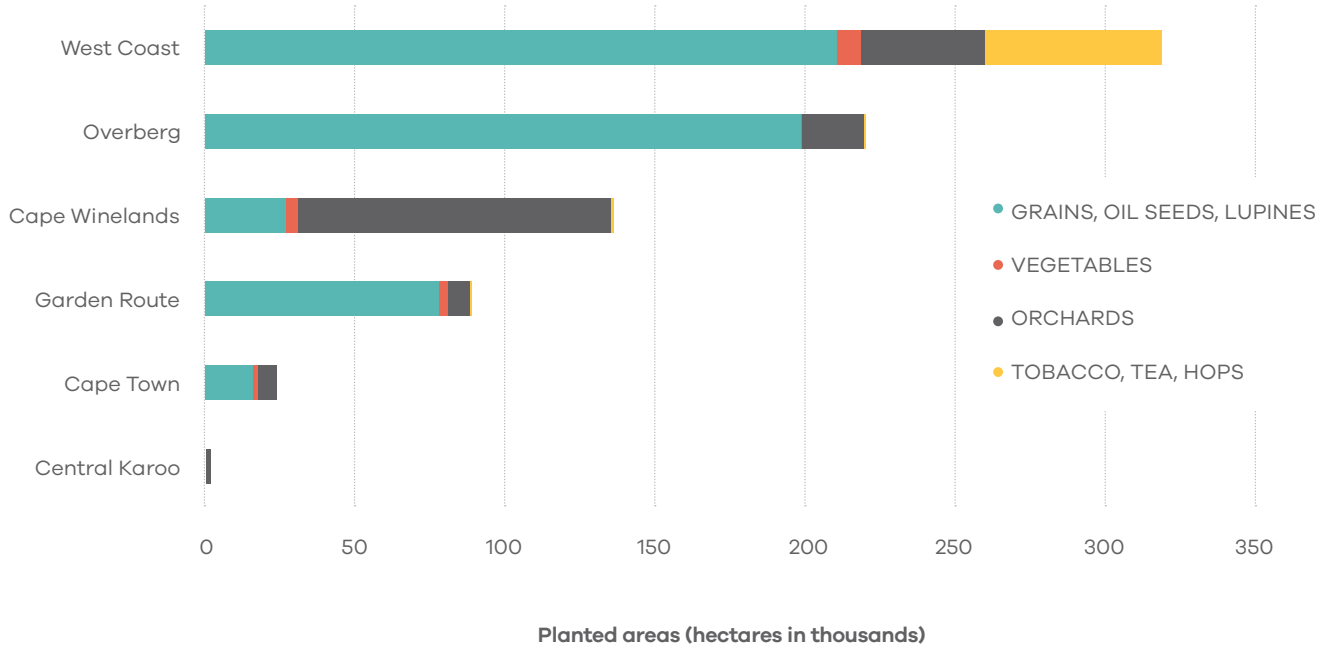


Figure 5: Agricultural production of broad crop groups per district, 2017
*Note: Figure 5 excludes extensive grazing areas
Source: Morokong *et al.*, 2022

In 2021, the Western Cape's gross value-added (GVA) of agriculture was R16.8 billion – 14.21% real growth year-on-year – while the agro-processing sector experienced a decline in production as a result of economic decline and the impact of load shedding[5] due to the energy crisis in South Africa.

2.3.2. Trade

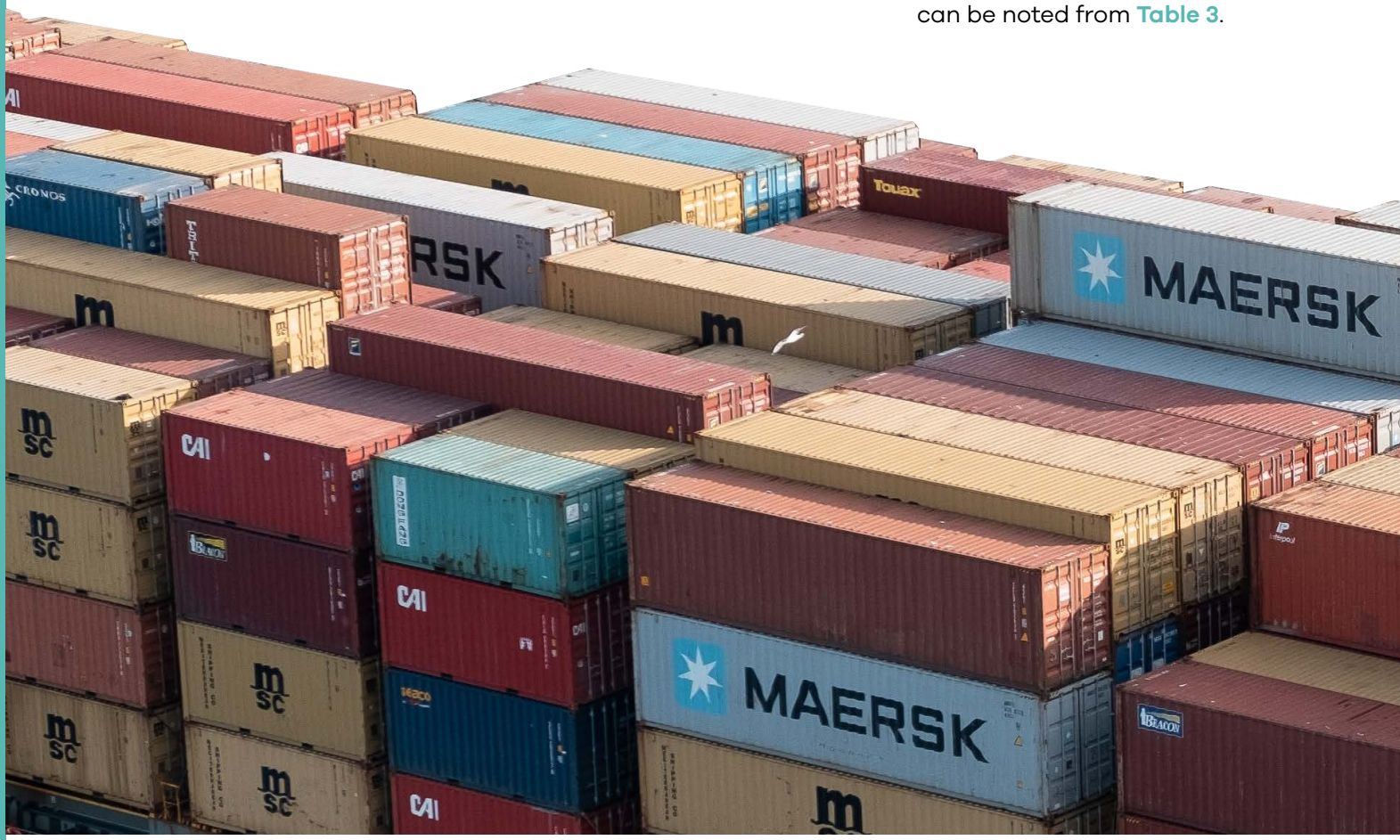
The Western Cape agricultural sector is strongly export-orientated. In the past ten years it has experienced substantial growth in agricultural exports, while imports have remained quite stable.

The performance of the export market is particularly notable, considering the disruption of international supply chains stemming from the Covid-19 pandemic, which played a significant role in depressing trade.

Commodity-wise, grain farmers have been experiencing a significant boost to trade conditions due to high grain prices resulting from the Russia-Ukraine war, the drought in South America, and rising demand for grains and oilseeds from China.

Horticulture producers have also seen a boost in trade; however, this has been dampened by trade bans implemented by traditional markets such as the European Union (EU), and logistical challenges and supply chain disruptions at ports, that have negatively affected their profitability. The livestock industry has also experienced some significant challenges, particularly the temporary blockage of markets such as China in the face of a biosecurity challenge, i.e., foot-and-mouth disease.

However, these challenges cannot completely undermine the positive indicators that underpin farmers' confidence, especially in view of the sustained growth of agricultural exports in the Western Cape, as can be noted from **Table 3**.

