UNLEASHING THE POTENTIAL OF THE PRIVATE SECTOR TO DRIVE GREEN GROWTH AND JOB CREATION IN SOUTH AFRICA

FIRST DRAFT REPORT

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Acronyms and Abbreviations

4IR	Fourth Industrial Revolution
AfCFTA	African Continental Free Trade Area
Agbiz	Agricultural Business Chamber
AI	Artificial Intelligence
AIDC	Alternative Information and Development Centre ,
CAGR	Compounded Annual Growth Rates
CBA	Cost benefit analysis
CDM	Clean Development Mechanism
CEA	Controlled-Environment agriculture
CER	Certified Emission Reduction
CH_4	Methane
CIF	Climate Investment Funds
CO_2	Carbon Dioxide
CSA	Climate Smart Agriculture
CSIR	Council for Scientific and Industrial Research
CSOs	Civil Society Organizations
CSP	Concentrated Solar Power
DAFF	Department of Agriculture, Forestry and Fisheries
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DoE	Department of Energy
DTI	Department of Industry and Trade
DTIC	Department of Trade, Industry and Competition
DTIC	Department of Trade, Industry and Competition
EGSA	Energy Governance South Africa
ELIDZ	East London Industrial Development Zone
EPI	Environmental Performance Index
EU ETS	European Union Emissions Trading System
FAO	Food and Agriculture Organization of the United Nations
GBCSA	Green Building Council of South Africa ,
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEISA	Green Economy Inventory for South Africa
GHG	Greenhouse Gas
GPS	Global Positioning System
GRI	Global Reporting Initiatives
ICT	Information and Communications Technology
IDC	Industrial Development Corporation
IPAP	Industrial Policy Action Plan
IPM	Integrated Pest Management
IPPs	Independent Power Producers
IRP	Integrated Resource Plan

IWMSA	Institute of Waste Management of South Africa
JET	Just Energy Transition
JSE	Johannesburg Stock Exchange
JT	Just Transition
LC	Least Cost
MAASA	Master Artisan Academy of South Africa
MCS	Mpfuneko CommunitySupport
MSMEs	Micro, Small and Medium-sized Enterprises
MW	Megawatts
N_2O	Nitrous Oxide
NCPC	National Cleaner Production Center
NDCs	Nationally Determined Contributions
NDP	National Development Plan
NGOs	Non-Governmental Organizations
NPC	National Planning Commission
NRF	National Recycling Forum
NWMS	National Waste Management Strategy
PA	Precision agriculture
PRASA	Paper Recycling Association of South Africa
PV	Photovoltaic
RD	Rapid Decarbonisation
REEEP	Renewable Energy and Energy Efficiency Partnership
REFITs	Renewable Energy Feed-In Tariffs
REIPPPP	Renewable Energy Independent Power Producers Procurement Programme
SABS	South African Bureau of Standards
SADC	Southern African Development Community
SANEDI	The South African National Energy Development Institute
SAPIA	South African Petroleum Industry Association
SAPVIA	South Africa PV Industry Association
SAREC	South African Renewable Energy Council
SASTELA	Southern Africa Solar Thermal and Electricity Association
SAWEA	South African Wind Energy Association
SAWEA	South African Wind Energy Association
SCP	Sustainable Consumption and Production
SDG	Sustainable Development Goal
SESSA	Southern African Solar Sustainable Energy Society of South Africa
SESSA	Southern African Solar Sustainable Energy Society of South Africa
SMEs	Small and Medium-sized Enterprises
SNMI	Sustainable Nitrogen Management Index
STP	Science and Technology Park
TIPS	Trade and Industrial Policy Strategies
UF	Undercover farming
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNGC	United Nations Global Compact

UNGC	United Nations Global Compact
WEEE	Waste Electric and Electronic Equipment
WEF	water-energy-food
WISP	Western Cape Industrial Symbiosis Programmes
WRC	Water Research Commission

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Definition of key terms

Decent Jobs	Opportunities for work that are productive and deliver a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men
Green Business	Profitable business activity that is low carbon, climate resilient, and contributes to efficient use of natural resources, reduces or eliminates waste and pollution or contributes increased availability, quality, or productivity of water, forests, land and other natural assets *(UNECA definition)*
Green Economy	An economy that results in improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities *(United Nations Environment Programme definition)*
Green Growth	Economic growth that entails increased and efficient production and competitiveness while at the same time ensuring climate resilience and maintenance or increase in the quality, quantity and productivity of natural assets *(UNECA definition)*
Green Jobs	Decent jobs that contribute to preserve or restore the environment *(International Labour Organization definition)*
Private Sector	Organisations or firms that engage in profit-seeking activities and have a majority private ownership (i.e. not owned or operated by the government). It includes financial institutions and intermediaries, multinational companies, small, and medium-sized enterprises, cooperatives, individual entrepreneurs, and farmers which operate in the formal and informal sectors *(UNECA definition)*

Executive Summary

Greening the economy has great potential to contribute to environmental sustainability while stimulating economic growth. This is particularly important for South Africa, given high levels of greenhouse gas emissions (GHG), unemployment, poverty and inequality. With population increase, and a rapid rate of urbanisation in South Africa, there is increasing pressure on natural resources. Thus, there is an urgent and fundamental need to improve the management of natural resources and to establish sustainable production and consumption systems. An enabling environment could foster inclusivity, job creation and South Africa's shift to sustainable development. In line with international commitments, a range of supporting and enabling policies exist in South Africa that have been the basis for steering the way to a green economy. However, it has to be noted that the outbreak of the novel coronavirus disease (COVID-19) is and will affect the achievement of the commitments significantly but in varying ways. Unfortunately, at the moment, social distancing seems to be only viable way to control the spread of COVID-19, and this has direct adverse effects on the economy of the country.

The private sector is a key stakeholder in the path to greening the South African economy; contributing to GHG emissions, and on the other, investing in green growth. This study sought to strengthen measures and conditions to expand private sector investment in South Africa so as to increase green growth and create decent jobs.

Desk reviews of literature/publications were conducted to identify, analyse and showcase examples of existing and potential green business along the value chains of the selected economic sectors and present a solid case including costs, returns or benefits, rationale and other stimuli for private sector investment in green business. Primary data was collected through a questionnaire survey. The focal sectors were: *energy*; *agriculture*; *manufacturing*; and *waste management*. Although a range of stakeholders and institutions are involved in the green economy across the country in different value chains, more investments need to be made in fostering private-private and public-private collaborations and linkages.

Energy sector

Coal-based power stations contribute to about 90% of the electricity supply in South Africa. This primary energy source has high carbon content. Carbon dioxide is the main GHG arising from the country's energy sector, with large volumes resulting from power plants and refineries. The government of South Africa has established several policies and undertaken various measures to mitigate climate change through supporting mitigation actions, investigating the technical feasibility of carbon capture and storage, diversifying sources of electricity generation and liquid fuels, decreasing coal bed methane and promoting energy efficiency.

Efforts to diversify sources of energy supply and using of renewable energy and other potential new technologies are detailed in the country's Integrated Resource Plan. The renewable energy subsector is endowed with a plethora of profitable business opportunity. Renewables are the cheapest form of new energy generation and promise to create multiple decent jobs in the country particularly at Micro, Small to Medium Enterprises level. A survey conducted to ascertain job creation and skills development mainly in the Solar PV value chain during the initial rounds of the Renewable Energy Independent Power Producers Procurement Programme showed that most jobs are concentrated in the

construction and installation phase and accounted for about 63 % of total headcount employment opportunities and 47 % of total job years. Manufacturing and development each accounted for 5 % of total job years. Operations and maintenance provided 1,575 job years of employment (43 % of total job years); operations and maintenance jobs last for a period of 25 years, whereas the typical period for employment in non-operations and maintenance jobs is approximately 1.5 years to 3 years.

South Africa is seriously considering and initiating investments in the concept of Just Energy Transition (JET), especially in the coal mining sector, paying attention to potential job losses that can occur by the transitioning from fossil energy to renewable energy. Below are some of the considerations that need to be taken into account in the energy sector:

- Decentralise the energy sector, especially electricity supply that has been monopolised by Eskom before and after independence. The current vertical structure of Eskom is not financially viable and an economically sustainable approach enabling more renewable energy private sector players into the industry will fast track the JET process.
- Government to work with the private sector to adopt the concept of JET. This concept will insure that switching from fossil driven energy to renewable energy will have minimum negative impacts on the livelihoods of the workforce and communities that rely on the current unsustainable system. Engaging communities that will be affected and labour unions from the coal mining sector in particular, might enhance buy-in and minimise on likely antagonism in this process.
- Government to strengthen and utilise the role of InvestSA One Stop Shop to improve coordination among government departments that play a role in the energy sector. This will subsequently minimise inefficiencies that seem to impede investment processes in the energy sector.
- Government and institutions like the South African Bureau of Standards (SABS) need to contextualise and adapt the localisation requirements that are currently superficial and unsustainable
- Government to work with research institutions and determine the exact amount of investment required to unlock the transition to renewable energy in South Africa. There is currently no clarity in terms of required financial investment and that hinders evidence-based planning and execution.
- Direct private sector investment into the specific energy clusters and fast track deployment of renewable energy.
- Create awareness on renewable energy and its benefits to stimulate demand that will enhance market uptake and subsequently green economy sustainability. There is generally little awareness about renewable energy in South Africa thus compromising the level of demand required to draw in more investment.

Agriculture Sector

The agricultural sector is faced with a number of challenges, such as addressing climate change and variability, declining resources and low productivity. As a result, there is pressure to shift to greener agricultural practices that do not degrade the environment, have a lower carbon footprint, reduce GHG emissions, increase water use efficiency, improve the soil and grazing, integrate pest management and improve profitability in the sector, while simultaneously securing supply for the growing population and safeguarding the scarce natural resources.

The greening of agriculture among both commercial and smallholder farmers in South Africa can be achieved through conservation agriculture, organic farming, and the bio-economy, which incorporates renewable biological resources and their adaptation to feed, bioenergy and food. Furthermore, use of naturally and sustainably manufactured nutrient inputs, diversified crop rotations, livestock-crop integration, integrated pest management, climate smart agriculture and waste reduction – through the use of post-harvest storage, processing and distribution facilities can all contribute to greening of agriculture.

Policy frameworks guide agricultural initiatives related to the green economy in the agricultural sector. The government plays a very important role in mainstreaming and coordinating green growth in this sector, which is also seen its public procurement. Various smart agriculture technologies are available and these show great potential for profitability and job creation. To drive the greening of this sector the following need to be taken into account:

- The agricultural sector is already contributing significantly to environmental degradation and climate change. There is therefore an urgency for government to continue enhancing and adapting policies that ensure an enabling environment for investment in green agriculture. There is also a need to enforce regulations like carbon tax but at the same time incentivise farmers that adopt green agricultural practices.
- There is need to adopt the fair value system for agricultural commodities, particularly for smallholder farmers and entrepreneurs who want to adopt green economy technologies in the sector. This will incentivise more farmers to adopt green agricultural practices. The government can play a pivotal role in regulating a fair value system in consultation with all value chain actors in the agricultural sector.
- Government and the private sector need to support farmers, rural smallholder farmers in particular, with necessary resources such as access to finance, infrastructure, information and fair value markets to adopt green agricultural practices. Agri-Parks are a good example of such infrastructure that can be combined with a plethora of other support services required by smallholder farmers. This kind of infrastructure will, however, need to be extensively socialised or alternatively built to be compatible with the level of capacity of the rural smallholder farmers and gradually upscale as capacities increase as well. Agri-Parks are currently underutilised and vandalised in some instances as the kind of equipment and technology is beyond the capacities of rural smallholder farmers in most cases.

Manufacturing Sector

The manufacturing sector plays a critical role in encouraging the growth of other areas, enabling economic empowerment and creating employment opportunities in South Africa. However, the conventional manufacturing industry has been a remarkable contributor of resource depletion, harmful GHG emission, and environmental damage. Green economy industries present entrepreneurs with opportunities to find innovative ways of solving critical energy- and environment-related challenges. The government of South Africa is committed to implement greener productions steps that are resource efficient and minimize waste discharge into the environment. Lack of awareness of incentives and support, limited funding, lack of benchmarks and standards, lack of management support, employee resistance, high initial implementation costs and operational challenges have been listed as barriers of green or sustainable manufacturing. The following considerations need to be taken into account to have a smooth transition to a green manufacturing sector:

- Increase awareness of how the manufacturing sector can switch to a green economy, the available opportunities and incentives therein. This may minimise change resistance and attract more investment and entrepreneurial enterprises in the sector.
- Support in form of funding and technical capacity building to switch to green manufacturing. There are high costs associated with switching to green manufacturing at the initial stages and a significant reskilling of the work force will be required.
- An enabling policy environment and supportive mechanisms such as subsidies will be required to ensure a smooth and just transition to green manufacturing.
- The government working with the private sector need to develop clear benchmarks and standards to guide the greening of the manufacturing sector.
- A phased approach might be a less risky way to adopting the green manufacturing systems. As more pressure to meet environmental sustainability obligations is applied across the globe, the sectors that are adopting green approaches will be at an economic advantage, while those that are not complying with the trends will be left behind.

Waste Management Sector

With the increase in world population, consumption of resources will continue to increase, resulting in the immense generation of waste. The green economy approach in relation to waste management would mean implementing the supposed '*life-cycle approach'*, providing economic opportunities within the objectives of reduction, reuse and recycling wastes.

In the South African context, waste is defined as any *undesirable or superfluous by-product, emission or residue of any process or activity which has been discarded, normally accumulated or stored for the purpose of* discarding or further processing through treatment. The country's waste management landscape is changing steadily each year as South Africa shifts to sustainable waste management. This is largely driven by enabling policies, municipality's tendency to partner with private sector – giving tariffs reliefs from the local authorities that are tied to the volumes of waste that the companies generate, and the increased demand for secondary materials.

South African legislations for waste is informed and influenced by the main elements of the waste hierarchy, which determine the total strategic approach for waste management. The waste management hierarchy assigns the highest priority to waste avoidance, followed by waste reduction, reuse, recycling, energy recovery, and treatment and disposal, in that order.

The overall waste management sector in the South African economy is valued at a minimum of R25 billion, which still remains largely unexploited. This sector has a high job creation potential due to the different chains of waste management ranging from primary collection to the large-scale recyclers and affords opportunities to several actors with different skills and financial resources to participate in sustainable waste management. Creating job opportunities in the waste management sector is about creating valued and sustainable 'green jobs', or jobs in sectors that demand less excessive carbon emissions, while contributing to an improvement of the environmental conditions. The following recommendations have to be considered in waste management:

- Greening the waste management sector needs to be informed by current demographics and economic trends that are showing an increase in population and economic growth. This ultimately translates to increased volumes of waste requiring management hence more opportunities in this sector.

- Improved waste management systems taking into account the circular economy approach will need to be adopted to green the waste management sector. There is increased complexity in the waste stream due to urbanization and industrialization that also requires sophisticated approaches.
- The government needs to utilise the backlog of waste services for urban informal areas, tribal areas and rural formal areas as an avenue for increasing private sector investment into the sector.
- The policy and regulatory environment needs to be revised to prioritise and effectively promote opportunities in the waste management value chain. There should be autonomy in greening the waste management sector with minimum political interference in decision-making that often lead to bureaucracy.
- Waste management services need to be priced at a fair value across the whole value chain. The current pricing system is on the lower bracket and does not attract business investment and might compromise the appetite to switch to green waste management.
- Profiling and promoting alternative waste management options to that of landfills, which is the most common way of managing waste in South Africa. This profile should include green waste management options including cost and benefit analysis of each option.
- Capacitate service providers in the waste management value chain green approaches. There is currently a lack of sufficient training on the different hierarchy of the waste management.

Although a range stakeholders and institutions are involved the green economy across the country in different value chains, more investments (especially green financing) need to be made in fostering private-private and public-private collaborations and linkages. Participation of civil society organizations, developmental partners and researchers is critical in driving green growth in South Africa. Further, there is a need to invest in increasing awareness of the importance of going green, skilling and re-skilling stakeholders and committing public funds at all levels for green-related research and development, infrastructure and investment, giving signals to encourage private sector investments.

Key messages

Energy Sector

- Investment in renewable energy can provide decent jobs and increase skills in South Africa.
- Some tax incentives are offered to companies interested to invest in energy efficiency, renewable energy, state-of the-art technologies and research and development.
- South Africa's energy sources over the past 10 years shows that renewables are the cheapest form of new energy generation. Renewables are also quicker to construct and, given the shortage of electricity experienced recently, are an obvious answer to ensure new generation capacity is brought on line in the shortest possible time frame.
- Onshore wind energy is debatably the lowest priced renewable energy and is already believed 'competitive' where there is strong resource and the cost of carbon is reflected in costs. Wind energy is also cheaper in larger wind farms or more accessible areas, either in terms of size or number of turbines.
- Of all renewable energy sources in South Africa, solar holds the most potential. However, the large-scale deployment of Solar Photovoltaic (PV) has been constrained due to its relatively high energy generation cost, although cost trends have been downward. Competitiveness with electricity market prices from wholesalers could be reached in early 2022.
- By 2019, the Renewable Energy Independent Power Producers Procurement Programme had managed to create 40,134 job years from only 18 in 2012. The growth rate seems to be at an average of 2000 job years per year. Employment is expected to grow by an additional 40% in the period 2018 to 2030, accounting for 580,000 job years.