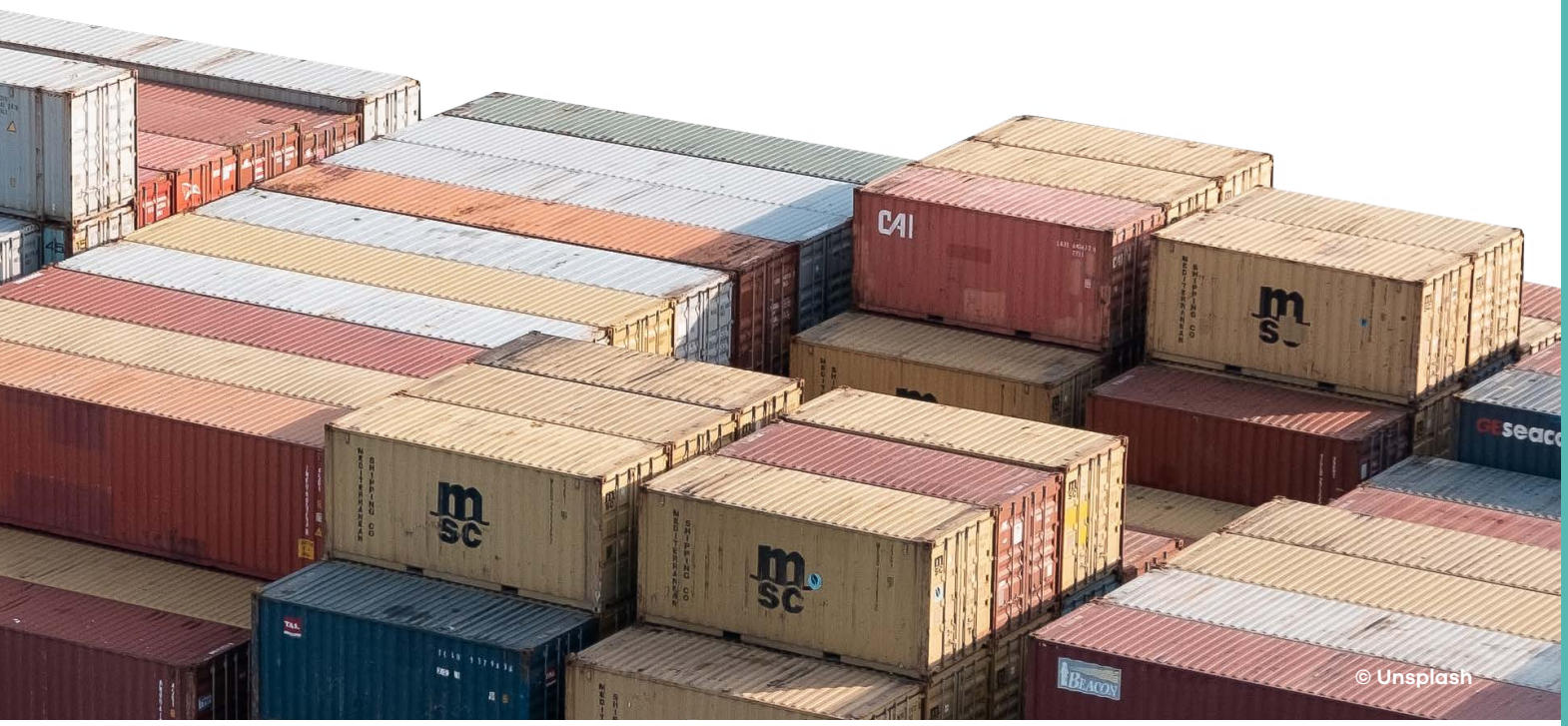


[5] South Africa's national electricity utility, Eskom, implements rolling blackout referred to as 'load shedding' – the action of cutting electricity supply to some areas when generation capacity is lower than demand.

Table 3: Largest agricultural and agro-processing exports by value, 2020

#	Description	2020 Exports (R million)	Real growth 2019 – 2020
1	Oranges	8 623	49%
2	Table grapes	7 347	16%
3	Bottled wine in containers holding 2 litres or less	6 633	15%
4	Apples	6 146	35%
5	Mandarins	5 369	80%
6	Lemons	2 995	68%
7	Pears	2 995	23%
8	Cranberries, bilberries	2 010	32%
9	Wine of fresh grapes include fortified wines and grape must	1 951	6.2%
10	Flours, meals and pellets of fish or crustaceans	1 679	110%

As shown in Table 3, citrus fruits have performed particularly well in the export market, outperforming traditional high-value commodities in the Western Cape such as table grapes, wine, and apples.



POLICIES AND REGULATIONS

South Africa has an extensive range of policies and regulations governing the country's agricultural sector. More information about these is available on the Plan and Policies tab of the GreenAgri portal **here**.

3.1. Updates on policies and regulations

The 2022 Sustainable Agriculture Market Intelligence Report (MIR) highlighted key policies and legislation, both national and international, that had an impact on the South African agricultural sector. As South Africa seeks to provide greater policy certainty to encourage investment in the economy, the national and international policies affect the (geo)political landscape that underpins the viability of the South Africa's agricultural sector. Changes to key policies and regulations highlighted in the 2022 Sustainable Agriculture MIR are summarised in **Table 4**.

Table 4: Updates on policies and regulations highlighted in the 2022 Sustainable Agriculture MIR

	Policies and regulations	Updates for 2023
National	**Land Reform – Draft 18th Amendment Bill** The Joint Constitutional Review Committee (JCRC) advised that Section 25 of the Constitution of South Africa should be amended to allow for expropriation of land without compensation. Following that, a draft amendment bill, *Draft Constitution 18th Amendment Bill (Section 25 Amendment)* was published where it described the circumstances upon which "It may be just and equitable for nil compensation to be paid where land is expropriated in the public interest, …"	Having made it to the National Assembly (NA), the Bill failed to make it through the parliamentary vote with a two-thirds majority (Mokoena, 2021). Although the proposal for the Amendment of Section 25 of the Constitution failed, several outstanding bills and policies need to be addressed to enable land reform, including the *Land Reform (Labour Tenants) Act 3 of 1996*, and the *National Policy on Comprehensive Producer Support*.
	Cannabis for Private Purposes Bill Following amendments made to the schedules of the Medicines and Related Substances Act, No. 101 of 1965 (Medicines Act), the Minister of Justice and Correctional Services introduced the *Cannabis for Private Purposes Bill* that sought to "respect the right to privacy of an adult person to possess cannabis plant cultivation material; regulate the possession of cannabis plant cultivation material and protect adults and children against the harms of cannabis." However, the recreational use of cannabis and cannabis products remained restricted, and thus acted as a barrier for the growth of an industry with an estimated market size of R28 billion.	In March 2022, the Minister included significant amendments to the bill, expanding the limits of cultivation and possession beyond personal use. With support from the Department of Trade, Industry and Competition (dtic) – and in response to input from public hearings on the bill – amendments were made to allow for licensed commercial cultivation and sale of cannabis for recreational purposes (Department of Justice and Correctional Services, 2020). The licensing scheme, aimed at regulating the recreational industry, would encourage local economic growth and investment, and aims to give preferential access to rural communities historically involved in the industry (Harper, 2022). The amendments to the bill are still undergoing public participation hearings.
	Climate Change Bill In October 2021, the *Climate Change Bill* was tabled in Parliament to "enable the development of an effective climate change response and a long-term, just transition to a climate-resilient and low-carbon economy and society for South Africa in the context of sustainable development"	The *Climate Change Bill* is still under consideration by the National Assembly and is undergoing public participation to gather comments from the wider public. Public participation sessions continue to take place into 2023. Additionally, the Department of Environment, Forestry and Fisheries (DEFF) – in partnership with the Presidential Climate Commission (PCC) – presented the Climate Change Bill at the 2022 Conference of the Parties (COP27) of the United Nations Framework Convention on Climate Change (UNFCCC).

	Policies and regulations	Updates for 2023
	Carbon Tax Act The first phase of the *South African Carbon Tax Act (No 15 of 2019)* came into effect in June 2019, running until December 2022 with the second phase coming into effect from 2023 until 2030. The carbon tax rate was set at R120/tCO_2e in 2019, rising to R127 and then R134 in 2020 and 2021 respectively, due to inflation. As the agricultural sector is exempted from phase one of the bill, farmers have an opportunity to generate revenue by obtaining carbon credits through carbon offsetting.	In the 2022 Budget Speech, the first phase of the carbon tax was extended by three years to 31 December 2025, with the carbon tax rate increasing to R144 per tCO_2e for the 2022 calendar year. With the extension of phase one to December 2025, the agriculture sector is granted a reprieve as the sector would only be subject to inclusion in the Carbon Tax Act in phase two (Kotze, *et al.*, 2022). However, amendments have been proposed in the draft Taxation Laws Amendment Bill to limit the carbon sequestration deduction to forestry plantations. This is to address concerns about the real value of carbon sequestered in production of harvest wood products.
International	**African Continental Free Trade Area (AfCFTA)** Since the beginning of 2021, intra-Africa trade has been conducted under the AfCFTA as a drive to boost intra-continental trade – only 17% of African exports in comparison to exports to Asia (59%) and Europe (68%). In 2017, total intra-African trade was valued at US$24.4 billion, with South Africa as a main exporter of agricultural commodities to the rest of the continent. Main intra-Africa agricultural exports are palm oil, sugar, maize, rice and cigarettes, where South Africa contributed 15% of sugar exports and 54% of maize exports (Trade Law Centre, 2019).	A notable development in the instruments linked to the AfCFTA has been the launch of the Guided Trade Initiative (GTI) in October 2022. The GTI aims to test the AfCFTA's policies, legal framework and operation and institutional environments as they pertain to the free movement of goods through customs clearance. Eight countries – Cameroon, Egypt, Ghana, Kenya, Mauritius, Rwanda, Tanzania and Tunisia – have all met the minimum requirements to participate in the GTI and allow the shipment of goods between these countries. These include goods such as ceramic tiles, sisal fibre, batteries; and beverages and foodstuffs like tea, coffee, processed meat products, corn starch, sugar, pasta, glucose syrup and dried fruits. The intended outcome of this initiative is to develop frameworks whereby the AfCFTA can be used as a catalyst for African nations to address infrastructure gaps and improve manufacturing capacity so that local production and regional trade can thrive (Subban, 2022).
	EU Green Deal and Farm-to-Fork Strategy Europe is the Western Cape's biggest export destination for agricultural products, accounting for 41% of the total agricultural exports (Morokong, *et al.*, 2022). The Farm-to-Fork (F2F) Strategy looks at how the EU's food chain can be revolutionised to contribute to the EU's target of carbon neutrality by 2050. Initial aims of the F2F Strategy were: making 25% of EU agriculture organic by 2030; 20% reduction of fertiliser use by 2030; 50% reduction of chemical pesticides by 2030; and 50% reduction of EU sales of antimicrobials (European Commission, 2020).	While the targets of the F2F Strategy is still under deliberation, South African agricultural producers are concerned about whether the EU will introduce a 'mirror clause' that will require foreign producers to comply with the same production standards as EU producers, to allow EU producers to remain competitive whilst encouraging sustainable food production methods outside of the EU (Bell, 2022). SA producers continue to organise engagements, both with local producers and international experts, to gain a sense of what shifts in production will be needed to maintain access to the EU market once the F2F Strategy is active.

3.2. New policies and regulations

3.2.1. Agriculture and Agro-Processing Master Plan

A key initiative being driven at national level is the Agriculture and Agro-Processing Master Plan (AAMP). The AAMP is one of a number of sector-specific social compacts co-created by government, business, labour and civil organisations.[6] The AAMP was signed by the compact partners in May 2022.

The AAMP seeks to support the growth of the sector on an equitable and inclusive basis, and to enable a sector that is internationally competitive, has a predictable policy environment, and is aligned with international best practices regarding both sustainability and labour conditions, from primary production level all the way across the value chain.

The specific objectives of the AMMP are:

i. **increased food security** in South Africa;

ii. the promotion and acceleration of **sustainable transformation** in the agriculture and agro-processing sectors;

iii. **improved access to local and export markets,** which will require constant upgrades in the quality of supply to bolster South Africa's competitiveness;

iv. **enhanced competitiveness and entrepreneurship opportunities** through technological innovation, innovative financing models for black farmers, infrastructure construction and digitalisation;

v. the creation of an **effective farmer support system and agro-processing incentives**;

vi. the creation of **decent, growing and inclusive employment**, in addition to improving working conditions and fair wages in the sector;

vii. **improved safety of the farming community** and reduced stock and crop thefts and farm attacks;

viii. the creation of a **capable state and enabling policy environment**; and

ix. enhanced **resilience to the effects of climate change** and promotion of sustainable management of natural resources.

[6] Other masterplans of relevance to the agriculture and forestry sector are outlined in the 2022 Sustainable Agriculture Market Intelligence Report.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OPPORTUNITIES, DRIVERS AND BARRIERS

The opportunities highlighted in this section fall under the category of climate smart agriculture (CSA) – "a framework for an integrated approach to managing landscapes (cropland, livestock, forests and fisheries) that address the interlinked challenges of food security and climate change" (World Bank, 2021).


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The intended outcomes of CSA are as follows:

i. **Increased productivity:** intensifying food production and nutritional diversity to meet the food and nutrition demands of the world population, whilst providing a source of income for those who live in rural areas and rely on agriculture as a source of food and income.

ii. **Enhanced resilience:** improve the ability of agricultural production to mitigate against production losses due to climate related risks and shocks, and improve its ability to rebound from prolonged stresses such as erratic weather patterns.

iii. **Reduced emissions:** transition to production systems that emit less greenhouse gases whilst maintaining productivity, avoid deforestation and biodiversity loss from agriculture and absorb carbon out of the atmosphere.

(World Bank, 2021)

As the agricultural sector faces an existential threat due to climate change, several different adaptation pathways must be identified to ensure that the sector is able to produce enough to meet the current generation's food and textile needs, whilst not compromising on the ability of the next generations to meet their own needs.

Nevertheless, these threats can also be considered as opportunities for investment and development as agricultural producers invest increasingly in sustainable agricultural production methods. The investment opportunities in sustainable agriculture stem from reducing input costs, either through greater resource efficiency or alternative production methods, protecting productive land and increasing the quality and quantity of output, and introducing greater circularity within production. The following investment opportunities in sustainable agriculture are discussed in this section:

4.1. Renewable energy applications
4.2. Regenerative agriculture
4.3. Smart farming
4.4. Circular agriculture

Previous Sustainable Agriculture MIRs have delved deeply into each of these opportunities and can be accessed to provide more context. The section below highlights key technologies within each opportunity, which are well placed to support producers in the agricultural sector in shifting to sustainable agriculture to protect and even expand agriculture on current productive land.

4.1. Renewable energy applications

Energy accounts for approximately 6% of total expenditure in agriculture – in the Western Cape alone, agricultural producers spent a combined R3.4 billion on electricity and fuel in 2017[7]. The agricultural activities that use the most energy on farms are refrigeration, heating, irrigation and operation of equipment and machinery.

Previous MIRs identified the investment opportunities for small-scale solar PV and solar-powered irrigation systems. The drivers for these technologies – rising electricity costs; decreasing costs of solar; increasing inconsistency in electricity supply threatening agricultural production – remain as relevant this year as they have in the past.

There have been no major changes in the macro environment, other than an increased number of technology suppliers coming in with innovative financial models for agricultural producers.

[7] Statistics taken from the 'Census of commercial agriculture, 2017' released by Statistics South Africa (StatsSA). The census provides the most accurate data for South Africa's agricultural sector.

Featured case study

An example of how technology suppliers have entered the market with increasingly innovative financial models is Sun Exchange. Sun Exchange is self-described as the world's first peer-to-peer leasing platform. The company identifies solar PV projects to provide electricity to businesses through power purchase agreements (PPAs) and raises the funds for the projects through crowd-sales where members of the public can invest in individual solar cells. Investors earn their investment back from revenue generated through the PPAs. Sun Exchange assumes responsibility for the capital investment and maintenance costs of the full system whilst providing electricity at prices typically lower than those of Eskom, offering businesses the opportunity to purchase low-carbon electricity without having to take on the burden of the initial capital outlay.

While Sun Exchange does not work exclusively in the agricultural sector, it does have a number of projects with agricultural producers, such as Groot Constantia (164 kW solar system), Bo Karoo Farm (108 kW solar system), Karoo Fresh (332 kW solar system + 640 kWh storage), and Buhle Farmers' Academy (48.6 kW), to name a few. The owner of Karoo Fresh, Eric Brown, commented that "having access to continuous, reliable, affordable clean energy is a game-changer that will enable [them] to sustainably expand the reach and impact of [their] agriculture business" (Omarjee, 2022). It is expected that the project will assist Karoo Fresh in cutting its diesel use by 90 000 L per annum, which translates to around R2.3 million and 240 metric tons of carbon dioxide emissions annually.

4.1.1. Featured technology: solar drying

While renewable energy alternatives such as solar PV systems, solar-powered irrigation systems and wind energy have remained popular, there are other technologies which could have substantial potential in agriculture, particularly solar drying technology. More detail on these investment opportunities is provided in **Table 5**.

© Sun Exchange

Table 5: Investment opportunities in renewable energy – 2023 featured technologies

Opportunity				
Renewable energy applications				
Solar applications				
Key technologies	**Drivers**	**Barriers**	**Term**	**Western Cape (WC) market size**
Solar dryers	• High electricity and diesel prices • Policy-level push for greater on-farm processing/ beneficiation (e.g., AAMP in Section 3.2.1)	• Lack of technical expertise • Lack of financing (outside of government grants)	Medium	**R372 million** Assuming 10% conversion of 3084 total dryers for agricultural use in WC = 308 solar dryers Solar dryer cost[8] = R1.2 million[9]

Solar drying technology presents an exciting opportunity in agriculture, not only as an opportunity for greater beneficiation on farms but also as an environmentally sustainable method of reducing post-harvest losses in low- and middle-income countries. This technology has successfully penetrated markets in Asia and Africa, such as India, China, Kenya and Burkina Faso. South Africa's agricultural sector is an untapped market for this technology.

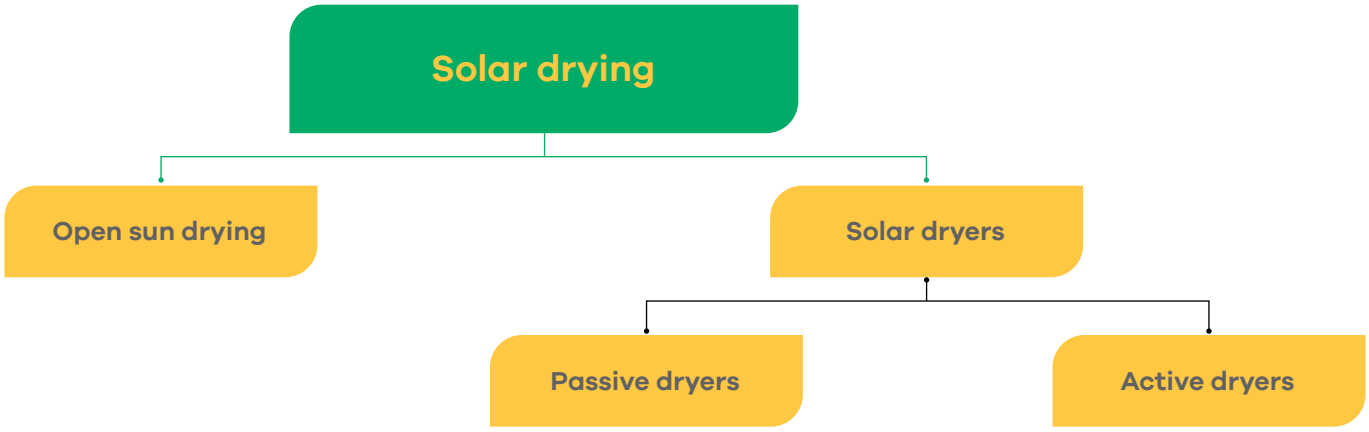

Figure 6: Main classification of solar dryers

Source: Adapted from (Udomkun, *et al.*, 2020) & (Balasuadhakar, *et al.*, 2016).

[8] Cost of a 1 000 kg capacity greenhouse dryer for fresh products.

[9] Based on US$ = R17.00 conversion rate. Solar dryer price = US$71 000.