Agricultural Sector

- According a Stats SA (2019), approximately 843,000 people are employed in the agricultural sector in South Africa, and about 8.5 million people are directly or indirectly dependent on agriculture for their employment and income. The National Planning Commission (NPC) estimates that agriculture has the potential to create 1 million jobs by 2030, with the most of these jobs being in the smallholder sector.
- The implementation of Precision Agriculture creates opportunities for investors through the need for remote sensing technologies (e.g. drones) and software solutions. For example, for 2015, a global drones market valued USD 670 million (R8.8 billion) was estimated. It is expected to grow at a compound annual growth rate of 18.5% to 38% during 2018-23.
- In South Africa, a conventional estimate for the present market size for low- and medium-tech Undercover Farming in the Western Cape was R1.4 billion for 2018. As Undercover Farming is relatively new, further opportunities for manufacturers and suppliers of steel, plastic, netting, hydroponic equipment, growth medium, air conditioning and lightening, and ICT solutions as well as trainers and consultants are available.
- The fast-developing South African biofuel industry has the potential to shake up the agricultural sector from a circular economy perspective, thereby creating opportunities for investors in green agriculture.
- Another crucial area with substantial market potential for small businesses is the drive towards smart (i.e. inter-connected and efficient) irrigation systems for emerging smallholder farmers and commercial farmers.

Manufacturing Sector

- The government has established the National Cleaner Production Centre, which plays a critical role in maintaining sustainable practices within the manufacturing sector promoting efficient use of energy and waste reduction.

- Opportunities in the manufacturing sector include embedded generation technologies, water technologies, biogas-to-transport value, bio-composite materials, chemicals, plastic fabrication, pharmaceutical manufacturing, Forestry, Pulp and paper, and Furniture, and Capital / Transport Equipment and Metal Fabrication.
- Results of CBA made in China for gear manufacturing company using process-based cost model and a systems dynamics model showed that equipment and carbon emission costs are the main components of a manufacturing company and the total life cycle of a green manufacturing product is lower than that of the same product in conventional manufacturing.
- Employment potential (2018-2025) of the formal sector in the green economy is around 462,000 full-time and/or part-time jobs, of which the manufacturing and construction jobs account about 10% (46,000), additional 80,000 direct jobs will be created from manufacturing by end of 2020.

Waste Management Sector

- Nearly 46.8 million tonnes of general waste is generated yearly in South Africa with the largest proportion from the Gauteng (45%) and Western Cape (20%) provinces. In addition, more than 5 million cubic meters of hazardous waste is produced annually, mostly in the provinces of KwaZulu-Natal and Mpumalanga.
- South Africa has endorsed legislation, developed strategies and formulated policies to improve the waste management sector.
- The formal waste sector employs about 36,000 individuals. A large proportion of these employees were from large enterprises with 77.5% from the private waste sector and metropolitan municipalities contributing 64.9% of public sector employees. The minimum value of the formal waste sector was R15, 3 billion or 0, 51% of the GDP for both public and private enterprises.
- Potential future investment sectors include cleaner production, industrial efficiency and design for environment, dismantling, refurbishment and reuse, collecting, sorting, reprocessing and manufacturing, waste-to-energy processing, landfill operation and research on innovative handling of waste.
- The organic, e-waste, plastics and builders' rubble sectors have the potential to unlock ~R1.2 billion in value.

Chapter one: Introduction

1.1 Background and context

1.1.1 Toward sustainable development in South Africa

Greening the economy has been shown globally to have great potential to improve the environmental sustainability and stimulate economic growth [1]. This potential is particularly important in South Africa, due to the country's high levels of greenhouse gas (GHG) emissions and its unemployment, poverty and inequality challenges. Estimates for green growth show the potential scale of employment to be promising. Thus, the just transitioning to a green economy is not only viewed as a pathway to a sustainable future, but also as the driver to overcome South Africa's development challenges. To ensure sustainability, this will require systemic transformation across the economy with key sectors such as energy, agriculture, manufacturing and waste management taking the lead in this change [2]. Climate change poses a major threat to all sectors of South Africa's economy and is already compounding challenges associated with resource scarcity, especially water, energy and food security. South Africa's Gross Domestic Product (GDP) expected losses induced by climate change over the next 30 years range from R217 billion to R651 billion, with a median loss of R259 billion [3]. The economic implications of climate change could also increase unemployment and inequality at sub-national and sector-based levels. This is particularly evident in the agricultural sector where unskilled labourers are unable to adapt, and where necessary make the transition from agriculture to other sectors of the economy [3].

In line with international (global, continental and regional) commitments, a range of supporting and enabling policies exist in South Africa that have been the basis for steering the way to a green economy [4]. The National Strategy on Sustainable Development that describes '*Towards a green economy'* as a strategic priority for '*a just transition towards a resource efficient, low carbon and pro-employment growth path*'. Other important policies include the Medium-Term Strategic Framework Programme of Action, the New Growth Path 2020, National Development Plan (NDP) Vision 2030, the Green Fund, and Green Economy Accord. Through the National Climate Change Response White Paper, South Africa is committed to implement various mitigation actions as well as develop a low carbon economy. Further, the Industrial Policy Action Plan (IPAP) focuses on mainstreaming resource-efficient and value-adding industries in the South African economy. The polices highlighted above, together with several other acts, strategies, plans and white papers that address specific sectors, serve to facilitate the transition to a green economy.

South Africa's rapid industrialisation has been dependent on the primary sectors of the economy; such as agriculture, forestry, fishing and mining [4]. However, innovative ways of adding value to natural resources through the development of the secondary and tertiary sectors of the economy could reduce the demand exerted on natural resources, while developing fourth industrial revolution (4IR) compliant skills and employment opportunities. There are various opportunities to add value along the entire product value chain taking advantage of science and technology, and thereby stimulating local economic development. For example, adding value to agricultural products through the establishment of food processing industries, coupled with

renewable energy supply, could assist in achieving food security and improving resource efficiency, while stimulating socio-economic development in rural areas and contributing to low carbon economic growth [4]. There is also a range of clean technologies and solutions for a green economy that can reduce the generation of pollution and waste, improve the treatment of wastes and pollutants before discharge into the environment, and mitigate the socio-ecological impacts from wastes and pollutants. Examples of clean technologies and solutions include: green building design and green buildings; green chemistry and materials; green product design; material efficiency; waste prevention; upcycling, recycling and recovery; waste to energy; and renewable energy technologies. In addition, the use of science and technology becomes more essential in advancing and building resilience of green economy supply chains against external shocks such as climate related disasters, diseases such as COVID-19 etc. Automation and development of Artificial Intelligence (AI) to aid in running some operations in the supply chain become more apparent in such circumstances. However, there is a need to strike a balance between the adoption of technology and creating employment opportunities especially in circumstances where advancement might lead to machines taking jobs meant for people and consequently exacerbate poverty and inequality. This is crucial particularly in the South African context where unemployment rate is escalating [5].

1.1.2 Green growth and job creation as a response to the development challenges

The poverty levels in South Africa rose from 53.2% in 2011 to 55.5% in 2015 [6]. This translated to 30.4 million South Africans living below the upper boundary poverty line (UBPL) of R992 in 2015. The situation has worsened in 2020 with the unemployment rate of 30.1% against that of 25% in 2015 and nearly half the adult population in the country living in poverty [6]. Poverty and unemployment in South Africa have been exacerbated by the outbreak of the novel coronavirus disease (COVID-19), which is highly contagious and lethal, particularly to people with compromised immune systems. COVID-19 started in Wuhan, China towards the end of 2019 and has since spread throughout the world including in South Africa. One of the key strategies of minimising the spread of COVID-19 is social distancing and this has an impact on businesses that require human interaction. Many countries across the globe declared states of disaster/emergency and imposed lockdowns to slow down the spread of the virus in anticipation of a vaccine, and to ensure that health systems are not overwhelmed by the number of cases with serious symptoms requiring hospitalisation. The lockdowns consequently affected economic activity and caused some firms and companies to shut down and employees to lose their jobs.

South Africa adopted a five levelled approach to the lock down, with level five being the highest and characterised by extreme measures and regulations that hinder a lot of economic activity. Level one is the lowest stage expected to return the country to normal economic activity and most likely a new way of living should a vaccine be not found sooner. The lockdown in South Africa started in March 2020 and was expected to get to level one in August 2020. Stats SA conducted surveys during the lockdown to determine the impact of COVID-19 on the loss of jobs and businesses in South Africa. According to one of the surveys, 8.1% of the 2688 respondents indicated that they lost their jobs during the first month of the lockdown or had to close their businesses, with small enterprises being the most affected. The informal sector, where most of the South Africans living in poverty earn their income, was also affected by the lockdown. This further pushed the already affected populations away from the UBPL. It is expected that COVID-19 will have far reaching impacts on businesses and employment

including in the rollout and fast tracking of the green economy, if a vaccine or treatment is not found sooner. There will be a need for a paradigm shift in the way business is done including greening the economy in South Africa and across the globe in general. It is noteworthy that, in spite of the negative impacts of COVID-19 on the achievement of most of the Sustainable Development Goals (SDGs), the pandemic crisis has brought reduction in emissions of carbon dioxide (CO_2) [7].

With a rapid rate of urbanisation in South Africa, there is increasing pressure on natural resources to derive materials and energy needs to fuel economic growth [4]. This is further aggravated by migration of nationals from neighbouring countries into South Africa in search of jobs [8]. In fact, the number of foreign nationals in South Africa accounted was 2.2 million in the 2011 census conducted by Stats SA [6]. Therefore, there is an urgent and fundamental need for the improved management of natural resources and the establishment of sustainable production and consumption systems. Maintaining or improving economic performance while reducing resource intensity will require the more efficient use of materials and energy (that is, obtaining more value from the same resources, or obtaining the same value using fewer resources); as well as switching to alternative inputs [4]. This will require the more efficient use of energy resources and moving away from non-renewable fossil fuels to the use of low carbon-emitting, renewable energy resources. South Africa has an abundance of untapped renewable energy resources; an excellent solar resource, a good wind resource, a good wave energy resource, reasonable biomass resources, and local hydropower and geothermal energy resources, which positions it to play a leading role in the Southern African region and in the continent. However, this requires evidence-based planning informed by mapping of renewable energy resources available across the country. This will in turn determine the establishment of renewable energy clusters across the country. Such segmentation will provide guidance on the supporting infrastructure investment required by each renewable energy cluster in South Africa [9].

Also, if supported by an enabling environment mainly created by the government through policies and funding, green sectors have the potential to foster South African growth and employment, as well as the shift to sustainable development. However, there is much uncertainty around these estimates and their underlying assumptions. One of the key issues concerns the size of the stimulus necessary to create sustainable green industries [1]. The extent to which local procurement is emphasised will also have a significant impact on the extent of green job growth. The ability to deliver and implement industrial policy and skills training will also have an impact on green job growth. Further, how greening growth will be financed is another crucial issue to be considered. Despite the questions surrounding these estimates, green economic activity does appear to generate more local jobs than fossil-fuel-based industries [1]. Some of the estimates also indicate the potential for significant employment. Many informal green activities are recognised to contribute to sustainable livelihoods, however, issues on procedure, process and participation hinder their true inclusion in the green economy [10].

1.1.3 The private sector context in the region/selected countries

Private sector[a], including both large and Micro, Small and Medium-sized Enterprises (MSMEs), is a key actor and has a crucial role to play in the path to greening South Africa's economy. On one hand, there is a large environmental footprint associated with private sector particularly in contexts with weak safeguard systems and environmental governance. On the other hand, the private sector plays an important positive role in the green economy as a source of finance (investor) and through investments in research and development, innovation and technology transfer, as well as creating jobs in the country. As a result, there is increasing emphasis to integrate private sector engagement approaches into green growth and climate change programmes [11]. Improved partnerships and cooperation are needed to build a broad front for development that involves a strong relationship between government, private sector, researchers, developmental partners and civil society. The transition to a green economy will need the commitment and actions of multiple sectors and stakeholders in society to act as agents of change and this will require the development of increased environmentally responsible behaviour; through awareness, education, champions, and changes in the prevailing culture.

MSMEs are a vital engine in the South African economy. They drive growth, create employment—especially among youth—and spearhead innovation. MSMEs are also customers to larger companies across the supply chain and supply vital goods and services to companies and households, helping to keep the wheels of the economy in motion. Furthermore, they can leverage their agility to design and incubate new technologies and business models to build a better future. Many of South Africa's MSMEs have the potential to become tomorrow's large corporations, key stakeholders that this continent needs to continue on its path to growth and prosperity.

The South African government is undoubtedly a key player in the MSME ecosystem, and post COVID-19 there will be new pressures, forcing them to be even more careful about ensuring that scarce funds are effectively deployed and utilized. Their role can be viewed through two lenses: as an enabler of MSME growth; and through the delivery of targeted support, especially to high-growth businesses [12].

1.2 Conceptual/analytical Framework

In this study, the focus is on establishing an enabling environment, in terms of policies, innovations, profitability and platforms, to unleash the potential of private sector to drive green growth and job creation in South Africa. The study is in embedded in the concept of the green economy and sustainable transition. The green economy is a system that seeks to sustainably grow economies with very minimum, if any, environmental and ecological degradation. It is closely linked to ecological economics but has a more politically inclined perspective. As already highlighted in the background, the concept has potential to address South Africa's triple challenge of unemployment, poverty and inequality. It also has potential to mitigate climate change and enhance the adaptive capacity of ecosystems. To achieve transformative change and for the green economy to reach its full potential there are strategic sectors that need to be

[a] For this study, private sector refers to organisations or firms that engage in profit-seeking activities and have a majority private ownership (i.e. not owned or operated by the government). It includes financial institutions and intermediaries, multinational companies, small, and medium-sized enterprises, cooperatives, individual entrepreneurs, and farmers which operate in the formal and informal sectors. This definition excludes actors with a non-profit focus, such as private foundations. This is adapted from Morgado and Lasfargues (2017).

targeted for driving the process and these are energy, agriculture, manufacturing and waste management. An enabling policy environment is also essential for these sectors to perform at their optimum transforming the system to a green economy. The transition process has to shift the current economy to a socially and environmentally sustainable production system that is managed fairly and being inclusive. The diagram below presents the conceptual framework informing the study.

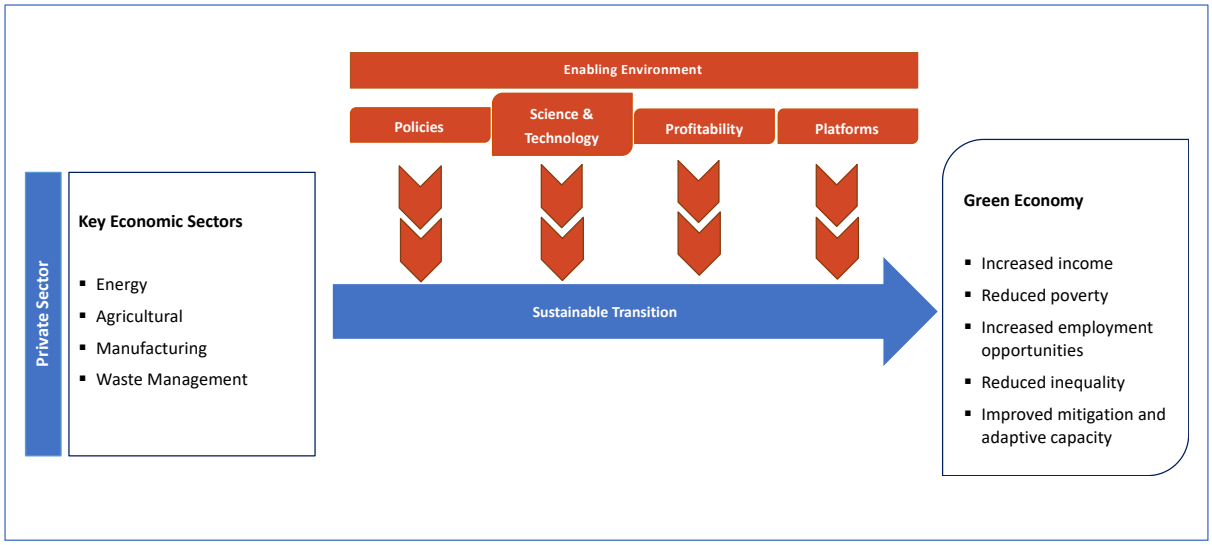

Figure 1: Conceptual Framework

1.3 Purpose and objectives of the study

The overall objective of the study is to strengthen measures and conditions to expand private sector investment in South Africa that will increase green growth while creating jobs. In particular, the focus was on unleashing the potential of the private sector to drive green growth in South Africa and create decent jobs in four key sectors of the economy i.e.: energy, agriculture, manufacturing, and waste management. The intention was to provide evidence on green business[b] and identify measures, incentives and conditions that need to be strengthened to spur green investment to generate green growth while creating jobs. Further, it sought to establish unique challenges and provide examples of 'what can be done?' to transition to a more equitable, resource efficient and low carbon economy.

The specific objectives of the study were to:

(i) Strengthen national strategies to expand private sector investment that will increase green growth while creating jobs;

(ii) Increase knowledge and appreciation of the benefits and opportunities for private sector to invest in green business and increased ability of the private sector to seize business opportunities offered by green growth pathways in selected sectors;

[b] In this study, green business refers to a profitable business activity that is low carbon, climate resilient, and contributes to efficient use of natural resources, reduces or eliminates waste and pollution or contributes increased availability, quality, or productivity of water, forests, land and other natural assets. As such, the green business could also reap benefits including supply chain, input or market stability, climate resilience or tapping into green market opportunities.

(iii) Strengthen knowledge, skills and overall capacity of the private sector to identify design and expand investment in green business thereby contributing to green growth and job creation;
(iv) Strengthen knowledge and capacity of the policy makers to design and implement policies and incentives for private green business to drive growth and employment. In this regard the study will contribute to strengthening the capacity of state actors to develop, reform and implement their green economy frameworks, including the African Continental Free Trade Area (AfCFTA), and nationally determined contributions (NDCs); and
(v) Strengthen platforms or networks to increase peer learning and collaboration among the private sector and between the private sector and governments.

This study builds on the work of partners and other organisations in the related fields. It also builds on and complements the UNECA work particularly on greening industrialisation, greening value chains and private sector development, thus contributing to ECA's strategic direction of fostering local responses and adapting global solutions to the continent's problems. Moreover, the study was premised on the importance of and need for innovative solutions and approaches to increasing growth and job creation, thus aligning with the ECA's strategic focus on articulating policy options to accelerate economic diversification and job creation in the region.

Further, the study made substantial contributions to the achievement of many regional, continental and global development goals and targets including those set out in the Southern African Development Community (SADC) industrialization Strategy, Africa's Agenda 2063, the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change. In particular, this work will contribute to the achievement of the SDGs 2, 7, 8, 9, 12, 13, 14 and 15 and the corresponding goals of Agenda 2063 and nationally determined contributions under the Paris Agreement.

1.4 Methodology

A five-phase strategy, providing for *project inception*, *data collection and analysis*, development of *draft report*, *validation of findings* and *finalization of the study report* was employed. Details of each phase are presented in Figure 2 below.

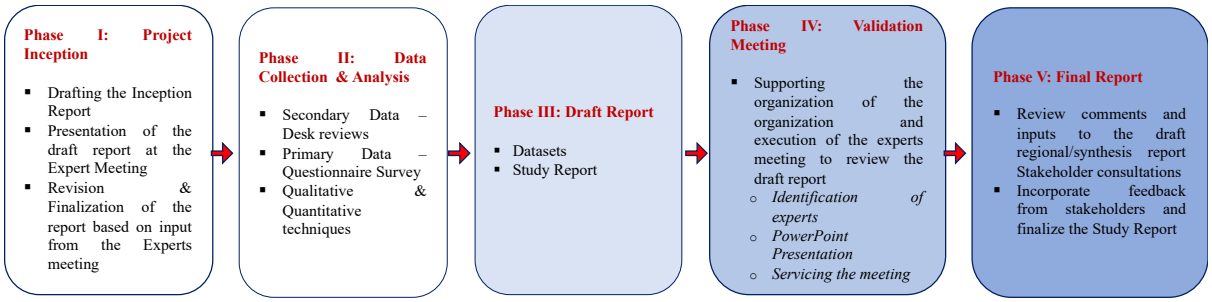

Figure 2: Framework guiding the study on unleashing the potential of private sector to drive green growth and job creation in South Africa

1.4.1 Project Phases

1.4.1.1 Phase I: Project Inception

Phase 1 focused on conceptualization of the assignment, strongly demonstrating a clear understanding and interpretation of the tasks and providing a conceptual framework, the methodology and a work plan. Annex 1 is the Inception Report for the '*Unleashing the potential of the private sector to drive green growth and job creation in South Africa*' study.

1.4.1.2 Phase II: Data Collection and Analysis

This Phase focused on the collection of data, and data analyses.

a) Data Collection

(i) Secondary Data – Desk Review

To establish the country's status quo, desk reviews of literature/publications were conducted to identify, analyse and showcase examples of existing and potential green business along the value chains of the selected economic sectors and present a solid case including costs, returns or benefits[c], rationale and other stimuli for private sector investment in green business. Feasible green business models were also highlighted following a rigorous examination of the green business environment in South Africa.

The desk study also focused on mapping and reviewing policy instruments, strategies, programs in place that support greening the South African economy. Further, key stakeholders in South Africa's quest for a green economy from government departments/institutions, private sector businesses and associations, developmental partners, researchers and research institutions as well as civil society/organisations (CSOs) were identified during this phase.

(ii) Primary data

Primary data was collected through a cross-sectional survey for twelve (12) weeks using a questionnaire, with sector-specific and simplified questions (Annex 2). Information was collected on both existing and potential green investments. The questionnaire was administered through structured interviews and via an online platform - *Qualtrics*. Respondents (key informants), including government officials, private sector entities, researchers, developmental partners and civil society organizations (CSOs), were selected through purposive, stratified random sampling techniques. Only key informants who were engaged in the targeted economic sectors and were willing to participate in this study were considered.

[c] Examples of benefits include increased competitiveness, quality and productivity improvements, reduced costs and reduced exposure to risks including input security (water, raw materials) and meeting corporate social and environmental responsibility objectives.

b) Data Analysis

Data collected were analysed to demonstrate the level of actual and/or potential environmental benefits including resources efficiency, climate resilience and reduction in resources degradation and waste generation that could arise in selected green economic investments. Cost, benefit and/returns analysis were undertaken to determine the business case for private sector investment in green business. Both qualitative and quantitative data were processed to identify the underlying factors contributing to the achievement and/or failure of green outcomes and impacts such as adoption of green technology, use of green investments, incorporation of green value chains and green jobs.

1.4.1.3 Phase III: Draft Report

In this Phase, a draft report was produced using datasets from the desk reviews and survey.

1.4.1.4 Phase IV: Validation Meeting

This Phase will involve the identification of experts to participate in the meeting, a PowerPoint presentation (of the report produced in Phase III) at the meeting and servicing the meeting.

1.4.1.5 Phase V: Final Report

The Final Report will be produced following the incorporation of reviews and inputs from key stakeholders.

1.5 Limitations of the study

Although questionnaires were sent to a wide range of stakeholders as had been planned, only a few responses were received. In March 2020, South Africa turned its attention to responding to the COVID-19 pandemic, and it made it very difficult to engage with key informants. As a result, findings in this study are mostly based on secondary data.

1.6 Structure of the report

Chapter One has provided a background and context of this study, and highlighted the conceptual/analytical framework, purpose and objectives of the study, methodology and limitations of the study.

Chapter Two presents an analysis of the status and potential of private sector-led green business that creates jobs in selected sectors. Sector specific findings and implications based on the desktop review and questionnaire survey presented and discussed in this chapter.

Chapter Three provides the conclusion and sector specific recommendations in line with the objectives of the study.

Chapter Two: Analysis of the status and potential of private sector-led green business that creates jobs in selected sectors

2.1 Introduction

This section is based on desk reviews and feedback from key informants. For the survey, a total of 53 key informants participated in study; 16 from the energy sector, 12 from the agriculture sector, 14 from the manufacturing sector and 11 from the waste management sector. Although most key informants were from the private sector, some stakeholders from CSOs, research and government also participated in the survey.

One researcher, a Professor from a renowned university in South Africa, refused to participate in this study, stating that, since 2015, the global development agenda and related initiatives are now focused on sustainable development, with no much interest on the green economy per se. It is likely that such perspectives were/are shared by several key stakeholders targeted during the survey, which may have resulted in lack of participation of some key informants.

2.2 General status and trends in private sector green investments and businesses

In the South African context, a green economy is defined as a "system of economic activities related to the production, distribution and consumption of goods and services that result in improved human well-being over the long term, while not exposing future generations to significant environmental risks or ecological scarcities". It refers to two inter-linked developmental outcomes for the economy, which include: growing economic activity (which leads to investment, jobs and competitiveness) in the green industry sector; and a shift in the economy as a whole towards cleaner industries and sectors.

In line with the United Nations Environmental Programme (UNEP) definition, Green Jobs is defined as any form of work that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonise the economy; and minimise or altogether avoid generation of all forms of waste and pollution [13].

Green investments successfully prevent adverse environmental impacts or investments towards production of goods or services that have positive effects on the environment. According to PAGE [14], green investments in South Africa have increased sharply since 2010, with active participation of all economic sectors across the country. However, energy and agriculture are

the most advanced economic sectors, with initiatives in solar and bio-energy, non-motorised transport and planning, and farming. Various nexus initiatives involving water, energy, agriculture also exist. It is also noteworthy that most green economy initiatives in South Africa are currently funded by domestic public finance, with limited private sector investments. However, promoting green growth is in the business interest of private companies as it reduces costs, and diversifies business and investment opportunities. The need for innovation and new green and inclusive business models also provides an opportunity for companies to contribute to green growth and climate action on a profitable basis, by developing new products and services, diversifying their business streams, as well as reaching new targets. Green sectors have experienced higher-than-average growth rates over the last few years; for example, the 'green and renewable energy' sector ranks first globally in compounded annual growth rates (CAGR) in revenues by sectors over 2012-2017 [15]. Many investment opportunities in clean(er) technology and even relatively simple behavioural changes have a short payback time and proven economic benefits.

2.2.1 Barriers and enablers for private investments/businesses

2.2.1.1 Barriers for private investments/businesses

According to the 2010 ILO country report, Skills for Green Jobs in South Africa, that a shortage of environmental educators and trainers could be a key barrier to advancing the green economy in the country [16]. Small businesses are often not sufficiently aware of the impacts of climate change and environmental degradation and lack the knowledge and capacity to tackle these impacts, or sometimes seem unwilling to hedge against the risks they represent [17,18].

Owing to the legacy of the exclusion policies of apartheid which remain deeply embedded in the social and economic structure of the economy, South Africa suffers among the highest levels of inequality in the world. As a developing country, the country faces many political and economic challenges that influence its domestic priorities, focused mainly on tackling the triple challenge of poverty, unemployment and inequality. Inequality manifests itself through a skewed income distribution, unequal access to opportunities, and regional disparities. Low growth and rising unemployment have contributed to the persistence of inequality.

Despite many policy reforms promoting a green economy in the country, there have been great difficulties in shifting away from a fossil fuels-driven and water-intensive economic model. Unsustainable mineral extraction and processing remains central to the South African economy and to the interests of the political elite

The country also lacks a common national narrative and reference point of the green economy, which is needed for domestic institutions to ensure effective implementation. This absence has meant that different stakeholders construe the green economy differently, and this has led to conflicting goals among the many government departments responsible for promoting the green economy.

Abuse of public office for private gain, corruption, is one of the key barrier in South Africa, causing disastrously inefficient economic, social and political outcomes. In fact, South Africa is ranked the most corrupt in Africa [19], and its rankings in the ease of doing business have been deteriorating. This is revealed in the bureaucratic processes involving complex mechanisms, lengthy timeframes, and unclear distribution of responsibilities are delaying and even preventing establishment of green businesses in the country and investments towards the green economy [20].

Although they hold the potential to foster green growth and create new job opportunities, technologies are not intrinsically safe and bear risks that pose a significant barrier to transition to a green economy. The absence of venture capital coupled with the inability and unwillingness of commercial banks and private equity companies to bear the risks associated with technology development, inhibits commercialisation and scaling-up of green technologies in the country. In fact, statistics show that South Africa is among the fastest adopters of new technology in the world, not a technology leader. Public finance institutions set up to support green projects have stringent criteria (almost similar to private banks) for supporting business, which inhibits their meaningful contribution in the transition - especially MSMEs.

The high rate of adoption of technology, rather than creation of new technologies in South African is, in part, a function of the limited entrepreneurial and artisanry focus in the curricula. Generally, South Africa faces an enormous lack skilled and semi-skilled workers in many disciplines, which presents significant challenges in the country's quest for a green economy, which requires different knowledge and skills.

2.2.1.2 Enablers for private investments/businesses

The overall enablers of implementation for the green economy programmes include: regulatory framework facilitating the establishment of projects to thrive and be sustained; market-based instruments such as taxes; and investments in innovation, science and technology commercialisation, greater localisation and manufacturing. The country is positioning itself as a primary investor in funding a transition towards a greener economy commitments funding through DEFF, the Development Bank of Southern Africa (DBSA) and the Industrial Development Corporation of South Africa Ltd (IDC). Through its policy instruments, the govern is also creating an enabling environment to encourage private sector investments in the green economy.

2.2.2 Cross-cutting enabling environment

2.2.2.1 Regulations and standards

In line the National Greenhouse Gas Emission Reporting Regulations under Section 53(a), (o) and (p) read with section 12 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), companies in South Africa are required to report their GHG emissions annually. The foundation of the carbon tax, including its administrative system, is also based on the National Greenhouse Gas Emission Reporting Regulations. These regulations exist to introduce a single national reporting system for the transparent reporting of GHG emissions [21].

2.2.2.2 Institutional arrangements

There are nine key focus areas identified in the green economy programmes. These key focus areas include: green buildings and the built environment; sustainable transport and infrastructure; clean energy and energy efficiency; resource conservation and management; sustainable waste management practices; agriculture, food production and forestry; water management; sustainable consumption and production; and environmental sustainability. The implementation of these green economy actions is significantly decentralised and includes private sector, civil society and all levels of government [22].

2.2.2.3 Policy instruments

The green economy is prioritized in South Africa and a number of policies towards transition have been established, and the main supporting policies that help include the: National Skills Development Strategy III; National Framework Sustainable Development; New Growth Path and the Green Economy Accord; National Strategy for Sustainable Development and Action Plan; National Development Plan Vision 2030; and Medium Term Strategic Framework 2019-2024 [23].

2.2.2.4 Financing/investment

According to the South-Africa-Green-Economy-Barometer-2018, the South African government finances about half of green economy initiatives in the country. Several financial mechanisms of the South African government aimed at facilitating investment in the green economy, which include: the South African Green Fund (see Text Box 1); Municipal infrastructure grant; Urban settlements development grant; Electricity demand side management programme; Public transport infrastructure and systems grant; Provincial and municipal disaster grant; Municipal drought relief grant; Regional bulk infrastructure grant; and Manufacturing competitiveness enhancement programme. DEFF, DBSA, IDC and private financiers have made significant investments toward greening the country's economy. In addition, South Africa has received support by the Climate Technology Fund - a multi-donor trust fund under the global Climate Investment Funds (CIF), and various green financing instruments are being explored and implemented in civil society and the private sector to transition to a green economy. However, access to finance is the foremost barrier to private sector operation and growth in developing countries. This situation is even worse for investments towards clean technologies and environmental solutions, in part, to a lack of proven and readily available business [24].

Text Box 1: The South African Green Fund

According to the South-Africa-Green-Economy-Barometer-2018, the South African government finances about half of green economy initiatives in the country. The South African Green Fund, which was launched in 2012, aims to catalyse the country's transition to a green economy by investing in innovative projects that help realise a low carbon, resource-efficient and climate-resilient future. By 2016, R1.1 billion had been allocated towards implementation of investment projects, research initiatives and capacity-building programmes. Financial support was also secured from other investors that include Jobs Fund, the National Empowerment Fund, the Green Energy Efficiency Fund. At the provincial level, the City of Johannesburg released the first green bond in 2014 for R1.5 billion to finance sustainability related activities, while the City of Cape Town also launched its own green bond in 2017 and managed to raise R4.3 billion. The private sector has been a significant participant in funding the REIPPPP programme, unlocking more than R200 billion of investment. International funds, such as Global Environment Facility (GEF) and the Adaption Fund, are also supporting green initiatives in the country.

Source: Amis et al. [24] (www.greeneconomycoalition.org)

2.2.3 Scalability of private green businesses

2.2.3.1 Use of national platforms for peer learning and green business advancement

Action is required to provide a space for and facilitate a productive social dialogue and collaboration between actual and potential stakeholders. South Africa's Green Economy Accord, signed in 2011, was the outcome of social dialogue between government, business and labour. It is the first multi-stakeholder effort to identify the tangible benefits of a green economy transition. Since then, the enabling policy environment put in place by the South African government and public and private sector green investments have resulted in an increase of initiatives that seek to deliver environmental, social and economic outcomes across the country. These initiatives are innovative, practical and implementable, and are built on existing best practices in key sectors. They have real potential to bring about significant change and respond to critical issues such as resource inefficiencies in the water and energy sectors.

Upon request by the South African government, the Green Economy Inventory for South Africa (GEISA) was commissioned to assist with tracking, monitoring and evaluating existing green economy initiatives and programmes, to foster sector-wide coordination and coherence, and to help identify gaps and areas requiring further support. The GEISA is a first attempt to capture a selection of green economy initiatives and provide a knowledge base of existing activities and help to prioritize work streams and actions under Partnership for Action on Green Economy (PAGE) in South Africa. The intention of PAGE in South Africa is to further strengthen cooperation, coordination and capabilities required to implement the country's planned green economy transition [14].

The GEISA has shown that multi-stakeholder partnerships and active collaborations are essential to green initiatives and transitions, and are required along the entire value chain of green initiatives, from policy formulation to research and development, funding, capacity development, coordination, implementation, and monitoring and reporting. Government has played a key role in creating an enabling policy environment for green economy transitions in South Africa, but further discussion about the profound transformation of (still) dominant modes of production and consumption requires greater engagement with social partners through social dialogue mechanisms such as consultations, negotiations, and/or knowledge-sharing forums. Ongoing engagement with stakeholders will help to define challenges from multiple perspectives and co-create innovative solutions needed in sustainability transitions [14].