A summary of the different types of solar drying technologies is provided in **Figure 6**. In this figure, solar dryers are categorised by the method of air movement (natural or forced convection). The classifications are expanded on below:

- **Passive dryers**
  Passive solar dryers use natural convection of air to dry agricultural products. Agricultural products are placed in batches within an insulated box and are dried by solar-heated air that circulates due to the natural force of buoyancy and/or because of air pressure. Passive solar dryers such as cabinet and greenhouse dryers are simple and cheap to construct, composing of an insulated box with inlet and outlet holes. The efficiency of these types of solar dryers depends on operation parameters – direct passive dryers have an efficiency range of 20% to 40% compared to indirect passive dryers, whose drying efficiency averages 13% to 25%. Cabinet and greenhouse dryers both operate using natural convection. Cabinet dryers are best suited for small-scale drying of fruit and vegetables, while greenhouse dryers can be used for large-scale drying of multiple agricultural products.
- **Active solar dryers**
  Active solar dryers use fans, pumps or blowers that run on electricity to circulate heated air, in contrast to the natural forces of buoyancy and air pressure utilised in passive dryers. Control of the air mass flow rate means that active solar dryers can achieve greater drying efficiency and product quality compared to passive dryers. It is for this reason that active dryers are better suited for crops with a higher moisture content, such as kiwi and papaya. However, active dryers constitute a bigger capital investment than passive dryers and require greater technical expertise to operate and maintain.

4.1.1.1. Key drivers and barriers of featured technology

Drying is a practical means for extending the shelf-life of agricultural product, reducing post-harvest losses, and improving the quality of products making their way into market. Solar dryers are considered a simple but effective method of drying agricultural products in comparison to more conventional fuel-fired boilers.

A limitation of solar dryers in commercial settings is the difficulty in controlling the temperature and speed of heated air applied, which may lead to variation in product quality. However, this suggests that the technology would be most applicable for smaller operations such as small-scale emerging farmers, where outputs are small enough to effectively dry goods to specifications.

4.1.1.2. Suggested target market

In the Western Cape, farms that produce fruits such as tomatoes and apricots, as well as nuts, would be well-positioned to invest in solar dryers as there are existing markets for goods such as dried fruits and nuts. The relatively higher value of these commodities would also suggest that those farmers are better placed to make the required capital investment, provided that a clear business case for the technology has been made.

Featured case study

Zizamele Farmers' Cooperative, based near Coffee Bay in the Eastern Cape, is a group of 20 women who grow lemon grass on two hectares of land (Joubert, 2012). The cooperative, launched in 2009, supplies dried lemon grass as flavouring for rooibos tea produced by the Cape Natural Tea Products in Cape Town. The cooperative has seen many successes but experienced a major set-back when half of their December 2010 harvest had to be thrown away due to mould (Bulungula Incubator, 2011). The humidity of the local climate made fungus a problem during the drying process. In an effort to explore a more effective method for drying the lemon grass leaves, they were able to procure a solar dryer. Access to the solar dryer, which is a more efficient method of drying to open sun drying and more cost-effective than traditional fuel-fired boilers, has supported the ability of Zizamele Farmers' Cooperative to continue to supply their market consistently (Bulungula Incubator, 2011).

Marquis Macadamias (Africa) is South Africa's largest macadamia processor, supplying 20% of global kernel demand through Marquis Marketing (Arnoldi, 2021). One of their processing plants, located in Alkmaar near Nelspruit, Mpumalanga, is designed to cure 6 000 tonnes of dry wet-in-shell macadamia nuts to a kernel moisture content of 2%. The curing system is solar assisted, with sunlight providing approximately 85% of the heating needs whilst electric heating elements provide the balance (Nel, 2015). The system collects solar heat at a 400 m^2 section of the factory roof that is transferred to the air used to cure the nuts. The processing plant is a complete shift from the conventional fuel-fired boilers previously used. The capital cost of the systems is 40% less than a shell-fired boiler, with a calculated repayment period of 18 operating months (Nel, 2015).

4.1.1.3. Market insights

Food loss and waste management

A waste management guideline compiled by the Department of Environment, Forestry and Fisheries (DEFF) and the Council for Scientific and Industrial Research (CSIR) estimated that 5.1 million tonnes of food are lost at primary production and post-harvest handling and storage stages of the agriculture value chain in South Africa (DEFF & CSIR, 2021). **Table 6** breaks down the estimated percentage waste generated at each stage per commodity group. The commodity with the highest losses was fruit and vegetables, with an estimated 66% wastage that included both local produce and imports.

Table 6: Estimated waste percentage per commodity group at each stage of the supply chain for sub-Saharan Africa

Source: (DEFF & CSIR, 2021)

Commodity group	Agricultural production	Post-harvest handling & storage	Processing & packaging	Distribution	Consumer	Total
Cereals	6.0%	8.0%	3.5%	2.0%	1.0%	**20.5%**
Roots & tubers	14.0%	18.0%	15.0%	5.0%	2.0%	**54.0%**
Oil seeds & pulses	12.0%	8.0%	8.0%	2.0%	1.0%	**31.0%**
Fruit & vegetables	10.0%	9.0%	25.0%	17.0%	5.0%	**66.0%**
Meat	15.0%	0.7%	5.0%	7.0%	2.0%	**29.7%**
Fish & seafood	5.7%	6.0%	9.0%	15.0%	2.0%	**37.7%**
Milk	6.0%	11.0%	0.1%	10.0%	0.1%	**27.2%**

The huge amount of food waste along the value chain illustrates that agricultural producers, particularly fruit and vegetable farmers, who can make the investment in better agricultural production and post-harvest handling and storage would be able to benefit from increased revenue as more products would be making it to market.

4.2. Regenerative Agriculutre

Regenerative agriculture (RA) is a holistic farm management concept that not only includes maintaining current soil health but also rehabilitating soil that has been degraded due to exploitative production practices.

It encompasses conservation agriculture (CA), whose scope more narrowly looks at practices that preserve the health of soil during farming only.

The three main principles of CA are minimum soil disturbance, permanent soil cover and crop rotation (FAO, 2022).

In RA, this includes additional principles of living roots and animal integration. Previous MIRs provide further information about RA as a key opportunity in sustainable agriculture. **Figure 7** describes the steps to transition from conventional agriculture to regenerative agriculture.

Figure 7: Seven steps towards regenerative agriculture[10]

[10] HEI = High External Inputs, LEI = Low External Inputs

Various studies focussed on the implementation of CA principles on South African farms have shown that CA farms experience increased yields with increased biodiversity of crops and food, improved soil health and moisture retention, with decreasing use of inputs such as fertiliser, pesticides and herbicides over the long-term (Strauss, *et al.*, 2021) (MacLaren, *et al.*, 2018) (Conradie, *et al.*, 2021).

South Africa has seen a slight increase in cropland under no or minimum tillage (25% in 2021 compared to 23% in 2015) but continues to lag behind other nations such as the MERCOSUR[11] countries, which have a conservation agriculture adoption rate of over 70% of total cultivated area.

There is considerable space for expansion of conservation agriculture (see **Table 7**) and thus for growth in the attendant markets for the specific green technologies highlighted here.

Table 7: Extent of adoption of conservation agriculture in South Africa

Source: (Smith, 2021)

Province	Total annual crop area (ha)	Area under conservation agriculture in 2021 (ha)	Conservation agriculture adoption in 2021
Western Cape	1 569 277	804 866	51%
North West	890 437	330 464	37%
Mpumalanga	850 484	205 598	24%
Free State	2 196 986	73 520	3%
KwaZulu-Natal	164 620	62 956	38%
Limpopo	255 866	68 834	27%
Gauteng	173 435	57 649	33%
Eastern Cape	160 307	3 194	2%
Northern Cape	69 498	0	0%
TOTAL	**6 330 910**	**1 607 081**	**23%**

As can be seen in **Table 7**, the Western Cape has the highest CA adoption rate in South Africa, indicating a healthy market for regenerative agriculture inputs and equipment.

Climate change modelling for the province indicates that the province will experience longer periods of drought in the coming years, which is likely to drive more farmers to shift to regenerative agriculture.

4.2.1. Featured technologies: no-till tractors and biostimulants

This section provides updates on market size and insights for specific technologies, namely no-till tractors and biostimulants. More detail on these investment opportunities is provided in **Table 8**.

[11] Southern Common Market (Spanish: *Mercado Común del Sur*, abbreviated as MERCOSUR) is a South American trade bloc consisting of Argentina, Brazil, Paraguay and Uruguay as full member countries.

Table 8: Investment opportunities in regenerative agriculture – 2023 featured technologies

Opportunity				
Conservation agriculture				
Soil remediation				
Key technologies	**Drivers**	**Barriers**	**Term**	**Western Cape (WC) market size**
No-till tractors	• Increased water use efficiency • Reduced diesel usage • Greater weed control • Increase in RA farmers in the WC, particularly grain farmers, will likely drive other farmers to do the same • Increased number of CA farmer = increased demand for no-till machinery • Opportunities to generate carbon credits through carbon sequestration	• Retrain farm workers to operate no-till tractor • High capital cost in comparison to conventional till tractors	Short – medium	**R1.3 billion** Assuming 10% conversion of 16 561 tractors in WC [12] = 1 656 tractors No-till tractor cost = R800 000
Bio stimulants	• Reduced yield dip timeframe associated with shifting to regenerative agriculture • Improved quality, quantity and consistency of yield • Effective treatment for transplant shock of fruit trees	• Commercial product ranges remain limited • Biostimulants fall under the subcategory of fertiliser by definition; therefore, subject to administrative red-tape for certifying products for commercial use • Lack of industry standards in South Africa	Medium – long	**R217 – 435 million** Sprays within foliar application at 2 – 4 L/ha 804 866 ha under conservation agriculture in the Western Cape Biostimulants = R135/L

[12] Statistics taken from the 'Census of commercial agriculture, 2017' released by Statistics South Africa (StatsSA). The census provides the most accurate data for South Africa's agricultural sector.