2.2.3.2 Mapping of environmental performance indicators

The 2020 Environmental Performance Index (EPI) [25] provides a quantitative basis for comparing, analysing, and understanding environmental performance for countries. Countries are scored and ranked based on their environmental performance using the most recent year of data available as well as data from approximately a decade earlier. Based on a 10-year change, South Africa ranks 95th in the world and 4th in Sub-Saharan Africa, which indicates great improvements since 2018, where it was ranked 142nd in the word and 22nd in sub-Saharan Africa. These results reveal current standings on a core set of environmental issues and identify where progress is or is not being made. This performance reflects the strain that developing countries' are likely to have on the environment, and that the level and pace of development is one of many factors affecting environmental performance.

For the agriculture issue category, which measures efforts to support healthy populations while minimizing the threats of agriculture to the environment, based on one indicator, the Sustainable Nitrogen Management Index (SNMI), South Africa ranks first in sub-Saharan region, while in ranks second in controlling solid wastes. However, in the GHG emissions per capita the country has the worst score in the region, with a score of 22 out of 100. Thus, the country still has a number of issues to improve upon towards sustainability.

2.2.3.3 Stimulating green financing/investments

South Africa has a stable and well-regulated financial sector. It also has a long history of pioneering sustainable finance policy innovations, ranging from the Financial Sector Charter that focuses on black economic empowerment to the Johannesburg Stock Exchange's mandate that listed companies should conduct 'integrated reports' on how the company creates and distributes value. The reform of financial markets to support green economy initiatives and programmes is being prioritised in South Africa [24].

The private sector is an important catalyst for green economy initiatives in South Africa. Mining companies are partial funders or project stakeholders on a variety of green economy projects, including conservation (BHP Billiton), fuel cell technologies (Impala Platinum Holdings) and SCP (Anglo American). Woolworths, a South African retailer is at the forefront of business and sustainability through their Good Business Journey programme. Woolworths has partnered with WWF SA to drive greater sustainability through their products and operations. Financial institutions, including Nedbank and Investec, play a role in funding green economy initiatives [14].

2.3 Energy Sector

South Africa has an energy intensive economy whose industry relies on relatively cheap electricity (generated from coal) and liquid fuels to supply to industries such as metal processing and mining, for chemical processing, transport, heating, and other activities. However, even though electricity is relatively cheap for industry it is quite expensive for the majority of South Africans who are leaving below the UBPL [2]. Coal accounts for over 70% the primary energy sources of the country. There is about 48 Gt of coal in South Africa, representing 5.7% of the total global reserves. The bulk of the coal in South Africa is situated in Highveld, South Rand, Witbank, Ermelo and KwaZulu-Natal. Although coal is a critical part of the country's energy mix required to drive the social and economic progress, future sustainability of its production and use has been a growing concern. Crude oil (21.6), waste and renewable energy sources (7.6%), natural gas (2.8%), nuclear (1.9%) and hydro (0.2%) comprise the rest of the country's energy supply. South Africa's liquid energy is comprised of petrol (47%), diesel (36%), jet fuel (9%), liquid petroleum gas (3%), paraffin (3%) and fuel oil (2%). Majority of the liquid fuels are produced locally through the gas-to-liquid and coal-to-liquid processes.

South Africa has been faced with a persistent energy crisis leading to outage, energy shortages, high energy tariffs, energy poverty in low income communities and power under-investment for many years [26, 27]. While most of the households are electrified (77%), as much as 6 million households remains without electricity. In 2008, Eskom (State owned utility) implemented "load shedding", defined as 'rolling blackouts on rotating' schedule, as demand started to rapidly surpass supply. This was followed through in December 2014, wherein Eskom reinstated stage three load shedding all over the country. The major contributing factors to the introduction of load shedding included absence of significant investments in the energy sector over the past 20 years, build-ups in infrastructure maintenance developments and outstanding metropolitan and municipality accounts.

2.3.1 Existing and potential of private sector green investments/businesses

2.3.1.1 Existing private sector green investments/businesses

Coal-based power stations contribute to about 90% of the electric supply in South Africa. This primary energy source has high carbon content. Carbon dioxide (CO_2) is the main GHG arising from the country's energy sector, with large volumes typically resulting from stationary combustion facilities such as power plants and refineries. Approximately 65% of all energy-related emissions in South Africa are attributed to power generation. Other sources of emissions in the energy sector include those related to industrial processes, fugitive emissions, and indirect emissions from the consumption of electricity. Process emissions arise from production processes, from the use of greenhouse gases in products, and from non-energy uses of fossil fuel [3]. Overall, energy generation from coal is exceedingly emissions intensive and as a result South Africa was ranked 14th highest GHG emitter in the world in 2018 [28]. In addition, as the seventh coal producer in the world, South Africa's per capita greenhouse emissions are the highest in Africa resulting in increased level of environmental pollution in the continent. South Africa's coal-intensive energy sector will therefore need a just transition from coal to renewable energy to meet national GHG emissions reduction commitments as highlighted in its NDCs.

Stirred by an urgent need to solve energy challenges through new generation capacity, as well as to address the growing international pressure to decarbonize the energy supply and meet global standards, the South African government has set a target to produce 45% of the power supply from renewable energy sources [29, 30]. By replacing extremely harmful fossil fuel composition, the just transition to renewable energy options will help alleviate challenges such as excessive water and land use, wildlife and habitat loss, air and water pollution, global warming and ultimately damage to public health. Local employment, consumer choices, increased life standard and community development can also be achieved through the establishment of renewable sources of energies [31]. It is noteworthy that the power sector alone, under the energy category, is estimated to contribute to the reduction of 20% of CO_2 (416 Mt) by 2050, making it the biggest contributor of GHG emission reduction. The whole energy sector has a capacity for the abatement of 21% and 31% of the overall emissions for the years 2030 and 2050, respectively [32].

Eskom, a state-owned utility is a monopolised enterprise that supplies about 90% of South Africa's electricity. It has a vertically integrated structure, allowing for one company to control more than one component of the supply chain thus excluding the rest of the society to economically benefiting from the energy sector [2]. In 2019, the Minister of Finance indicated that this structure is no longer financially viable, and Eskom needs to be restructured. This provides an opportunity for the private sector to position itself in way that allows it tap into the economic opportunity that might be provided by this process.

However, there is a need for the energy sector in South Africa to adopt the energy democracy concept to open up the market for the private sector, MSMEs in particular. Energy democracy is a concept that considers just transitioning from fossil fuel-generated energy to renewable energy and at the same time give more control over all components of the energy supply chain to the users and workers. Energy democracy denotes that, the supply chain should enable universal access to energy, fair prices, and decent jobs and work in line with public value [2]. Transforming the energy system through a strategically planned just energy transition process, applying the concept of energy democracy, has the potential to create jobs and stimulate livelihoods, enhance energy security, and decentralise the ownership structure of electricity in South Africa [2].

The Integrated Resource Plan (IRP) is an electricity capacity plan which aims to provide an indication of the country's electricity demand, how this demand will be supplied and what it will cost. The IRP 2019: *A promising future roadmap for generation capacity in South Africa*, establishes the electricity demand profile over the next 10 years and specifies how this demand can be most effectively met from different sources such as coal, nuclear energy, gas and renewable energies. The IRP 2019 also details a number of government objectives such as carbon mitigation, affordable electricity, localisation, and regional development thereby creating a balanced strategy toward diversified sources of electricity generation, storage and an on-going decarbonisation of the electricity sector in South Africa.

As part of promoting green businesses in the renewable energy sector, the Department of Energy, National Treasury, and the DBSA initiated the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) in 2010. The role of REIPPPP is to procure renewable energy from independent power producers (IPPs). REIPPPP's latest reports indicate that 6,422 MW of electricity has been procured from 112 RE IPPs in seven bid rounds. There are currently 64 IPP projects that are contributing a total of 3,976 MW of electricity to the national grid. About 99 percent of this electricity comes from Solar PV and Wind as a result of

abundance of these natural resources in South Africa. This is also in line with the international trend towards accelerating growth in these two technologies that have the potential to be the key pillars for the growth of renewable energy globally [33]. A total of 40,134 job years has also been secured for South African citizens by the Independent Power Producers Procurement Programme (IPPPP) [2].

2.3.1.2 Business cases for green investments/businesses in the energy sector

Global investment in renewable energy has increased significantly in recent years. This trend is anticipated to continue over the next few decades, as more countries around the globe invest in the development and deployment of renewable energy. However, there remains suspicion with regard to its applications, in particular, on the cost level of actual installation and in contrast to the expected benefits. Renewable energy faces the challenge of high initial capital costs. The effectiveness of the investment in the renewable energy sources can practically be taken as a key parameter for each investor who desires a profitable investment. It also comprises a basic selection criterion for the authorities or institutions, related to the implementation of renewable energy, upon the assessment of possible interventions, taking into consideration the financial cost-benefit data, as well as the indirect consequences of the policies in such sectors such as environment protection, health and/or creation of new employment jobs. Within this context, cost-benefit analysis can provide an overall assessment of the investment considering all the cost-benefit parameters [34].

In the renewable energy industry, generation of energy accounts for between 60% and 67% of overall electricity cost, with the transmission and distribution of the power together with marketing costs, adding up to 33% to 40%. While all power generation technologies include some integration costs, the integration of variable renewable-based power production such as solar and wind are more expensive than non-variable resources. Electricity generation costs are often split into capital as well as operations and maintenance costs [35].

Onshore wind energy is debatably the lowest priced renewable energy and is already believed ‘competitive’ where there is strong resource and the cost of carbon is reflected in costs. Wind energy is also cheaper in larger wind farms or more accessible areas, either in terms of size or number of turbines. The biggest capital cost goes to the turbines, while replacement parts make the bulk of operations and maintenance costs. The large-scale deployment of Solar PV has been constrained due to its relatively high energy generation cost, although cost trends have been downward. Competitiveness with electricity market prices from wholesalers could be reached in early 2022. The main cost element of the capital for Solar PV is the PV module, the price of which has declined by more than 70% (between 2000 - 2012). The remaining capital cost, mainly consisting of the ‘balance of system cost, is fragmented and comprises various elements from several industries. Concentrated Solar Power (CSP) energy production has not shown the same drive as PV, although a renaissance of interest has transpired in recent years. A substantial ramp-up in the building of large-scale CSP plants is anticipated to improve economies of scale along the entire value chain of receivers, mirrors, power blocks cooling, working fluids, and maintenance systems. The major capital cost element in this renewable energy source is a CSP plant’s collector field, with the power block contributing the other main share of capital cost. With regard to its maturity, the technology is behind those of solar PV and wind power, while electricity generation cost competitiveness stands at approximately twice that of conventional combined cycle natural gas. The intention of ongoing investments in research and development is to find innovative solutions to reduce CSP generation costs [35].

In 2011, a Cost/Benefit Analysis of implementing renewable energy policy in South Africa was undertaken and, considered two scenarios of South African power system; a reference scenario without renewable energy and a renewable energy scenario with 3,625 MW of renewable generating capacity which was planned to be implemented in 2015 under the Department of Energys' (DoE) program. According to the analysis, the implementation of renewable energy sources was estimated to displace 8.1 TWh of fossil fuel generation, 6.8 TWh of coal-fired generation and 1.3 TWh of diesel-fired generation. The study also indicated that R2.7 billion of short-term marginal production costs will be saved and 8.4 million tons of carbon dioxide emissions would be avoided [36].

An independent study which was conducted by the Council for Scientific and Industrial Research (CSIR) in 2014, indicated that the renewable energy projects generated 2.2TWh of electricity with a saving R3.6 billion worth of fuel for the conventional fleet (mainly coal and diesel fuel), being realised. The introduction of renewables furthermore eluded to the restriction of customer load, with macroeconomic value of R1.7 billion. Therefore, the overall financial benefit of renewable energy was R5.3 billion in 2014, when compared to R4.5 billion in tariff payments to the owners of the wind and solar PV in the same year. This led to the net financial benefit to the country of R800 million in 2014. A follow up study between the periods of January to 30 June 2015, indicated that diesel and fuel cost savings valued at R3.6 billion were obtained following 2 TWh wind and solar energy generation, that would otherwise have been produced from coal and fuel. In addition, the R4.6 billion savings to the economy resulted from 203 hours of the so called 'unserved energy' that were avoided. These direct cash savings on fuel spending to Eskom and the macroeconomic benefits of having avoided 'unserved energy' are countered by the tariff payments to the independent power producers of the first Solar PV and wind valued at to R4.3 billion from January to June 2015. Therefore, the renewable energy being generated, contributed towards an overall benefit of approximately R4 billion to the South African economy [37].

Finally, an analysis of South Africa's energy sources over the past 10 years shows that renewables are the cheapest form of new energy generation. Renewables are also quicker to construct and, given the shortage of electricity experienced recently, are an obvious answer to ensure new generation capacity is brought on line in the shortest possible time frame. Relative to the direct costs incurred by Eskom's two flagship coal-fired plants, Medupi and Kusile, the environmental costs of this technology, and the indirect cost to the economy from load-shedding as a result of the dire state of Eskom's coal fleet, renewables are the pre-eminent solution to South Africa's crisis.

2.3.2 Job creation through private sector green investments/businesses

Employment can be considerably improved in South Africa by growing the share of renewable energy production. By end of 2017, the REIPPPP had managed to create 31,702 job years from only 18 in 2012. The growth rate seems to be at an average of 2000 job years per years [38]. Employment is expected to grow by an additional 40% in the period 2018 to 2030, accounting for 580,000 job years. By following CSIR's Least Cost (CSIR_LC) pathway this number can be more than doubled to a greater than 1.2 million job years, created along the renewable energy value chain [39]. With the change from IRP 2016 to IRP 2018, new jobs created in the power sector will grow by an additional 17% by 2050, adding up to more than 150,000 new net jobs. With regard to net employment in the electricity sector, wind and solar together account for greater than 80% of overall net employment in the CSIR_LC and DEA Rapid Decarbonisation (DEA_RD) scenarios [39]. Most key informants in the energy industry were

optimistic and projected that, with an enabling policy environment, green energy businesses could create more than 1,000% decent green jobs by 2025, mostly (>60%) accommodating youth and women.

In greening the energy sector, the concept of Just Energy Transition (JET) has to be taken into account, especially in the coal mining sector, focusing on potential job losses that can be triggered by switching from fossil energy to renewable energy. JET is a component of the broader concept of Just Transition (JT), which is defined as an approach that seeks to shift to development systems that are sustainable, and to do so in a fair and manageable way that 'leaves no one behind' [2].

To achieve JET there is need to develop programmes for placement and reskilling workers in the coal mining and other impacted sectors. The education curriculum has to introduce relevant courses that prepare students to take up jobs or create employment in renewable energy as South Africa transitions to a decarbonised economy. There will be a need to also build infrastructure for setting up renewable energy power grids to allow the marginalised groups to tap into the opportunities that come with such transition. Economic diversification in affected areas, such as the province Mpumalanga, will be essential to enable those that might lose jobs in coal mining to find opportunities in other sectors if not in renewable energy [2]. A perfect example of JET in terms of job creation is that of Wind Turbine Service Technicians. A study conducted by Altgen found that Wind Turbine can create a high-quality permanent position paying approximately R20 000 a month, for every 10 MW wind power installed. However, this will require considerable training for the Service Technicians [38].

2.3.3 Scalability of private sector green enterprises or investments/business

2.3.3.1 Existing enabling factors for green investments/business

The government of South Africa has established several policies and undertaken various measures to mitigate climate change through supporting mitigation actions, investigating the technical feasibility of carbon capture and storage, diversifying sources of electricity generation and liquid fuels, decreasing coal bed methane and promoting energy efficiency. The initiatives for environmental assessment through science councils (e.g. CSIR, co-investments through its development finance institutions such as the IDC, and Department of Energy's REIPPPP are some key examples [40].

The country is also endowed with other enabling factors namely good research and innovation capacity in different tertiary institutions, including the University of Stellenbosch, the Cape Peninsula University of Technology and University of Cape Town, supported by different institutions such as the South African Wind Energy Association (SAWEA), South African Renewable Energy Council (SAREC), South Africa PV Industry Association (SAPVIA), Southern Africa Solar Thermal and Electricity Association (SASTELA), Southern African Solar Sustainable Energy Society of South Africa (SESSA). Together, these institutions are capable of driving research, influencing policy, informing business and the public on renewable energy and interact with international and local renewable energy stakeholders. In addition, other enabling factors for renewable energy in South Africa, include the declining price of renewable energy with technological advances, global politics direction and sustainability commitment of the international community [30].

In Africa, South Africa is one of the leading countries in the growth of the green bond market. The country was the first in the continent to successfully issue listed green bonds from private

investors – the private sector has been instrumental in accelerating the growth of the green bond market in the country.

Further, the government is actively promoting sustainable public procurement of renewable sources of energy and creating an enabling environment for green energy businesses through the establishment of technology service centres, green technology data banks, functional national innovation systems and state of the art technology transfer infrastructure.

2.3.3.1.1 Institutional arrangements for green investments/business

Some of the key platforms in the South Africa energy sector include the SAREC for renewable energy and South African Petroleum Industry Association (SAPIA) for liquid fuels. There are a number of platforms being run by Civil Society Organisations (CSOs) as well that may be a supportive mechanism for creating an enabling policy environment for renewable energy business in South Africa. These include Life After Coal/Impilo Ngaphandle Kwamalahle campaign which started in 2016 as a joint initiative of the Centre for Environmental Rights, groundWork and Earthlife Africa. The initiative seeks to discourage the construction of new coal power plants, encourage phasing out of coal mining, advocate for the reduction of GHG and JT to sustainable energy sectors in South Africa. The other initiative is the Campaign for a Just Energy Future which was also started in 2016. The objective of the campaign is to promote access to clean, affordable, reliable, safe energy in South Africa. This campaign was able to stop the South Africa nuclear deal in 2017. In 2018 and 2019, the campaign convened Indaba/dialogues on how to hold decision makers accountable and map a way towards JET to a decarbonised economy. The Alternative Information and Development Centre (AIDC), an alliance of labour, social movements and CSOs working on issues pertaining to climate change and unemployment launched the One Million Climate Jobs Campaign. The campaign is advocating for evidence-based solutions that can enable South Africa to move to a decarbonised economy and at the same time create jobs for the poor communities. There is also the Energy Governance South Africa (EGSA) which is a network of justice oriented CSOs that are geared towards inclusivity and accountability in decision-making in the energy sector. Policy, planning and governance is their fort.

2.3.3.2 Gaps and challenges hindering flourishing green investment/ business

The categories for the different challenges of business investment in the sector of energy are summarized in Table 1. Overall, the following have been noted as challenges by key informants: i) regardless of the presence of InvestSA One Stop Shop, which is meant to curb bureaucracies in the system and ensure efficiency in facilitating investments, there is still need to enhance co-ordination and integration among government departments as well as the three distinct, yet inter-dependent spheres of government (national, provincial and local); ii) superficial and unsustainable localization requirements; iii) financial feasibility; v) political volatility; iv) grid infrastructure (mapped out but not yet developed) and electricity supply; v) economic factors related to foreign exchange; vi) lack of social awareness; and vii) opposition of organized labour unions such as those affiliated to coal mining and operation and maintenance of coal-based power generating sectors [30, 40-42]. Further, the novel COVID-19 is compounding challenges faced in this sector especially when it comes to engagement of key stakeholders.

Table 1: Typical categories of barriers to business in greening energy [32]

Category of	Description/Example of barrier
Economic and financial	▪ High cost of capital ▪ Low expected rate of return ▪ Technology investment considered risky (e.g. due to few prior local reference examples of renewable energy) [18]
Market conditions	▪ Few local suppliers of auxiliary good and services ▪ Market control by industry ▪ Uneven playing field between big players and MSMEs (e.g. due to subsidies on competing technologies).
Legal and regulatory	▪ Bureaucracy ▪ Conflict of interest ▪ Highly controlled sector ▪ Insufficient legal framework: The legislation is not investor friendly. Furthermore, financial incentives need to accommodate MSMEs in renewable energy taking into account the current strangle hold being enjoyed by big power suppliers. ▪ Political instability ▪ Rent-seeking behaviour ▪ Technology opposing incumbent sectors (such as utilities) ▪ Inconsistent enforcement of legal, policy and regulatory frameworks due to uncoordinated numerous policies and laws.
Network	▪ Incumbent networks being favoured ▪ Limited distribution networks ▪ Weak connectivity between actors
Institutional and organisational capacity	▪ Few professional institutions ▪ Limited institutional capacity ▪ Limited management and organizational skills
Human skills	▪ Unskilled technical personnel and inadequate training
Social, cultural and behavioural	▪ Limited consumer awareness on renewable energy products due to ineffective communication ▪ Limited knowledge on a product based on levels of literacy by the consumer thus limiting adoption
Information and awareness	▪ Inadequate information ▪ Lack of awareness ▪ Missing feedback
Technical	▪ Few local references/examples ▪ Poor technology quality/performance
Environmental sustainability	▪ Environmental impacts
Supportive Infrastructure	▪ Physical infrastructure conditions that do not support renewable energy

2.3.3.3 Opportunities to enhance the enabling environment

The government of South Africa plans to diversify sources of energy supply and hence is advocating the use of renewable energy and other potential new technologies as detailed in the IRP 2019. It also intends to improve efficiency of energy utilization throughout the economy. To this end, the regulator of South Africa's energy first introduced the use of renewable energy feed-in tariffs (REFITs) in 2009 before changing to a competitive bidding process in 2011. In 2010, the REIPPPP, a public procurement program, was established [40]. The REIPPPP is aimed at introducing additional megawatts (MW) into the current power supply infrastructure through the private sector investment in solar, wind, PV, biomass, concentrating solar power, and small hydro technologies. These energy sources forms part

of the broader energy mix that includes nuclear, gas, coal and imported hydro technology planned to be used to meet the growing South Africa's energy demand [26]. The potential of the energy sources varies from province to province. The seven provinces, with the exception of Mpumalanga and KwaZulu-Natal provinces which are known for their high biomass potential, have high solar energy potential (Figure 3). The Khi Solar One project, in the Northern Cape province is one of the flagship commercial solar thermal power plants in the country. The Eastern Cape, Northern Cape and Western Cape provinces have wind as the second highest potential, biomass and hydro being the second highest potential energy source for Limpopo and the Free State province, respectively [30].

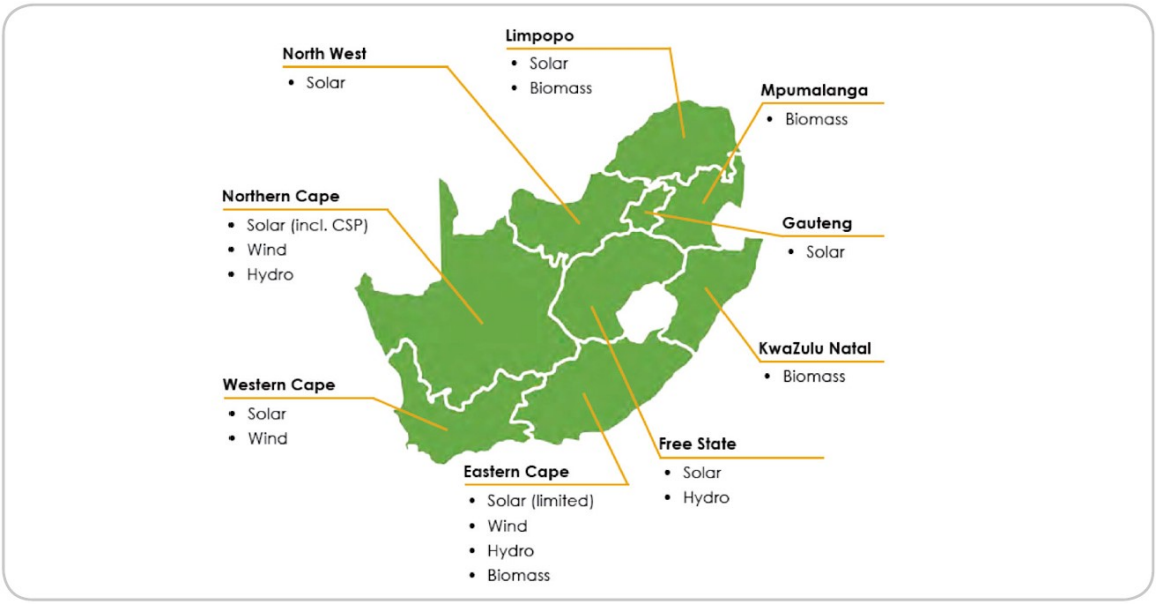

Figure 3: Provincial distribution of renewable energy resources across South Africa [43]

The REIPPPP bidding process has two phases; the qualification phase and the evaluation phase. The REIPPPP allows competitive bidding and evaluates investors based on bidding price and their ability to fulfil the qualification requirements such as land, environment, commercial and legal, financial, economic development and technical. Since its introduction, REIPPPP has by all means been successful in fast and efficient delivery of clean energy to the grid. Over six rounds of the program, the government of South Africa aims to develop private sector renewable energy investments with production capacity of 6,725 MW using a competitive bidding process [30]. For example, 102 independent power producers (IPPs) have been chosen as preferred bidders since its conception and 6,376 MW in renewable energy capability has been procured from different technologies in the six bidding rounds of the REIPPPP. The bulk of the power capacity has been procured from wind (3,365 MW), and solar PV (2,322 MW) projects, the rest being from Concentrating Solar Power (CSP) (600 MW), landfill gas (18 MW), hydro (19 MW), and biomass (52 MW). In 2018, 51 IPP projects were functional, adding a total sum of 2,738 MW to the national grid of the country [44]. The Department of Energy (DoE) started the Solar Water Heating Programme in 2008 and the programme managed to roll out about 424,790 solar geysers by 2015. Notably, the country's IRP makes provision for the generation of 17.8 GW of renewable energy by 2030, to be commissioned by REIPPPP.

The major costs for achieving emission reduction in the energy sector comes from the heating and electricity subsectors - subsectors where more emissions savings can be attained. The

use of wind and solar energy sources are considered measures with high potential for emission reduction in these subsectors for the year 2020. For the 2030 and 2050 periods, the steps with high reduction potential also include solar and wind energy generation, other mitigation technologies as well as carbon capture and storage (the latter assumed in 2050). For the years 2030 and 2050 investment in the 'other energy industries' subsector will also be needed, as this is the second highest subsector for investment, after the aforementioned sectors. The estimated positive net annual cost for the year 2020 is about R17 billion, for 2030 it is about R74 billion, and R176 billion for the year 2050 [32].

Table 2 below details green market opportunities in the energy sector.

Table 2: Summary of green market opportunities in the energy sector [32]

Opportunity	Key drivers	Requirement and barrier	Expected timeframe	Macro environment
Rooftop PV system bundling with standardised PPAs	▪ Economies of scale helps ▪ Shift in average and minimum size of projects tendered for across market ▪ ESCos can attract investors ▪ Property assessed clean energy (PACE)/power purchase agreements (PPAs): better pricing	▪ Standardised PPAs ▪ Differential between feed-in and self-consumed energy ▪ Regulatory certainty ▪ (small-scale embedded generation)	10 years	▪ The lack of available, affordable finance for smaller projects ▪ Smaller clients are not attractive to larger EPCs, so they sometimes ask them to wait until they have a few similarly sized clients ▪ Smaller rooftop PV projects are bundled together to reach a scale where they become attractive to larger investors who, up until now, have only been interested in utility-scale RE projects
PV for energy resellers	▪ Electricity tariffs ▪ Energy security ▪ PACE/PPA ▪ Wheeling ▪ Carbon footprint ▪ Continuous revenue stream	▪ Regulatory certainty ▪ Standardised PPAs ▪ Home-owners association approval	5-10 years	▪ 1-2 property tenders per month nationally in the last year – green building industry is on the rise ▪ Eskom and municipal electricity tariffs on the rise
Operations and maintenance (O&M): taking over contracts or O&M only	▪ Renewal of O&M contracts after 2-5 years (project dependent) ▪ Specialisation of EPCs ▪ Enables foreign project developers and investors to have a footprint in	▪ Option in contracts to change O&M provider ▪ Only for cash or bank-financed projects (not PPA)	1-5 years	▪ Shoddy workmanship due to cut-throat competition resulted in poorly installed systems ▪ As these clients start exploring better EPCs for new projects, they sometimes request takeovers of older projects for O&M component

	South Africa without a dedicated labour force			▪ ESCos/EPCs are starting to specialise, focusing on niche services as part of the wider value chain ▪ Entrance to market: foreign EPCs trying to get footprint in SA but without a local office can partner post installation with local EPCs to continue doing O&M in the foreign EPC's name, and carry their brand; at the same time creating local employment
Battery storage (BTM) – 1.5 GWh	▪ Load-shedding ▪ Backup power demand ▪ Battery pricing ▪ Increase in renewable energy (RE) ▪ Electric mobility	▪ Battery pricing still high for the need ▪ Battery specific PPA / financing / lease	15 years	▪ Load-shedding and security of supply are major concerns. ▪ Battery storage prices are dropping fast. ▪ Electric mobility is gaining momentum
Energy efficiency as a service & modernization	▪ Legislative and regulatory changes ▪ Rising energy prices ▪ Falling cost of energy-efficient technologies	▪ Smaller project sizes ▪ Economic downturn	1-5 years	▪ New buildings only make up ~5% of total buildings in South Africa Retrofitting of existing buildings is expected to become the largest sector within the green building industry by 2020

2.3.3.4 Learning from the COVID-19 pandemic

Energy demand in South Africa decreased as a result of the lockdown measure related to the COVID-19 pandemic. This is because the industry/manufacturing sector consumes the majority of the country's energy, especially electricity. Thus, as a consequence of the pandemic crisis, electricity demand was reduced by an average of 6,000 MW up to a maximum of 11,000 MW. However, South Africa is still technically in an energy crisis, and as the lockdown measures are being eased and the economy is getting back on track, the energy demands are on the rise and the country is beginning to experience the pre-lockdown energy crisis. Therefore, the government needs to fast-track the issuing of the next round of REIPPPP to procure renewable energy from IPPs in order to close the energy supply gaps in the country [45].

2.5 Agriculture sector

In developing countries, including South Africa, agriculture is identified and contributes to the Gross Domestic Product, a fundamental sector for driving the economy. Globally, approximately 70% of the fresh water and 60% of terrestrial land is used for agriculture. In addition, 40% of the worlds' population directly relies on the agricultural sector for their livelihoods. In South Africa, approximately 80% of the land area is employed for agriculture, though only about 11% of the total area is suitable for cropping [10]. The South African agriculture industry abstracts approximately 62% of surface water. South Africa has a dual agricultural economy, with both subsistence-based production and a well-established commercial farming sector.

The agricultural sector comprises largely of cattle and sheep farming. Maize is the most common crop grown in the country, followed by wheat and to a lesser extent sunflower seed and sugar cane. Increased wealth and post-apartheid reforms have resulted in the shift from staple crops such as maize and wheat to a more diverse diet which includes chicken, eggs, fruit and vegetables, beef, milk, pork and mutton. However, an estimated 25% of South Africans are still food insecure and it is estimated that 30-40% of the food produced in the field is wasted throughout the food system [38, 46, 47]. In addition, 90% of commercially grown maize and 70% of cereals in the country are commonly rainfed on the Highveld. However, soil degradation and water scarcity are demanding issues. Moreover, commercial farmers, who are responsible for approximately 95% of the crop and livestock production, do rely heavily on fertilizers for maintaining their farm yield levels, which results in approximately 60% of the South African cropland being moderately to severely acidic in the topsoil, and 15% in the subsoil, respectively. Intensive tillage during land preparation, planting, mono cropping, as well as weed and pest control have also been indicated as some of the major causes of land degradation. Furthermore, livestock, the largest subsector of agriculture in South Africa that is known to contribute to approximately 25-35% of the total agriculture per year, has also been related to issues such as effects of overgrazing caused by free range livestock production ultimately leading to soil compaction, as well as bush encroachment and the availability of palatable grass species making the sustainability of cattle and beef production a concern [47].

The sustainability of agricultural activities in the country are also determined by climate change. Climate change is anticipated to have generally adverse impacts on the production of cereals, high value export agricultural production and exhaustive animal husbandry practices. However, it is probable that climate change will affect positively on tropical crops such as sugarcane, as well as increasing sugarcane pests. Though some crops may be more resistant to climate change, others might be more sensitive. There will be a need to develop drought resistant cultivars for specific areas or shift the agricultural practices to adapt to the *new* prevailing climatic conditions in a specific region.

Climate change effects on agricultural livelihoods, food production and food security in South Africa are significant national policy concerns. Climate change effects on food production and food security are connected to future projected water supply restraints, with subsistence dry-land farmers being the most vulnerable. Large-scale irrigated production is likely to be least endangered by climate change, provided that there is adequate water supply for irrigation and genetically modified crop varieties.

In terms of its contribution to the economy, when considering the whole agricultural value chain, it is estimated to contribute approximately 12% to the national GDP and provide

employment as well as earn foreign exchange. However, so far, the primary agricultural sector accounts for about 3% of the GDP and 7% of employment, suggesting the need to fast track the adoption of sustainable agricultural practices to transform the sector [46, 48].

2.5.1 Existing and potential of private sector green investments/businesses

2.5.1.1 Existing private sector green investments/businesses

In general, the conventional agricultural sector is faced by a number of challenges such as addressing climate change issues, declining resources (e.g. arable land, water, energy and nutrients), food security to ever growing population, and matters pertaining to land redistribution. Therefore, according to the report on the Green Economy Barometer of South Africa, the maintenance of the conventional way of agricultural industry is no longer sustainable [24]. With the South African population estimated to reach 82 million by 2035, there is pressure to shift to greener agricultural practices that do not degrade the environment, have a lower carbon footprint, reduce GHG emissions, increase water use efficiency, improve the soil and grazing, integrate pest management and improve profitability in the sector, while simultaneously securing supply for the growing population and safeguarding the scarce natural resources [24, 47, 47-50].

The greening of agriculture and/or uptake of more sustainable agricultural practices in South Africa, may be achieved through adopting different interventions in the production cycle. At the stage of input supply farmers should be capacitated to select climate compatible crop and livestock varieties in their regions. Water harvesting techniques and efficient water use for irrigation is also essential as an adaptive mechanism to climate change.