4.2.1.1. Key drivers and barriers of featured technologies

There has been an increased awareness among farmers of regenerative agriculture (RA) and conservation agriculture (CA) practices and their benefits, particularly in how RA and CA practices can assist in making farms more resilient to shocks such as droughts and increasing input costs. CA clubs and groups created by farmers and other stakeholders, such as commodity associations, have been key role players in supporting the increased adoption of CA in South Africa (Smith, 2021). Moreover, these structures have been useful knowledge-sharing platforms, where farmers are able to organise themselves and collaborate with international and local CA researchers, local service providers, and agribusiness.

The high capital cost of no-till machinery remains a barrier to uptake, though increased local manufacturing of no-till machinery is expected to reduce the price. Moreover, farm workers who have previously operated conventional till machinery have to undergo retraining to operate no-till machinery.

For biostimulants, the range of commercial products available in South Africa remains limited, as was the case previously. Moreover, the biostimulants are classified fertilisers under the Fertilisers, Farm Feeds, Seeds and Remedies Act 36 of 1947. Therefore, they are subject to administrative red-tape for certifying products for commercial use.

4.2.1.2. Suggested target markets

In the Western Cape, grain farmers have been at the forefront of CA adoption as most of the hectares under grain are dryland. Grain farmers were particularly hard hit by the drought experienced in 2016. Producers were able to see stark contrasts between those using conventional agriculture and regenerative agriculture in the ability of soils to retain moisture, crop yields and resilience during and after periods of drought. The grain sector in particular is a lucrative market for CA technologies, particularly no-till machinery such as harvesters, drill planters, etc.

4.2.1.3. Market Insights

Geopolitical instability

Rising global inflation, limited fertiliser exports from Russia and China – due to the Russia-Ukraine war and Covid-19 lockdown-related supply constraints, respectively – have exacerbated the sharp upward rise of input costs in South African agriculture and agribusiness, particularly fertiliser costs. Russia and China alone account for over a quarter of global exports (14% and 12% of global exports, respectively). Without clear sight of a resolution in the foreseeable future, farmers are looking for alternatives in either procuring domestic supply or shifting to farming practices that cut out fertiliser use.

Growth in the agriculture sector

Despite increased costs of inputs such as fertilisers, agrochemicals, fuel and electricity, the agriculture sector continues to show growth (14.9% y/y in 2020 and 8.8% in 2021). This is echoed in tractor sales in South Africa, which remain positive with 48% year-on-year growth in October 2022. The healthy financial condition of some farmers, specifically grain and oilseed producers, is one explanation for this growth. Grain prices remain high as the Russia-Ukraine war limits grain exports from Ukraine and Russia, both major producers of grain (Sihlobo, 2022). Furthermore, the drought in South America and rising demand for grains and oilseeds in China have exacerbated price increases. Indicators such as the Crop Estimates Committee's farmer intention-to-plant data show that farmers intend to increase their area planting for summer grains and oilseeds by 0.2% y/y to 4.35 million hectares in the 2022/23 season (Sihlobo, 2022). With the factors elevating grain and oilseed prices unlikely to be resolved soon, and favourable rains anticipated for the summer season, the farmers' optimism in the future and willingness to invest in moveable assets is likely to remain.

4.3. Smart farming

Smart farming refers to the use of technology to better inform where and how resources are dispensed on a farm. Over recent years, more local suppliers of smart farming technology have emerged. Previous hesitancy seen among farmers has eased as the applications become more tailored to South African farmers' needs and experience.

Farmers are starting to see the benefit of investing in smart farming technologies, particularly in the face of the increasingly unpredictable impacts of climate change. Other drivers of increased farmer interest have been the clear financial savings technology that suppliers have been able to demonstrate to farmers.

4.3.1. Featured technologies: farm management applications, precision spraying via drones and drip irrigation

There are several technologies that can be categorised under smart farming, as illustrated in **Figure 8**.

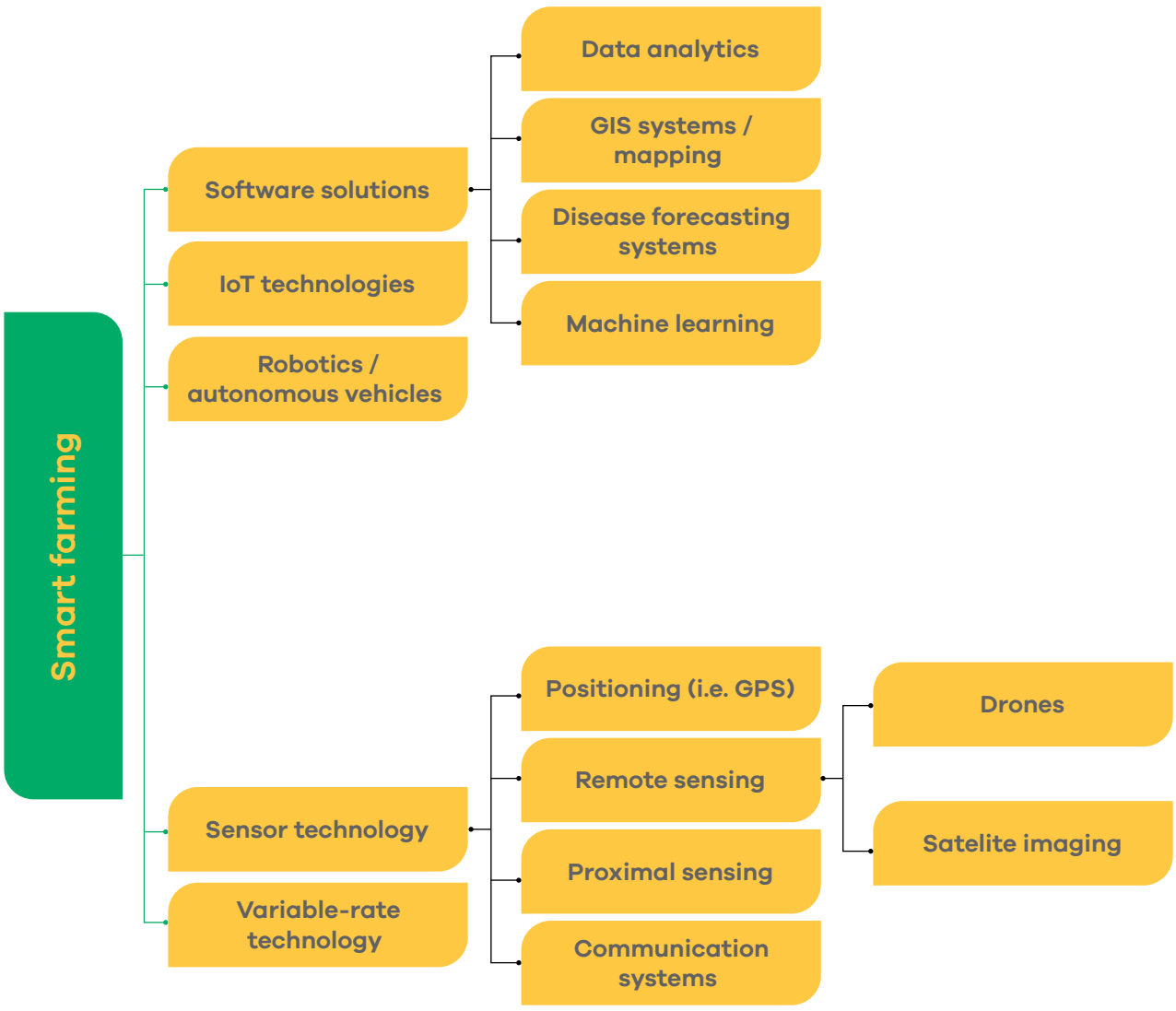

Figure 8: Aspects of smart farming

Source: GreenCape, 2020

Smart farming technologies that are showing particular potential are farm management applications, precision spraying via drones, and drip irrigation. More detail on these opportunities is provided in **Table 9**.

Table 9: Investment opportunities in smart farming – 2023 featured technologies

Opportunity				
Smart farming				
Internet of Things (IoT)				
Key technologies	**Drivers**	**Barriers**	**Term**	**Western Cape (WC) market size**
Farm management applications	• Greater efficiency at production level • Need for greater traceability from retail and export markets	• Low levels of digital literacy at farm management/owner level • Low internet bandwidth in rural areas	Medium	**R1.3 million/annum** Assuming: 10% conversion ~2 585 horticultural farm units in WC Cost/annum = R5 000[13] /farm unit
Smart farming				
Precision farming				
Key technologies	**Drivers**	**Barriers**	**Term**	**Western Cape (WC) market size**
Precision spraying via drones	• Reduced use of pesticides • Reduced runoff into rivers/streams, limiting pollution into local water systems • Cheaper alternative to spraying via planes • More efficient than conventional, manned-spraying, particularly with tall crops such as sugar, wheat etc.	• Minimum viable size > 10 ha • High capital investment • Tight regulations and licencing requirements for drone pilots	Short	**R10 million/season (for wheat)** Assuming: 10% conversion Wheat planted in WC = 338 588 ha Cost/season = R300/ha[14] **R1.8 million/season (for fruit trees)** Assuming 10% conversion Fruit trees planted in WC = 39 927 ha Cost/season = R450/ha[15]

[13] Based on € = R17 exchange rate. Annual subscription cost = €299/farm unit

[14] Costs obtained from industry engagements

[15] Costs obtained from industry engagements

Smart farming				
Precision farming cont.				
Key technologies	**Drivers**	**Barriers**	**Term**	**Western Cape (WC) market size**
Drip irrigation	• Greater irrigation efficiencies – water delivered directly to roots • Lower water usages (~10 kL/ha water reduction)	• Higher capital cost than other irrigation systems	Short	**R302 million – 1.5 billion** 302 684 ha dryland in WC 10% conversion = 30 268 ha Drip irrigation cost range = R20 000 – 100 000/ha[16]

4.3.1.1. Key drivers and barriers of featured technologies

The technologies highlighted within this opportunity are all useful tools for improving resource efficiencies on farms, and thus reducing waste and production losses. The continued rise of agricultural input costs is a driver for farmers to implement technologies which will allow them to reduce resource usage, while not compromising on productivity.