At production level, conservation agriculture an on-farm practice that sustains production through enhancing the environment and resource base is one of the climate smart techniques that van be adopted by farmers. Conservation agriculture is guided by the following principles: minimum soil disturbance, timely planting, precise use of inputs, crop rotation, intercropping, mulching and weeding. The other on farm practices that may be adopted by farmers include organic farming, that is, production management through promoting ecosystem health, and the bio-economy, which incorporates renewable biological resources and their adaptation to feed, bioenergy and food Livestock-crop integration, integrated pest management (IPM) and climate smart agriculture (CSA) are some of the techniques available for uptake [4, 46, 51].

Postharvest loss and food waste are also an integral part of greening the South African economy in the agricultural sector. Postharvest losses and food waste contribute about 4.4 gigatons of GHG emissions annually. These include emissions that occur on the farm and the amount of energy used to produce, transport and store food that is ultimately lost or wasted [52]. In fact, if food loss and waste were a country, it would take the third position in GHG emissions in globe after China and the United States [52]. There is therefore an opportunity for intervention at postharvest level as an entry point for greening the economy. Meat only contributes less than 5% to global food waste, however, when its carbon foot print is taken into it contributes about 20% of total food waste. The meat carbon foot print culminates across the entire value chain of production including methane from ruminants, emissions from feed and manure from livestock. Thus, opportunities for greening the economy at postharvest stage should focus on meat, dairy, fruit and vegetables and cereals which are susceptible to postharvest losses [52].

Stakeholders in the agricultural sector generally define the green economy as different terms that include CSA and ecosystems-based adaptation. Greening the agricultural sector creates an opportunity to provide livelihoods and food security for the growing population, minimize risks posed by climate change, and meet energy demands in the face of diminishing fossil fuel reserves. According to the Food and Agriculture Organization (FAO) of the United Nations, without significantly investing in and transforming the agricultural sector, the SDGs cannot be realized. In fact, agriculture is particularly central to SDG 1 (*Reducing Poverty*), SDG 2 (*Zero Hunger*), SDG 3 (*Health and Well-being*), SDG 4 (*Quality Education*), SDG13 on *Climate Change* and SDG 15 related to *Life on Land*, and many other SDGs.

Green agriculture minimizes environmental impacts by restoring soil fertility, reducing soil erosion, reducing agrochemical contamination, efficient water use, decreased deforestation, and minimizing emissions via sequestration, vegetation as well as avoiding the use of inorganic fertilizers [46, 53]. Furthermore, an investment in 'agriculture capital', and 'resource conservation' over time will result in an increase in 'agricultural production' with a subsequent increase in GDP with opportunities for further investments. It is also believed that, in this sector, investment in ecological practices could grow crop yields by as much as 23.9% by 2030, while circumventing further GHG emissions [46]. In addition, agriculture, through its forward and backward linkages to other sectors, can create both direct and indirect employment opportunities strengthening food supply security and relieving poverty. Moreover, agricultural food production capacity has the potential to create future economic opportunities. For example, Africa's food value market is estimated to increase from 313 billion US dollars in 2010 to 1 trillion US dollars in 2030 due to rising urbanization and the growth of urban middle-class consumers. This brings opportunities for the development of local businesses linked to food production, processing, distribution and marketing thereby further stimulating agricultural development [53]. Increased yields and productivity maybe an incentive to embrace the transition to sustainable agricultural practices if well demonstrated and communicated to the targeted group.

2.5.1.2 Business cases for green investments/businesses in the agriculture sector

Efficacy of smart or efficient agriculture options is context-specific and conditioned by microclimate, labour and the CSA technology combined. CSA options promise economic viability, with positive net present value and the internal rate of return greater than the discount rate. According to a recent study by Mutenje et al. [54], approximately 40% of the prioritized CSA options required at least two years start up timelines, in order to realise economic returns (increased productivity and income). The combination of CSA strategies with short and long-term benefits greatly improves the economic attributes of most of the promoted technology options. For instance, the integration of improved crop varieties and legumes with short-term benefits in all the options, seems to contribute to a wide range of positive profitability. CSA practice combinations that have cropping systems with high value legume crops had the highest net present values and internal rate of returns per hectare. In the study by Mutenje et al. [54], the CSA practice combinations with the highest profitability were also found to be less labour intensive relative to other CSA alternatives and conventional systems, reducing labour demand by 39-man days per hectare. The fact that these practices are less labour-intensive means that they can be easily adopted by resource-limited smallholder farmers in rural areas. CSA practices that are less labour intensive are also suitable for smallholder women farmers who produce 70% of Africa's food [55]. Thus, CSA practice combinations are worth implementing in financial terms and resource use efficiency.

2.5.2 Job creation through private sector green investments/businesses

Chapter 6 of the NDP entitled, *An Integrated and Inclusive Rural Economy*, focuses on agriculture and its goal is to *reverse the decline in the agriculture sector, promote food production and raise rural income and employment*. Much emphasis is on stirring poor rural inhabitants and emerging farmers, as well as creating employment opportunities in the agricultural sector. Chapter 6 urges agribusinesses, *white* commercial farmers, and organised agricultural industry bodies to provide support for the attainment of these goals [46].

The number of people of employed in the agricultural is a proxy indicator for the potential green jobs that can be created in the sector. According a Stats SA [56], approximately 843,000 people are employed in the agricultural sector in South Africa, and about 8.5 million people are directly or indirectly dependent on agriculture for their employment and income. The NPC estimates that agriculture has the potential to create 1 million jobs by 2030, with the most of these jobs being in the smallholder sector. Current and emerging technology may be a tool to attract millennials into green agriculture value chains and support services. Evidence shows that young people perceive agriculture as a boring and less lucrative job meant for the elderly and retirement. However, green agriculture practices such as precision and undercover agriculture may attract millennials into the sector [57]. The NPC emphasises that agriculture has the potential to expand if the basic environment can be created, and that job creation is attainable with effective land reform, creation of employment and strong environmental safeguards. Further, growing commercial agriculture has the potential to create 250,000 direct jobs and 130,000 jobs indirectly. Better use of land in the former homeland areas could also create 300,000 employment opportunities, with a further 326,500 potential employment opportunities downstream and upstream of the agricultural sector [51].

According to the survey, key informants highlighted that several private sector businesses have already created direct and indirect employment opportunities, seasonal as well permanent jobs for many people in the country and project that green decent jobs will be increased by 30% by 2025, accommodating most people in rural communities.

2.5.3 Scalability of private sector green enterprises or investments/business

2.5.3.1 Existing enabling factors for green investments/business

Policy frameworks guide agricultural initiatives related to the green economy. The government plays a very important role in mainstreaming and coordinating green growth in this sector, which is also seen in its public procurement. Particularly, initiatives which are in alignment with regulations and connected to sustainable agricultural practices create a real opportunity for the green economy. Commonly mentioned green economy enabling policy-related regulations/legislation governing agriculture in South African include: Conservation of Agricultural Resources Act 43, 1983; Genetically Modified Organisms Act 15, 1997; Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act 36, 1947; the Land Care Program within the former Department of Agriculture, Forestry and Fisheries (DAFF) land use and soil management; the Draft Policy for the Sustainable Management of Veld and Forage Resources in South Africa within DAFF Animal Production; draft national policy on organic production; policy in agriculture in sustainable development; and other statutes not necessarily addressing agriculture only, but, for example, issues of resource efficiency (e.g. the National Environmental Management Act) [38]. These policies are also accompanied by budgetary allocations.

Sustainable agricultural activities are being encouraged across the country to improve the productivity of the agriculture sector and address the challenges it is facing. Some of the organizations involved in driving the green economy through sustainable agricultural practices include Lima rural development foundation, WWF-South Africa, Cacadu District Municipality, Nkomamonta Organic Farmers' Cooperative, Sedikong Organic Farmers Cooperative, Ezemvelo Farming Initiative, Grain South Africa Farmers' Association, Wensyledale Farm Gauteng, Oranjezicht City Farm in the Western, Cape and the Umgibe Farming Organics and Training Institute in KwaZulu-Natal [46, 24].

2.5.3.1.1 Institutional arrangements for green investments/business

Government plays a key role in re-shaping the agricultural economy as a whole in the direction of sustainable development pathway. However, a successful green agriculture implementation and establishment requires the partnership of all stakeholders including private sector and civil society to work in a coordinated and integrated way to give the support needed for the various aspects of agricultural green economy [46].

Key roles players in the sector include creditors and financial institutions (banks being major players) and AgriBEE Fund which provides support to businesses owned by black South Africans' There is also Agri South Africa, a federation of agricultural organisations that conducts policy advocacy work around issues pertinent to the green agriculture such as trade negotiations, industrial policy, taxation, financing, land reform, labour laws, training, farmer development, environmental affairs, water rights and water pricing, other input-related issues, farm safety, law and order, infrastructure, technology development and transfer, statistical information and local government.

The Agricultural Business Chamber (Agbiz) is also one of the players critical in green agriculture, ensuring that agribusinesses play a positive role in the in the transition towards a green economy. Agbiz will be hosting a congress themed "Building resilient and sustainable agri-food ecosystems" in 2021. The congress will provide the key forum for identifying the critical developments needed over the coming decades to ensure agri-food value chains are managed sustainably for the benefit of current and future generations.

Other platforms include Transvaal Agricultural Union South Africa, National African Farmers' Union of South Africa, African Farmers' Association of South Africa, the Agricultural Research Council and various universities involved in research to transition the agricultural sector to a green economy, creating decent employment across the country.

2.5.3.2 Gaps and challenges hindering flourishing green investment/ business

Similar to other economic sectors, the agricultural sector is also faced by several challenges. These include low market values of agricultural commodities, impacts of agriculture in the environment, changing climate conditions, and resource scarcity to support the production particularly poor rural farmers. South Africa's major challenges are the rising scarcity and degradation of land, soil and water resources, poor infrastructure and logistics, lack of awareness, limited access to production inputs and equipment, lack of inclusiveness of low-income communities, power imbalance, no or little involvement of the South African youth and access to market and credits [51, 57-58]. Most stakeholders also identified lack of capacity to deliver green business, lack of incentives, limited access to finance, and limited access to

information as key barrier to transitioning to a green economy in the agriculture sector. Recent The outbreak of COVID-19 are also causing unprecedented challenges for stakeholders in the agriculture. One key example resulting from lockdowns is the loss of employment opportunities, especially for informal workers due to restrictions in movements and social distancing.

2.5.3.3 Opportunities to enhance the enabling environment

The transition to green economy in South Africa will involve the participation of small-scale farming households. South Africa's 2011 census shows that 2.9 million households in the country were involved in agriculture, primarily subsistence and smallholder farming, with the greater number of agricultural households located in the provinces KwaZulu-Natal (25%), Eastern Cape (21%), and Limpopo (16%). The Census of Commercial Agriculture shows that in 2017, there was a total of 40,122 farms/farming units involved in the commercial agriculture in South Africa. The biggest percentage from livestock farming (13,639 or 33, 9% of the total), then mixed farming (12,458 or 31, 1%) and finally field crops (8 559 or 21,3%). The highest number of farmers came from Free State (7,951 farms or 19,8% of the national total), followed by Western Cape (6,937 or 17,3%), North West (4 920 or 12,3%) and Northern Cape (4,829 or 12,0%). Those with the lowest number of farmers were Gauteng (2,291 or 5,7%), Mpumalanga (2,823 or 7,0%) and Limpopo (3,054 or 7,6%) [40]. International experiences have also affirmed the significant role of small-scale and commercial farmers in the transition towards the green economy [44].

Precision and undercover agriculture are also potential opportunities for investors and businesses. This kind of farming maybe suitable for commercial farmers or smallholder farmers with financial capacity given the costs that come with related technologies. Otherwise most of the smallholder farmers will require subsidies and more technical support from government and donors to be able to adopt and sustain the technologies. Precision agriculture (PA), also called 'smart farming', 'satellite farming' or 'site-specific crop management', permits producers to accurately apply inputs such as fertiliser, water, and pesticides through certain technologies [48]. PA uses sensor technology, including satellites, drones (i.e. remotely piloted aircraft systems), and positioning technology such as the Global Positioning System (GPS) to rapidly collect data about a crop or farm. The collected data is then used to make more informed decisions that are custom-made to a specific farm, part of a farm, and crop field. Figure 4 below shows the different components used for PA. The implementation of PA creates opportunities for investors through the need for remote sensing technologies (e.g. drones) and software solutions. For example, for 2015, a global drones market valued USD 670 million (R8.8 billion) was estimated. It is expected to grow at a CAGR of 18.5% to 38% during 2018-23. In South Africa, the estimated potential bespoke services based on hectares for high value export fruit production is R131 million. There are more opportunities for sellers of remote sensing hardware, and software developers and manufactures. Current market players providing remote sensing applications to increase efficiencies of agriculture production include Aerobotics, AeroVision, Agri-Sense, DRONESIX, FarmPin, FruitLook, and TerraCam [48].

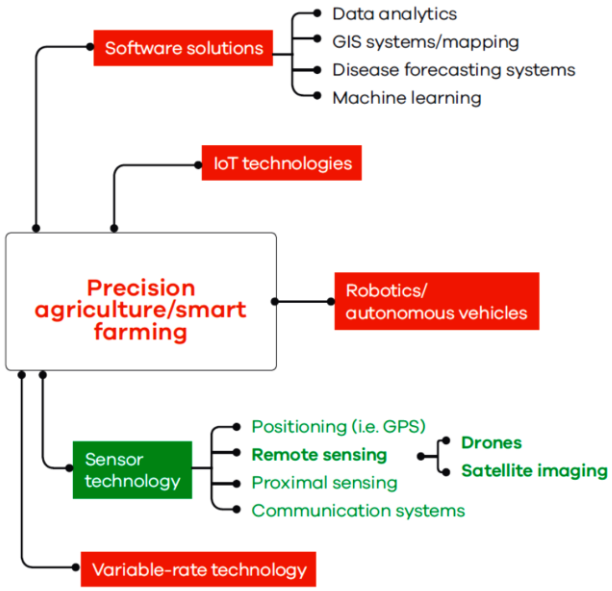

Figure 4: Features of precision agriculture and smart farming [48]

Undercover farming (UF) is a form of farming that permits for more favourable growth conditions through the use of several forms of agriculture such as indoor farming, controlled environment agriculture (CEA) and vertical farming. UF uses a range of technologies such as low tech systems (e.g. shade netting), tunnel systems (medium-tech) (e.g. ventilation control and hydroponics), and High-tech systems such as those used for CEA, where carbon dioxide, light, humidity, temperature, water, pH levels, and nutrients are monitored, (e.g. hydroponics, aeroponics and aquaponics). The global indoor farming market in 2017 was valued at USD 106.6 billion (R1.4 trillion). The global uptake is growing, and rapid increase is expected for vertical farming, with a CAGR of more than 20%. In South Africa, a conventional estimate for the present market size for low- and medium-tech UF in the Western Cape was R1.4 billion for 2018. As UF is relatively new, further opportunities for manufacturers and suppliers of steel, plastic, netting, hydroponic equipment, growth medium, air conditioning and lightening, and ICT solutions as well as trainers and consultants are available [48].

The fast-developing South African biofuel industry has the potential to shake up the agricultural sector from a circular economy perspective, thereby creating opportunities for investor in the agricultural sector. The circular economy is part of the green economy. It is an economic system that aims to ensure that raw material, components and products lose as little value as possible by ensuring their reuse as the same or different product. The focus of this concept is more on renewable energy sources and the use of systems thinking. The concept utilises the 3-R approach that is: Reduce - minimum use of raw materials, Reuse - maximum reuse of products and components, and Recycle high quality reuse of raw materials [59]. In 2007, the South African government recognised the Biofuel Strategy, which makes 2% provision of annual fuel demands. The crops suggested for the production of biofuels are sugar beet and sugar cane for bioethanol and soya beans, canola, and sunflower for biodiesel. A total of 1.4% of the arable land is estimated to be used to meet this biofuels target. The purpose is to use underutilised arable land in the former homelands for biofuel crops, thus creating opportunities to the rural poor by providing a market for their produce [60].

Another crucial area with substantial market potential for small businesses is the drive towards smart (i.e. inter-connected and efficient) irrigation systems for emerging smallholder farmers and commercial farmers. Agriculture is the largest sector in South Africa, and most of the irrigation schemes use comparatively inefficient irrigation methods. This inefficiency of irrigation methods introduces new opportunities in which better working, and more efficient methods can be used to enhance usage of water in the sector.

CSA provides a new way to fulfil food and nutrition security demands in the face of the changing climate. CSA in South Africa is based on the following production systems: namely agro-ecology, organic farming, and conservation agriculture. For example, the market for South Africa's no-till planting machinery is valued worth about R1.1 billion, with opportunities for local manufacturing as the sector is still dominated by imported machinery that is not well-suited to the country's soil conditions [61].

2.5.3.4 Learning from the COVID-19 pandemic

The agricultural sector could emerge from the COVID-19 pandemic in a strong position, if certain challenges can be overcome in South Africa. The coronavirus pandemic has emphasised the importance of the agriculture sector in South Africa and across Africa because of its potential to support economic growth, create and sustain jobs and boost exports. At a time when most industries will be reducing employment, it is hoped that agriculture will at least maintain employment in primary activities. Agriculture has kept employment levels going because by nature, it is a labour-intensive sector. There are many agricultural sectors that are increasing employment now, although seasonal, such as the fruit export sector [62].