Effective management of water, in particular, has been a concern noted by agricultural producers throughout stakeholder engagements. Climate projections for the Western Cape (WC) have predicted that the province will experience fewer rainfall events with productive agricultural areas becoming hotter and dryer in the coming years. The agricultural sector in South Africa is the country's largest water user, accounting for 60% water usage, and sharper focus has been drawn on the ethical and responsible use of water on farms.

Already, models for land and water stewardship have seen primary producers held accountable for efficient use of water resources, as well as better application of chemicals such as pesticides to reduce runoff and contamination of nearby water bodies.

However, the relatively higher capital costs of drip irrigation infrastructure (compared to other irrigation types) and service costs of precision spraying (compared to conventional manned-spraying) are barriers to uptake for these technologies, even though cost savings of reduced resource use over time makes the technologies competitive.

With farm management applications (apps), access to information can assist farmers to make informed decisions faster. Improving the ability of producers to closely track resources, labour and assets can help farmers reduce wastage and optimise production through effective management.

In addition, farm management apps can be useful tools for managing the reporting requirements for accreditations such as GLOBALG.A.P., SIZA, and the Rain Alliance.

A significant barrier to uptake of farm management apps is the low levels of digital literacy within the agricultural sector. According to the McKinsey Global Institute Industry Digitisation Index, agricultural and hunting industries have the lowest levels of digitisation globally in terms of assets, usage and labour (McKinsey, 2016). In South Africa, this is exacerbated by poor network connectivity in rural areas, where most agricultural production takes place (Aguera, *et al.*, 2020).

[16] The capital cost of a drip irrigation system can depend on a few variables, such as surface or subsurface installation, sprinkler spacing, water qua\

4.3.1.2. Suggested target markets

Farm management applications (apps) is a technology that is applicable across all agricultural producers, at all scales. Since the primary benefit of farm management apps is the effective use of resources on the farm and improved decision-making by agricultural producers, it is a technology that is useful for any agricultural production.

Precision spraying, using drones, is well suited for tall crops, namely wheat, sugar and fruit trees over more than 10 hectares of land. Although sugarcane is no longer planted in the Western Cape (WC), wheat and fruit trees are significant crops grown within the province.

In fact, wheat production accounts for the largest area of productive agricultural land in the WC, followed by orchards (see **Figure 5** in **Section 2.3.1**).

Drip irrigation is most applicable for row crops, orchard and vineyards (South African Irrigation Institute, 2021), especially crops which are particularly susceptible to pests and mould that thrive in damp conditions. As stated previously, the WC has a substantial number of hectares of vineyards and orchards which would be well placed to invest in drip irrigation.

4.3.1.3. Market insights

Offline access

More farm management apps are tailoring their apps for the South African context where rural connectivity remains lower than in urban settings (Aguera, *et al.*, 2020).

As such, these apps have additional functionalities which allow production data to be inserted on a smartphone or tablet without connectivity and uploaded into the cloud once internet access is restored. The apps also allow data to be recorded via electronic ID reader, if farmers use radio frequency identification tags. These system additions will assist in lowering the barrier to uptake for these farm management apps.

4.4. Circular agriculture

The circular economy is defined as an economy that "designs out waste, regenerates ecosystems and keeps products, components and materials at their highest use/value for as long as possible" (Ellen MacArthur Foundation, 2017). This requires agents in the economy to shift from a traditional linear economy of *Take, Make and Dump* to a circular economic model that follows the principles of *Reduce, Reuse and Recycle* (Farnham, 2021). A circular economy can be more resource efficient and potentially more resilient than the traditional linear economy in instances where producers are able to use circularity to reimagine production systems that have greater cost savings, income diversification, and increased profitability.

In agriculture, that means an approach which looks at how the production can become more efficient with resource usage and management in the food and textile system. For most South African agricultural enterprises, production remains linear and agricultural producers lose out on the opportunity to extract greater value from waste streams that would typically be disposed of.

4.4.1. Featured technology: anaerobic digestion

Previous MIRs have unpacked the opportunities for biogas generated from anaerobic digestion (AD) as an alternative energy source in agriculture, but there is a business case to be made for investing in AD as a tool for waste and wastewater management and beneficiation. **Figure 9** shows how AD technology can provide a solution to a growing number of issues in the agricultural sector, in particular: energy security for both seasonal and continuous production; management of agricultural waste residues and wastewater; and replacement of chemical-based fertilisers with a nutrient-rich soil enhancer.

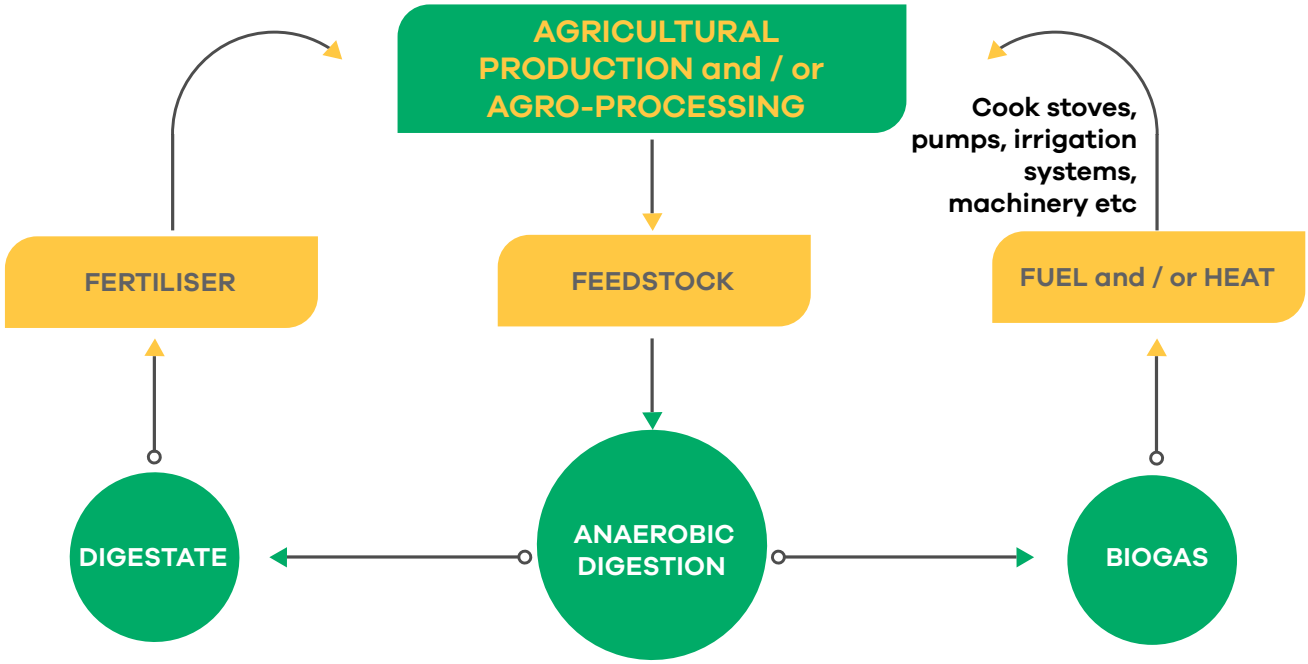

Figure 9: Circular use of agricultural waste using anaerobic digestion

The South African Biogas Industry Association (SABIA) has a **biogas map**, identifying industrial-scale anaerobic digestion plants in South Africa. Using the SABIA biogas map and insights gained through biogas project engagements, 14 industrial-scale anaerobic digestions plants with feedstocks derived from agriculture and agro-processing sectors were identified with the Western Cape. These plants operate using feedstocks from the following sectors:

- Agro-processing: Abattoir (2), Fruit juice (2); Distillery (4); Food processing (1), Breweries (1)
- Piggery (1)
- Poultry (1)
- Vegetable farm (1)
- Dairy (1)

Table 10: Investment opportunities in circular agriculture – 2023 featured technology

Opportunity				
Circular agriculture				
Waste-to-soil				
Key technologies	**Drivers**	**Barriers**	**Term**	**Western Cape (WC) market size**
Anaerobic digestion	• Legislative and market pushes for lower carbon emissions on farm • Ability to generate energy for heating applications • Increasing number of reliable technology suppliers • Provincial ban of organic waste at landfills • Anticipated second phase of Carbon Tax Act which will affect the agricultural sector	• Most applicable for feedlots – requires initial infrastructure investment of feedlot before installation • High capital cost • Restrictive waste management and energy legislation	Short – medium	**MS = 435 million (for crop production)** 10 MW feasible in next 5 years[17] Capital cost = R40 million/MW **MS = R2.6 billion (for diary sector)** 65 MW feasible in next 5 years[18] Capital cost = R40 million/MW **MS = R237 million (for piggery sector)** 6 MW feasible in next 5 years[19] Capital cost = R40 million/MW **MS = R4.0 billion (for poultry)** 99 MW feasible in next 5 years[20] Capital cost = R40 million/MW

[17] According to SABIA, the crop production sector has 103 MW of energy potential that is feasible in the next five years. Eleven per cent of land for crop production is in the WC; thus the energy potential would translate to 11 MW of energy potential feasible in the next five years in the WC.