2.6 Manufacturing sector

Manufacturing is a very important sector for several industrially emerging countries. It contributes to the economy *via* its synergistic connections with other areas such as trading, mining, financial, supply chain and even services. The South African manufacturing industry is a strong sector that is capable of competing in the global economy, providing an environment for boosting the growth of other activities, such as services, and achieving specific outcomes, such as employment creation and economic empowerment. This sector employs approximately 9.2 million people and contributes to about 15% of GDP in the country [38]. It has a potential to support the achievement of several economic and social objectives like poverty reduction, employment generation, better life standards and better access to nutrition, health care and education.

2.6.1 Existing and potential of private sector green investments/businesses

2.6.1.1 Existing private sector green investments/businesses

The manufacturing sector plays a critical role in encouraging the growth of other areas, enabling economic empowerment and creating employment opportunities. However, the conventional manufacturing industry has been a remarkable contributor of resource depletion, harmful GHG emission, and environmental damage. As a result, in the current competitive manufacturing setting, pressures continue to rise over sustainability issues in terms of economic, environmental and social performance [63-64]. The government of South Africa is also committed to implement greener productions steps that are resource efficient and minimize waste discharge into the environment.

Stakeholders in the industry define greening manufacturing as economic growth that entails increased and efficient production and competitiveness while at the same time ensuring climate resilience and maintenance or increase in the quality, quantity and productivity of natural assets. It involves using fewer natural resources, reduce pollution and waste, recycle and reuse materials, and moderate emissions and energy efficiency in their processes.

Greening the manufacturing sector is, therefore, increasingly being considered by industry-captains and policy makers to ensure sustainable economic growth and development through environmentally friendly approaches. Green manufacturing forms the basis for making products using green energy, producing and marketing renewable goods, changing outputs to inputs (recycling) and employing green technologies in operating businesses. It is the process of manufacturing using non-polluting, economically viable and feasible processes that preserve resources and energy, and are safe and sound for workers, consumers and the community at large [63, 65].

2.6.1.2 Business cases for green investments/businesses in the manufacturing sector

Manufacturing companies are expected to apply green manufacturing principles and increase product complexity at a reasonable price. However, a major challenge for engineering managers is to make sure the costs of embarking on green manufacturing are lower than the benefits derived, without compromising the quality of products. Cost benefit analysis (CBA) is then commonly applied for costing of green manufacturing at early stage to help make decisions by the managers.

Results of CBA made in China for gear manufacturing company using process-based cost model and a systems dynamics model showed that equipment and carbon emission costs are the main components of a manufacturing company and the total life cycle of a green manufacturing product is lower than that of the same product in conventional manufacturing [66]. The study also reported that greening *issues* of manufacturing can possibly reduce costs both at unit and batch level. At the unit level, reduction of cost is attained through using electric power and reducing waste during production. Waste reduction can be realized through the use of recycled material. The use of recycled materials can lead to substantial reduction of total carbon emission during production thereby resulting in a reduction in carbon emission tax, which comprises a larger part of total life cycle cost of the product. At the batch level, raw and finished products are transported to the manufacturing company, customer and waste reuse and/or recycling centre. Costs at the batch level can then be reduced by employing electric power and low energy consumption fuel with low carbon emission factor [66].

2.6.2 Job creation through private sector green investments/businesses

A joint report by Trade and Industrial Policy Strategies (TIPS), the IDC and the Development Bank of Southern Africa (DBSA) estimated that long-term (2018-2025) employment potential of the formal sector in the green economy is around 462,000 full-time and/or part-time jobs, of which the manufacturing and construction jobs account about 10% (46,000) [67]. According to the New Growth Path projections, additional 80,000 direct jobs will be created from manufacturing by end of 2020 [4]. Furthermore, the IPAP has a target of 2,447,000 additional indirect and direct jobs by end of 2020, out of which 350,000 direct jobs are projected to originate from the manufacturing sector [67].

According to the corporate association of manufacturers (Manufacturing Circle), the manufacturing sector has sheltered half a million jobs over the last two decades, and contributes about 14% to the country's GDP, which is less that is expected for South Africa's stage of development. According to the Manufacturing Circle, 800,000 to 1.1 million direct jobs can be created if manufacturing can expand to 30% of GDP, with 5 to 8 times that number in indirect jobs [69].

However, COVID-19 is expected to have negative effects across all the sectors in South Africa due to the lockdown that was applied by the government from March 2020. These negative impacts may have similar effects on the projected job creation in the manufacturing sector. A study that was conducted by Southern Africa – Towards Inclusive Economic Development [70] in April 2020, found that the lockdown that was enforced by the government will have different impacts across the different sectors and at varying levels. The subsectors in the manufacturing sector are likely to get varying impacts with:

i. Pharmaceuticals, hygiene and cleaning having a mild decline of 0 to1-0%;
ii. Food and non-alcoholic beverages, petroleum, plastic, glass with a moderate decline of -10 to -30%;
iii. Paper, paper products, basic chemicals, fertilizer, paint, and other having a decline of -30 to -60%
iv. Alcoholic beverages and tobacco, wood, wood products, tyres, rubber products, non-metallic minerals and products (cement, concrete, etc.), iron, steel, metal products, machinery and equipment having a decline larger -60%.

Some optimistic key informants in the industry project over 500% increase in decent job opportunities for youth and women mostly.

2.6.3 Scalability of private sector green enterprises or investments/business

2.6.3.1 Existing enabling factors for green investments/business

South African manufacturing industries are embracing sustainable initiatives by imposing strategies that incorporate green manufacturing practices. For example, South Africa is a signatory to the United Nations Global Compact (UNGC), and most of South African organizations are implementing the Global Reporting Initiatives (GRI) framework as an indication for commitment towards greener or sustainable manufacturing practice. The government has also established the National Cleaner Production Centre (NCPC), which plays a critical role in maintaining sustainable practices within the manufacturing sector promoting efficient use of energy and waste reduction. The National Framework for Sustainable Development, the National Strategy for Sustainable Development, Medium-term Strategic Framework, New Growth Path, Support program for industrial innovation, the IPAP, National Climate Change Response, NDP, Green Economy Accord, and National Skills Development Strategy are also among the several initiatives driving the transition to green manufacturing. For example, according to the National Climate Change Response, South Africa is committed to adopting a range of intervention actions and develop a low carbon economy, which will result in reduction of emission by 34% and 42% by end of 2020 and 2025, respectively.

Tax incentives are also offered to companies interested to invest in energy efficiency, renewable energy, state-of the-art technologies and research and development. The government also provides some market for the green manufacturing through public procurement. The industrial symbiosis of programmes of the country, which link companies so that they can explore business opportunities, enhance business sustainability and profitability, have enabled sustainable waste management at the industry level. The planned Atlantis Special Economic Zone in the Western Cape, dedicated to green technologies, is envisioned to further contribute to the uptake of green manufacturing technologies in the country [4, 71-73]. The East London Industrial Development Zone (ELIDZ) [74] has also established a Science and Technology Park (STP) that has seen good progress in the renewable energy sector. ELIDZ has incubated tenants whose business focus is on renewable energy at the STP such as AET Africa (previously Amahlathi Eco Tech) and the Master Artisan Academy of South Africa (MAASA). AET Africa has been a pioneer in the sector and have managed to manufacture energy saving prototype Hot Spot and energy transfer-Heat Raider. Twirly, a street light that uses a vertical wind turbine and solar panel was also engineered at the STP. Apart from the influence of the government through economic support, legislation and dissemination of information, other factors such as personal values and commitment of owners, brand image, increased profitability, cost reduction, competitive advantage, reduction of pollution, energy efficiency, recycling of products and reduction of waste and material use, suppliers, customers and communities can also be considered as drivers of green manufacturing [75].

2.6.3.1.1 Institutional arrangements for green investments/business

Established in 2008 as a corporate association of manufacturers, the Manufacturing Circle is one of the major platforms in South Africa that engages with key stakeholders to promote the benefits of manufacturing growth for the broader economy, influence policy, and highlight opportunities and key priorities for manufacturing growth. In pursuit of these objectives, the Manufacturing Circle meets periodically with government ministers, heads of key state-owned entities, provincial and local government leaders; and other business sector leaders. One of the result areas of the Manufacturing Circle linked to the green economy is the endorsement of

environmental measures and legislation that supports sustainable access to land, raw materials and beneficiation. The platform has about forty member companies and four companies that are affiliate members. Any company regardless of size can be a member of the Manufacturing Circle.

There are other platforms such as the National Recycling Forum (NRF) that seeks promote the recovery and recycling of recyclable materials in South Africa. Its members include the formal recycling industry in South Africa, government departments, regional recycling forums, local government-based organisations, local government utilities, and co-opted advisory members.

There is also the Paper Recycling Association of South Africa (PRASA). PRASA seeks to change the mindsets about paper recycling and ensure that paper is seen as a commodity, a renewable resource that can be reused and recycled into new products. The association engages with government, businesses, schools and communities to increase awareness on the benefits and operations of recycling.

The Polystyrene Association of South Africa is also one of the active platforms in green manufacturing. The association seeks to promote Polystyrene as a packaging material of choice and educate customers and consumers about its safety, use and recyclability.

However, key informants were of the view that collaboration/linkages between academic, industry, government, and civil society in the country for the advancement of green growth in the manufacturing sector still has a lot to be desired. Further, although technology service centres, green technology data banks, national innovation systems and state of the art technology transfer infrastructure are available in country, key informants these platforms/facilities are yet to contribute significantly to the transformation of the sector.

2.6.3.2 Gaps and challenges hindering flourishing green investment/ business

Lack of awareness of incentives and support, in adequate funding, lack of benchmarks and standards, lack of management support, employee resistance, high initial implementation costs and operational challenges (i.e. lack of profitability or examples of success stories) have been listed as barriers of green or sustainable manufacturing [38, 75-76].

Key informants also acknowledged that there is need for capacity development of players in the industry and highlighted the need for urgent enforceable of regulations that can also be tied to incentives for good practices by organisations.

2.6.3.3 Opportunities to enhance the enabling environment

Overall, the advancement of green industries and related trade flows seems to be flourishing, globally. Global trade in green goods has increased by 167% between 2001 and 2016, as a combination of promptly progressing technology, government initiatives, and global programs that have propelled the industry forward. The trade performance of South Africa, government policy priorities and capabilities on research and development offer stimulating insight into the potential green industrial and trade development opportunities. Some of the highlighted opportunities include embedded generation technologies, water technologies, biogas-to-transport value, bio-composite materials, chemicals, plastic fabrication, pharmaceutical manufacturing, Forestry, Pulp and paper, and Furniture, and Capital / Transport Equipment and Metal Fabrication [77, 78]. A study which was undertaken in 2017 on the assessment of

manufacturing opportunities available to South Africa further identified four high potential trade and manufacturing opportunities. These include: i) water technologies in both treatment and conservation sectors (e.g. manufacturing water filtration membranes); ii) biogas-to-transport value chain; iii) small-scale embedded generation (e.g. smart meters); and iv) bio-composites [79].

Green economy industries such as energy-efficiency and renewable energy solutions present entrepreneurs with opportunities to find innovative ways of solving critical energy- and environment-related challenges. The construction sector was used as a principal area to improve the performance of South Africa's energy efficiency. The energy efficiency in building standard (SANS 204), initially drawn up in 2009 as a voluntary scheme, was made compulsory in November 2011, new buildings being the main targets. Municipalities have duty to approve new buildings plan and are required to impose the SANS 204 standards.

There is a growing number of eco-friendly hotels and lodges in the tourism sector, such as the Hotel Verde in Cape Town, the Peech in Johannesburg, the Umlani Bushcamp in the Kruger National Park and the Phantom Forest Eco Lodge in Knysna Forest. The property industry is also showing encouraging signs in embracing the concept of green buildings. For example, companies, such as Growthpoint Properties, have increased their effort on saving water and energy in their buildings across South Africa. However, despite the long-term financial benefits triggered by energy savings and the reduction of GHG emissions, some players still see the new energy efficiency regulations as expensive, since they might increase building costs. The Green Building Council of South Africa (GBCSA), based in Cape Town, provides support to the construction industry on how to build eco-friendly building in a cost-effective way. There is a need for players in the manufacturing sector to engage with GBCSA for technical advice on building cost-effective green buildings.

Green industry investments are important target areas of the NDP and updates on investments are made every year through the IPAP. The Department of Trade, Industry and Competition (DTIC) incentivizes businesses that develop and use green technologies contributing to the country's mitigation efforts. Mitigation initiatives are also supported by National Treasury through various tax allowances in the Income Tax Act of South Africa. The Department of Energy has also been driving the development of low-carbon initiatives in the industry and South Africa is a host party to 56 registered projects and 35 registered programmes forming part of the Clean Development Mechanism. In addition, the requirements by the Johannesburg Stock Exchange (JSE) for listed companies to report on risks and opportunities across financial and sustainability considerations have put South Africa in the forefront of fostering strategy, governance and sustainability. At firm level, the triple bottom line reporting, which has three major areas - economic, environmental and social goals, industries are able to contribute to the sustainability agenda through coordinated interplay (see Figure 5 below) [80].

Figure 5: Triple Bottom Line Goal System [80]

2.6.3.4 Learning from the COVID-19 pandemic

South Africa's manufacturing sector suffered a decrease in output by approximately 50% due to the impact of COVID-19. According to Stats SA, the largest contributor to this decline was the motor vehicles, parts and accessories and other transport equipment sector, where output decreased by 98% (contributing -7.8 percentage points). This was followed by the basic iron and steel, nonferrous metal products, metal products and machinery sector, where output decreased by 65.4% (contributing -13.2 percentage points); the wood and wood products, paper, publishing and printing sector, where output decreased by 49.2% (contributing -4.9 percentage points); and the petroleum, chemical products, rubber and plastic products sector, where output decreased by 41.5% (contributing -9.5 percentage points). These disruptions have caused revenues to fall abruptly in the manufacturing sector, and MSMEs have suffered the most [81].

2.7 Waste management Sector

With the world population projected to reach more than 9 billion by 2050, consumption of resources will continue to increase, resulting in the immense generation of waste. The increase in disposable income, in developing and emerging countries, will further progress the waste generation. If not managed properly, waste may endanger human livelihood either through contamination or its impacts on climate change. There is sufficient evidence which indicates that inappropriate management of waste may lead to the contamination of surface water, ground water, soils, sediments, air and the biota. In line with the efforts to endorse sustainable development in the recent years, efforts have been made to sustain waste management [82-83]. The philosophies of sustainable waste management strategies are wired towards the circular economy concept that seeks to reduce waste generation, to capitalize on waste reuse and recycling, and to make sure the safe and environmentally sound waste management. The circular economy concept embraces the 3-R approach of Reduce, Reuse and Recycle [59].

Unrelenting blast of populations, human activities, and the drive for urbanization and industrialization have been regarded as the main causes of increased GHG emissions. Methane (CH_4), carbon dioxide (CO_2), and nitrous oxide (N_2O), which are produced during disposal and management of waste, are known to contribute the most to global warming. About 3–4% of the total global man-made emissions of GHG, ranging from $50x10^9$ to $60x10^9$ tonnes of CO_2

equivalent/year, is said to be contributed by post-consumer waste. Greening the waste management could, therefore, help to significantly reduce the GHGs emissions [84].

The green economy approach in relation to waste management would mean implementing the supposed '*life-cycle approach'* or circular economy according to the broader goal of economic development, providing economic opportunities within the objectives of reduction, reuse and recycling wastes. Understanding the potential of a resource-based approach of waste management has resulted in a shift in the focus of international community to the all-embracing policy goal of sustainable development. For example, the 10th Conference of the Parties of UNEP in 2011 recognized that unavoidable wastes can be useful resources and supported the concept of waste deterrence and waste management as a reasonable economic opportunity. Similarly, the Rio+20 Summit of, 2012 placed emphasis on a Green Economy as a possible tool/means of implementation for supporting sustainable development, and called for reduction, reuse and recycling of waste. The 17 SDGs, on many aspects, relate either directly or indirectly, to how waste and waste management can contribute to sustainable development. Overall, greening waste management contributes to climate change, reduced GHG emissions, and diversion of waste from landfill, increased employment, as well as sustainable human settlements and better quality of household life [85].

The European Union Emissions Trading System (EU ETS) is the anchor programme of the EU to reduce its manmade GHG emissions which contribute largely to the global warming [84]. The system puts a cap on overall emissions in installations covered by the programme and these are reduced on an annual basis. Companies are then able to buy and sell allowances as required but within this limit. This 'cap and trade' approach provides the companies with the flexibility to limit their emissions cost-effectively. South Africa on the other hand introduced the Carbon Tax Act 15 of 2019 that is also applied in the waste management sector as a means of reducing GHG emissions. It is designed to tax companies on the basis of the GHG emitted from their work. Robust assessments to review process, combustion and fugitive emissions on site a done to determine the total tax payable. Tax free incentives are also included in the Carbon Tax [86].

2.7.1 Existing and potential of private sector green investments/businesses

2.7.1.1 Existing private sector green investments/businesses

Internationally, municipal solid waste is defined as including refuse from households, commercial and institutional organisations such as hospitals, non-hazardous solid waste from industrial, yard waste, market waste, and street sweeping. Within the South African context, waste is defined as any *undesirable or superfluous by-product, emission or residue of any process or activity which has been discarded, normally accumulated or stored for the purpose of* discarding or further processing through treatment. Some stakeholders argued that green and circular economy innovation can be accelerated in waste management sector by defining waste differently, so that resources can be optimally used.