[18] According to SABIA, 299 MW energy potential is feasible in the next five years for the diary sector. With the WC accounting for 22% of dairy cows in South Africa, this would roughly account for 65 MW of energy potential feasible in the next five years in the WC alone.

[19] According to SABIA, 53 MW energy potential is feasible in the next five years for the piggery sector. With the WC accounting for 11% of pigs in South Africa, this would roughly account for 6 MW of energy potential feasible in the next five years in the WC alone.

[20] According to SABIA, 478 MW energy potential is feasible in the next five years for the poultry sector. With the WC accounting for 21% of chickens and ostriches in South Africa, this would roughly account for 99 MW of energy potential feasible in the next five years in the WC alone.

4.4.1.1. Key drivers and barriers of featured technology

There is a number of existing and incoming national and international pieces of legislation that will place targets for several sectors to reduce their GHG emissions, e.g., the Climate Change Bill, Carbon Tax Act, the EU's Green Deal and the carbon-border adjustment mechanism. These pieces of legislation will see agricultural producers face punitive measures for failing to reduce their greenhouse gas emissions, either through increased taxes or the closure of lucrative market destinations for goods (see more in **Section 3.1**).

A potential barrier to uptake is that the digestate can be a difficult by-product to manage – farmers and agro-processors looking to sell the digestate to other agricultural producers have not had much success due to legislative product registration requirements for trading. As a result, the most practical use of the digestate would be on-farm as a soil enhancer.

Additional barriers to implementing anaerobic digester projects in agriculture are:

- high capital cost of anaerobic digesters;
- scepticism and lack of understanding on project implementation; and
- restrictive waste and energy legislation.

4.4.1.2. Suggested target markets

Anaerobic digestion (AD) technology is well-suited for crop production and dairy sectors. Not only do they have a high potential for energy generation, but the digestate can be directed straight back into production as a fertiliser for crop production or soil ameliorant for pastures, mitigating against the need to find a third-party offtaker.

Table 11 illustrates the potential of AD technology in South Africa for energy generation alone.

Table 11: Agricultural theoretical and feasible energy generation potentials: adapted from (Southern African Biogas Industry Association, 2018)

Industry/sector energy generation potential	Theoretical	Feasible within 5 years	Percentage energy feasible within 5 years of total theoretical
Crop production sector	1 179 MW	103 MW	9%
Dairy sector	597 MW	299 MW	50%
Piggery sector	107 MW	53 MW	50%
Poultry sector	4 777 MW	478 MW	10%
Sugarcane	1 024 MW	53 MW	5%

4.1.1.4. Market insights

Landfill bans

The Western Cape is the first province in South Africa to announce its intention to ban organic waste from landfills by 2027. This is against the backdrop of landfills across the country reaching the end of their capacity, and serious concerns about what to do with waste in the coming years. Whilst the landfill ban does not necessarily affect the agricultural sector directly, the ban (and end of life of landfills) has resulted in an increased number of technology providers entering the space, which could be a boon for the agricultural sector. The increased number of available technologies, which would be able to handle different waste streams, may level out the learning curve agricultural producers would otherwise have to follow.

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FUNDING AND INCENTIVES

A range of general and sector-specific funding solutions and incentives is available to investors, manufacturers, and service companies in the green economy. It covers Development Finance Institutions, local public and private sector financiers and investors, and a considerable range of tax incentives.


EXIT
PRT
DSP
ENTER
373 967
804 029
1 296 731
1 859 317
2 499 808
3 227 076
4 050 935
R 28 331

The GreenCape Green Finance Desk (GFD) primarily acts as a facilitator in the financing of green projects and green business. The GFD works across all sector desks at GreenCape. For more support please visit https://www.greencape.co.za/content/sector/green-finance Finance databases

5.1. Finance databases

GreenCape's GFD has compiled and continues to maintain a database of climate finance sources and incentives that could be relevant to companies and projects operating in the South African green economy. A few of the available databases are highlighted below and can be sourced here: https://green-cape.co.za/archives/green-finance-databases/

5.1.1. The Green Economy Climate Finance Database 2022

The database contains information on funding opportunities, the types of funding and institutions providing the funding, and contact details. This includes information on national market players (e.g. commercial banks, microfinance banks, private equity/debt, venture capital, angel investors etc.), as well as international climate finance streams (e.g. climate funds, DFIs, multilateral institutions, bilateral development partners) and domestic sources of finance. The Green Economy Climate Finance Database 2022 analysed ~150 financing solutions valued at ~R25 billion.

The database is ideal for any entity seeking a broad range of funding solutions and financial incentives, with a largely South African focus.

Bilateral development partners, local and international development finance institutions, and government departments/ agencies make up the majority of the active financing stakeholders. Still, climate funds, commercial banks, private equity/debt, and venture capital make up most of the capital value available in the database.

Across the more than 150 climate finance opportunities, eight different financial products are available:

Debt [commercial (listed and unlisted) and concessional (listed and unlisted)] – A debt evidenced by a note which specifies, in particular, the principal amount, interest rate, and date of repayment at below-market rates. The concessionality can be achieved either through interest rates below those prevailing on the market, longer maturity or grace periods, or a combination of those.

Venture capital (limited) – Equity capital can be provided at various stages of funding rounds. Common funding rounds include early-stage seed funding in high-potential, growth companies and growth funding.

Mezzanine finance – Subordinated debt or preferred equity instrument representing a claim on a company's assets that is senior only to that of the common shares. Mezzanine financings can be structured either as debt or preferred stock.

Equity – A stock or any other security representing an ownership interest.

Guarantees and Risk Mitigation Instruments (RMIs) – RMIs facilitate access to debt and equity financing by mitigating and transferring risks from project sponsors and private lenders to third parties. Common instruments applied include contractual arrangements, joint ventures, insurance and guarantees.

Grants (very small "ticket size") – Transfers made in cash, goods or services for which no repayment is required.

Government spend – Government development finance or budget spend.

Finance products are available for almost all the sectors (biggest gaps remain in adaptation-focused and new and emerging sectors).

Still, as expected, clean energy is the focus of most of the tracked financial offerings, including energy efficiency and demand-side management and mobility/storage.

How to use the Green Economy Climate Finance Database 2022:

Each sheet is broken down into types of sources of climate finance (public, private and blended). These are covered by the government (local and international), development finance institutions, commercial and others. The diagram below details the five steps you can follow to filter the dataset for the best possible outcome.

STEP 01

Select the relevant source of finance sheet

STEP 02

Sort sheet by sector:

- Clean energy
- Energy efficiency & demand side management
- Low carbon transport
- Water conservation, supply & demand
- Agriculture, food production, fisheries and forestry
- Circular Economy
- Buildings and the built environment
- Material substitution
- General eco-system support
- Cross-sectoral

STEP 03

Sort sheet by investment instrument:

- Grant
- Concessional debt
- Debt / mezzanine debt
- Working capital
- Equity
- Budget expenditure
- Other

STEP 04

Check alignment of the size of investment and investment opportunity information.

STEP 05

Contact relevant financiers (including high-level ask, market size estimate and basic company track record).

For further information and support on any of the content provided here, please get in touch with GreenCape's Climate Finance team at **finance@greencape.co.za**

Additional resources on improving green economy financial resilience are available from: Government Funding and Incentives Database An updated document focused on government funding and incentives is available to view and download **here.**

5.1.2. Allied Crowds Database

This database is ideal for any entity seeking a broad range of financial solutions.

"**AlliedCrowds** is the first complete aggregator and directory of alternative finance providers in the developing world. We help donors, investors, and entrepreneurs navigate the alternative finance space through our reports, data, and Capital Finder, increasing the flow of capital to deserving projects globally."

Sign up to use the Capital Finder is free and allows users to access a global database where you can filter for a sector (including greentech, agriculture and social impact), type of capital (equity, lending, grant) and type of funding (crowdfunding, angel investing, venture capital, impact investing). The Entrepreneur Hub provides important tools and assistance for start-ups, including writing business plans and financial resources.

- In addition, themed databases around the Sustainable Development Goals (SDGs) and the World Green Economy Organization (WGEO) are found **here**. You can also contact Allied Crowds to create a customised funding database for you.
- An Alternative Finance glossary can be found.

ALLIED CROWDS WEBSITE

5.1.3. Finfind Database

Access to finance is the number one challenge experienced by SMEs - Finfind has been specifically developed to address this problem. Finfind is innovative, online access to finance solution that brings the providers and seekers of SME finance with a focus on finance readiness. Finfind has over 250 lenders and almost 500 loan products available to SMEs, and each lender's listing and loan product information are kept up to date daily. This database is ideal for South African SMMEs seeking funding and business advisory services or upskill themselves on finance matters.

FINFIND WEBSITE

5.1.4. RECP Database

The Africa-EU Renewable Energy Cooperation Programme (RECP) is a multi-donor programme that supports the development of markets for renewable energy in Africa. It was launched by more than 35 African and European Ministers and Commissioners under the Africa-EU Energy Partnership (AEEP).

Aside from the Finance Database, the site also hosts the Finance Catalyst, an advisory service geared towards African projects. This is supplemented with market intelligence (including RE potential, country-specific regulatory framework and key stakeholders). This database is ideal for renewable energy project developers looking to work in Africa.

RECP DATABASE

5.1.5. Government Funding and Incentives Database

An updated document focused on South African government funding and incentives is available to view and download online. These incentives cover local manufacturing, critical infrastructure grants, small enterprise development and a diverse set of sector specific incentives (i.e. Aquaculture Development and Enhancement Programme).

GOVERNMENT FUNDING AND INCENTIVE BOOKLET

5.2. South African Climate Finance Landscape

The South African Climate Finance Landscape looks at detailed project-level green economy finance data, understanding source, disbursement, instrument and use. The insights can support public and private role-players with information to shape sectoral strategies and selected policies and improve coherence and coordination between public and private level spending in the sectors. The South African Climate Finance Landscape has tracked R62.2 billion in annual climate finance invested in SA.

ACCESS TO THE SOUTH AFRICAN CLIMATE FINANCE LANDSCAPE

GREEN FINANCE DATABASE

5.3. Further funding sources

Click the buttons below to access the different funding sources.

SA INSTITUTIONS PROVIDING FUNDING FOR ENTREPRENEURS

SA BUSINESS FUNDING DIRECTORY 2016/17

THE GREEN OUTCOMES FUND

THE WESTERN CAPE: AFRICA'S GREEN ECONOMY HUB

The Western Cape is a world-class investment destination.


© GreenCape

The province provides businesses and investors with prime locations, modern infrastructure, a skilled workforce, low operational costs and an abundance of natural resources. It is also a sought after place to live, with unrivalled natural beauty, vibrant culture, excellent schools and universities, and an outstanding quality of life.

In 2017, Cape Town was ranked among the top 21 global investment destinations by Foreign Direct Investment (fDi) Intelligence, a division of the Financial Times.

A great place for green business

There are compelling reasons why the Western Cape Province is viewed by many as Africa's green economy hub. Coupled with a strong and rapidly growing market for green technology and services in South Africa and beyond, the Western Cape offers:

- Africa's renewable energy and cleantech hub, with a critical mass of leading companies present.
- Local presence of major professional services and financiers.
- Significant market opportunities for businesses and investors in agriculture, energy services, utility scale solar and wind, waste, water, bioeconomy and resource efficiency.
- A supportive government that has made ease of doing business and the green economy key priorities.
- Five universities with comprehensive R&D capabilities and dedicated green economy skills programmes.
- A range of investment incentives in the Atlantis Special Economic Zone (SEZ) for Green Technologies.

Supporting businesses and investors

The province also offers dedicated support for businesses and investors focusing on greentech and services, including:

Western Cape Department of Economic Development & Tourism: Driving the green economy policy landscape in the Province.

InvestSA One Stop Shop: Offers convenient investor support on permits, licensing and registrations - all under one roof.

City of Cape Town Enterprise and Investment: Creates an enabling environment to attract investment that generates economic growth and job creation in Cape Town

GreenCape: Provides dedicated support and market intelligence to green economy sectors.

Wesgro: The official investment and trade promotion agency for the Western Cape.

SAREBI: A business incubator providing nonfinancial support to green entrepreneurs.

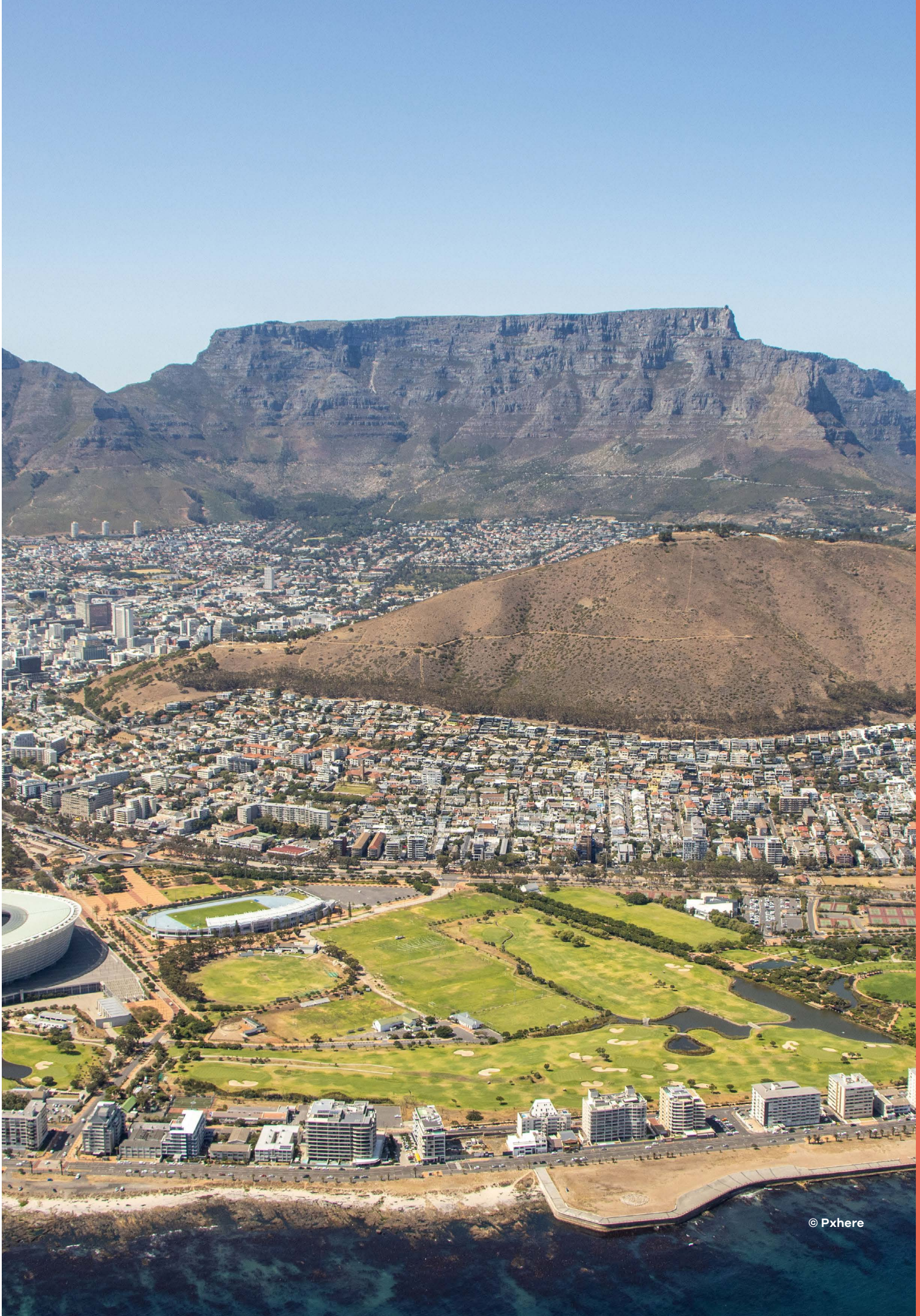
SARETEC: Offers specialised industry-related and accredited training for the wind and solar industries.

Market opportunities in the province and South Africa

Some of the major market opportunity areas in the province and South Africa in the next five years are outlined in the graphic on the next page (see individual MIRs and the GreenCape website for more information).

R&D capabilities and skills

The region's five universities – University of Cape Town, Stellenbosch University, University of the Western Cape, the Cape Peninsula University of Technology and the George campus of the Nelson Mandela Metropolitan University – underpin all of this with comprehensive research and development (R&D) capabilities and dedicated green economy skills programmes.


© Pxhere

GREENCAPE'S SUPPORT TO BUSINESSES AND INVESTORS

GreenCape is a non-profit organisation that works at the interface of business, government and academia to identify and remove barriers to economically viable green economy infrastructure solutions. Our vision is a thriving prosperous Africa, mobilised by the green economy.

© Pxhere

Working in developing countries, GreenCape catalyses the replication and large-scale uptake of green economy solutions to enable each country and its citizens to prosper. We work with businesses, investors, academia and government to help unlock the investment and employment potential of greentech and services, and to support a transition to a resilient green economy.

We assist businesses by removing barriers to their establishment and growth and provide our members with:

- free, credible and impartial market information and insights;
- access to networks of key players in government, industry, finance and academia;
- an advocacy platform to help create an enabling policy and regulatory environment for green business.

We assist local, provincial and national government to build a resilient green economy by providing:

- support on the development of standards, regulations, tools and policies
- expert technical knowledge on key sectors in the green economy;
- access to networks of key players across business, academia, and internationally

Since inception in 2010, GreenCape has grown to a multi-disciplinary team of over 40 staff members, representing backgrounds in finance, engineering, environmental science and economics.

Our market intelligence reports form part of a working body of information generated by sector desks and projects within GreenCape's three main programmes – energy, circular economy and resources.

Benefits of becoming a GreenCape member

We currently have over 3 050 members, and offer free membership. Becoming a member of GreenCape will give you access to the latest information regarding developments in the various sectors; access to tools, reports, and project information; and offer you the opportunity – through our networking events – to meet and interact with various stakeholders in the green economy.

We have facilitated and supported ~R42 billion of investments in renewable energy projects and manufacturing. From these investments, more than 19 000 jobs have been created.

Through our WISP (industrial symbiosis) programme, by connecting businesses with waste / under-used resources:

435 000 fossil GHG emissions saved (equivalent to the electrical usage of 117 840 households in SA);

Over R150 million in financial benefits (additional revenue, cost savings and private investments);

398 economy wide jobs.

135 00 tonnes of waste diverted from landfill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