In South Africa, waste is categorised into the following key streams: general waste - municipal waste (non-recyclable portion); organic waste (component of municipal waste), other (industrial and agricultural biomass waste), paper, construction and demolition waste, glass, metals, plastic, tyres; unclassified waste electric and electronic equipment (WEEE), ash (from power generation), slag (from mineral processing); and hazardous waste - waste oils. Nearly 46.8 million tonnes of general waste is generated yearly in South Africa with the largest proportion from the Gauteng (45%) and Western Cape (20%) provinces. In addition, more than 5 million cubic meters of hazardous waste is produced annually, mostly in the provinces of KwaZulu-Natal and Mpumalanga [87].

In 2017, it was estimated that South Africa generated about 54.2 million tons of general (municipal, commercial, and industrial) waste [88]. The breakdown of the general waste is presented in Figure 6, and Table 3 details of how general waste was managed in the same year.

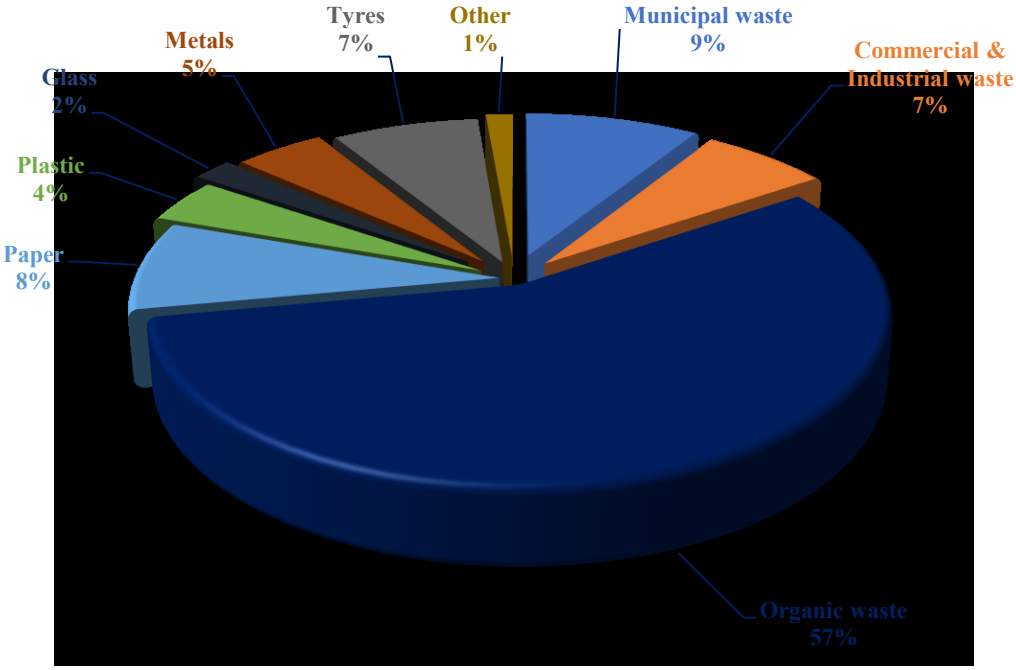

Figure 6: Summary of general waste generation in South Africa [88]

Table 1: Summary of general waste management in South Africa [73]

Waste Type	Estimated Tonnes	Recycling/ Recovered	Landfilled
Municipal waste	4,821,430	0.0%	100.0%
Commercial & Industrial waste	3,550,505	10.0%	90.0%
Organic waste	30,499,455	31.1%	68.9%
Construction & demolition waste		90.0%	10.0%
Paper	4,482,992	58.0%	42.0%
Plastic	2,211,225	43.0%	57.0%
Glass	1,113,362	78.4%	21.6%
Metals	2,492,646	75.0%	25.0%
Tyres	40,35,929	100.0%	0.0%
Other	729,615	9.1%	90.9%
Totals	**54,175,147**	**38.6%**	**61.4%**

Approximately 66.9 million tons of hazardous waste was generated in South Africa in 2017 [88], with contributions from the following waste types: Summaries of waste generation and management are detailed in Figure 7 and Table 4, respectively. About 94% of the hazardous waste in South Africa is managed in landfills.

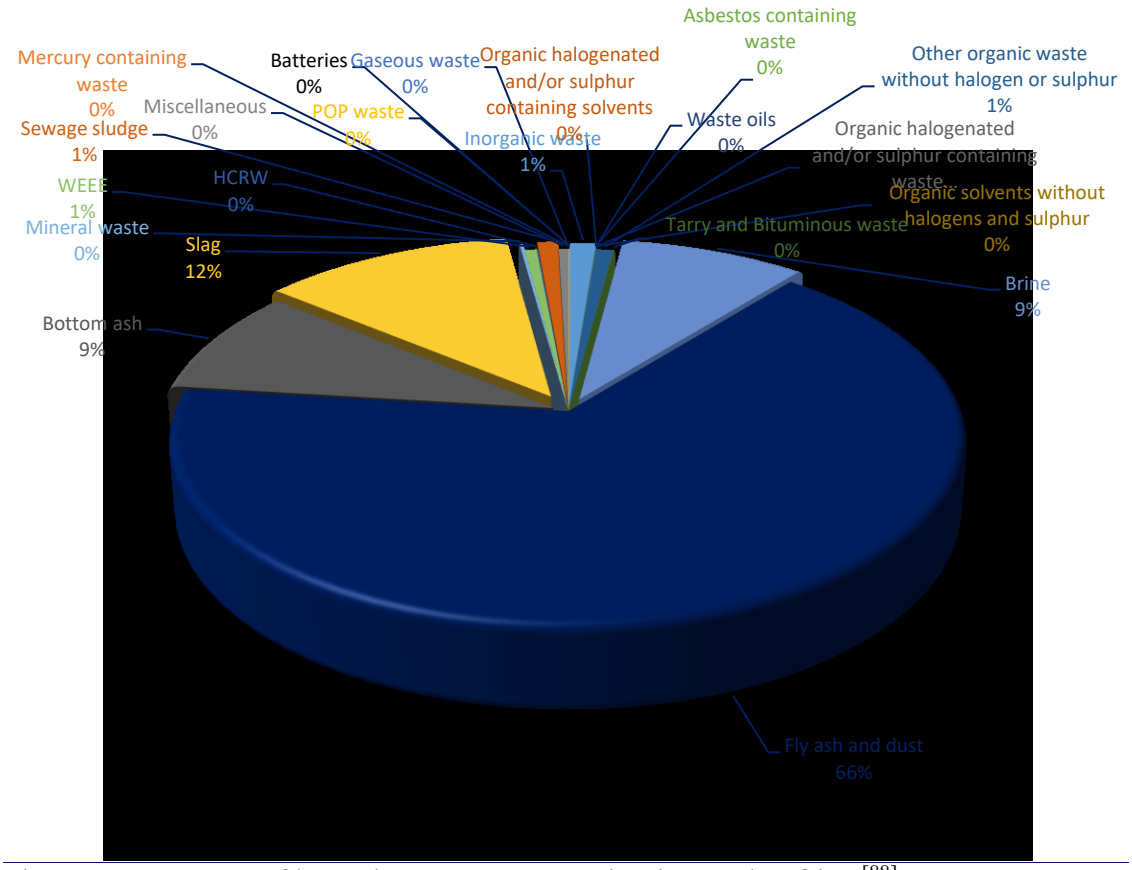

Figure 7: Summary of hazardous waste generation in South Africa [88]

Table 2: Summary of hazardous waste management in South Africa [88]

Waste Type	Estimated tonnes	Recycling/ Recovered	Treated	Landfilled
Gaseous waste	6		0%	96%
Mercury containing waste	1,392		0%	95%
Batteries	39,867		0%	26.9%
POP waste	570		0%	100%
Inorganic waste	786,083		0.6%	99.4%
Asbestos containing waste	6,721		0%	100%
Waste oils	116,25	80%	0%	20%
Organic halogenated and/or sulphur containing solvents	663	19.9%	6.2%	73.9%
Organic halogenated and/or sulphur containing waste	8,812	0%	4.4%	95.5%
Organic solvents without halogens and sulphur	4,562	42.1%	5.5%	52.4%
Other organic waste without halogen or sulphur	519,413	0%	4.7%	59.3%
Tarry and Bituminous waste	249,08	0%	0%	100%
Brine	5,793,645	0%	0%	100%
Fly ash and dust	44,000,000	6.8%	0%	93.4%
Bottom ash	6,000,000	8.3%	0%	91.7%
Slag	7,887,879	4.1%	0%	95.9%
Mineral waste	115,754	0.9%	2.8%	96.4%
WEEE	360,000	9.7%	0%	90.3%
HCRW	48,749	0%	0%	100%
Sewage sludge	632,749	15%	0%	85%
Miscellaneous	294,064	0.9%	1.5%	97.6%
Totals	**66,866,260**	**6%**	**0.3%**	**93.7%**

Of the 1,203 landfill sites for general waste in the country, only about 524 are registered, the rest are not legal, which results in backlogs for landfill sites. Both the unlicensed landfill and licensed sites are not being utilized and maintained according to the regulatory standards. Other persistent problems municipalities face in the sector of waste management range from the use of unpermitted landfills, to illegal dumping and dumping sites, inadequate waste collection service, inadequate waste minimisation, lack of waste storage facilities, lack of recycling initiatives by municipalities, lack of waste transfer facilities, lack of recovery facilities and regulation and enforcement. Consequently, the environment is being contaminated and ecosystems services damaged, with harmful effects to human health and well-being [89].

2.7.1.2 Business cases for green investments/businesses in the waste management sector

Discussions with regard to moving away from landfilling to different technology solutions are commonly hindered by the seeming increased cost of alternatives to the landfilling. Typical landfilling disposal fees are in the range of R600-R800/T for hazardous waste and R100-R150/T for general waste. However, these tipping fees, especially for general waste, are

thought to be insincerely low, since several municipal landfill sites are not constructed and operated according to sanitary engineered landfill standards, which would drive up costs through higher capital and operating expenses. To this end, the cost-benefit analysis of alternative waste management strategies can be assessed by examining the worth of resources which are currently lost to the economy of South Africa by disposing of them as waste in landfills [90].

Waste disposed in the landfills is money wasted since, with the right technology and anaerobic process, they can be converted to biogas, renewable energy whose cost of production is less costly than energy production from fossil fuels. Dumping of food waste to landfill comes at cost based on the external and financial costs related to the landfill itself. Food waste happens from postharvest, market, consumption and disposal, this includes leftovers from a meal, expired food, stale food, and blemished fruits and vegetables. Household food waste in South Africa costs R21.7 billion annually – equivalent to 0.82% of the country's annual GDP. Notably, household food waste accounts for less <4% of total food losses across the food supply chain. In addition, the availability of land for other sustainable developments is reduced as the amount of waste increases in the community. Even more important is the fact that more tax payer money will be employed for waste disposal. Also, every tonne of waste (particularly food waste) comes with wastage of water used for irrigation. Thus, food waste comes at a cost in terms of water loss to the nation and this is more costly now that South Africa experiences droughts every few years.

In a typical landfill or dumpsite, the build-up of waste is associated with GHG emissions such as CH_4. CH_4 is 20 times more potent than CO_2 regardless of staying for a shorter time in the atmosphere - 5% of global warming issues are attributed to CH_4. Another environmental cost is the air pollution. This is a constantly prevailing issue as various emission results in infection of humans and sicknesses such as asthma. Further, leachates from dump sites flow into the water bodies, which may adversely impact aquatic life and biodiversity [85].

According to studies made in Sweden and South Africa on externalities and CBA of landfill sites, because environmental and social costs (external) of waste management facilities or activities such as landfill operations are challenging to quantify in monetary terms, they are not commonly revealed in municipalities' accounting systems for waste management. The result is a bias against alternative waste management options, such as composting, recycling and treatment, all of which may be more costly and need high initial capital expenses and skills than traditional landfill sites, if looked from a purely financial lens. However, these alternatives are often more beneficial from a social and environmental perspective. As such, municipal waste management and financial planners need to consider aspects of the environmental and social benefits when quantifying costs. The options and alternatives can then be compared based on their overall costs to the user, as well as the financial and external costs. A study that estimated the external costs of landfill sites in Cape Town city found that they are presently at R111 per tonne of waste. However, these costs could drop if energy is recovered.

Some great progress has been made in the country in transitioning the waste management sector from a predominantly landfilling (90 in 2011) to one of recycling (40% in 2017) for general waste. According to a study done in 2014, the value of recycling/recovery, in terms of the resource value of recovered materials plus the avoided financial costs and externalities related to landfill disposal, is in the order of R10.5 billion/year; which could increase to as much as R46.5 billion/year under a scenario of 100% recycling and/ reusing. Achieving the goal of the Department of Science and Technology Waste Research, Development and Innovation (RDI)

Roadmap, which aims to reduce domestic waste by 60% and industrial waste by 20% by 2022, taking into account avoided financial costs and externalities associated with landfill disposal, could thus likely unleash R27.4 billion/year worth of resources into the economy, which otherwise would have been lost through disposal to landfill [90].

Text Box 2: An example of a green way of managing waste - USE-IT Waste Beneficiation

Established by the eThekwini Municipality as a non-profit organisation to research and develop waste beneficiation technologies in the eThekwini Metropolitan Area, the USE-IT Waste Beneficiation initiative aims to divert waste from landfill and creating jobs in the green economy. The USE-IT initiative identifies opportunities for waste beneficiation. Some of the Flagship Projects we are currently busy with. include:

1. Hammarsdale Waste Beneficiation Centre
2. The Compressed Earth Blocks (CEB), which promotes low technology manufacturing of building blocks from waste material and soil.
3. Glass Beneficiation Programme
4. E-Waste Recycling and Refurbishment Centre
5. Organics and Composting – working with the Duzi Umgeni Conservation Trust (DUCT) to establish small pilot composting operations using harvested local riverweed

2.7.2 Job creation through private sector green investments/businesses

Creating job opportunities in the waste management sector is about creating valued and sustainable 'green jobs', or jobs in sectors that demand less excessive carbon emissions, while contributing to an improvement of the environmental conditions. Waste recovery, reuse and recycling can create direct, indirect and induced jobs. For example, private and/or public recycling facilities provide direct jobs, while indirect jobs are created through businesses that buy recyclable supplies, such as brokers and processors (compost manufacturers and scrap metal dealers). Induced types of jobs include remanufacturers or re-users of recyclable materials and charity shops that sell used merchandise [91].

According to DEFF, the recycling industry in South Africa provides approximately 90,000 jobs, of which most of these opportunities are in the collection and sorting phases of recycling, as well as informal recycling activities such as 'waste-picking' on landfills. Government is keen to increase and encourage the involvement of SMEs, co-operatives and Expanded Public Works Programme projects, through applying separation at source and establishing buy-back centres and materials recovery facilities [90].

Key informants engaged during the survey projected that, with an enabling policy environment and the growing momentum towards recycling, employment opportunities could increase from as low as 40% to as high as 500% in the sector by 2025. The kind of jobs expected range from informal refuse pickers to formal managerial roles, accommodating women, youth and men across the value chain.

2.7.3 Scalability of private sector green enterprises or investments/business

2.7.3.1 Existing enabling factors for green investments/business

Similar to international trends, sustainable waste management is a subject of main concern in South Africa. As a result, the country's waste management landscape is changing steadily each

year as South Africa shifts to sustainable waste management. This is largely driven by enabling policies, municipality's tendency to partner with private sector – giving tariff reliefs from the local authorities that are tied to the volumes of waste that the companies generate, and the increased demand for secondary materials. Some technology service centres, and functional green technology data banks exist that support the growth of green businesses in the country.

South Africa has endorsed legislation, developed strategies and formulated policies to improve the waste management sector [4, 89, 92]. These include, the South African constitution Act 108 of 1996, Hazardous Substance Act 5 of 1973, Environmental Conservation Act 73 of 1989, National Water Act 36 of 1998, National Environmental Management Act 107 of 1998, Minerals and Petroleum Resources Development Act 28 of 2002, Air Quality Act 39 of 2004, Health Act 63 (South Africa, 1977), Integrated Pollution and Waste Management for South Africa, National Waste Management Strategy (NWMS) and National Environmental Management: Waste Act 59 of 2008 [85]. The revised National Environment Management Act: the Waste Act 59, discourses institutional structure and planning division in the waste management sector. It also promotes integrated waste management planning by all domains of government and role-players in the sector. Most significantly, the Waste Act delivers national regulating standards and norms, licensing and control of waste management activities as well as compliance and enforcement of the national waste information system.

South African legislations for waste is informed and influenced by the main elements of the waste hierarchy (Figure 8), which determine the total strategic approach for waste management. The NWMS validates the waste management hierarchy, assigning the highest priority to waste avoidance, followed by waste reduction, reuse, recycling, energy recovery, and treatment and disposal, in that preferential order [92]. The NWMS is structured against eight goals, namely; i) promoting waste minimization, re-use, recycling and recovery of waste; ii) ensuring the effective and efficient delivery of waste services; iii) growing the contribution of the waste sector to the green economy; iv) ensuring that people are aware of the impact of waste on their health, well-being and the environment; v) achieving integrated waste management planning; vi) ensuring sound budgeting and financial management for waste services; vii) providing measures to remediate contaminated land; and viii) establishing effective compliance with and enforcement of the Waste Act [93].

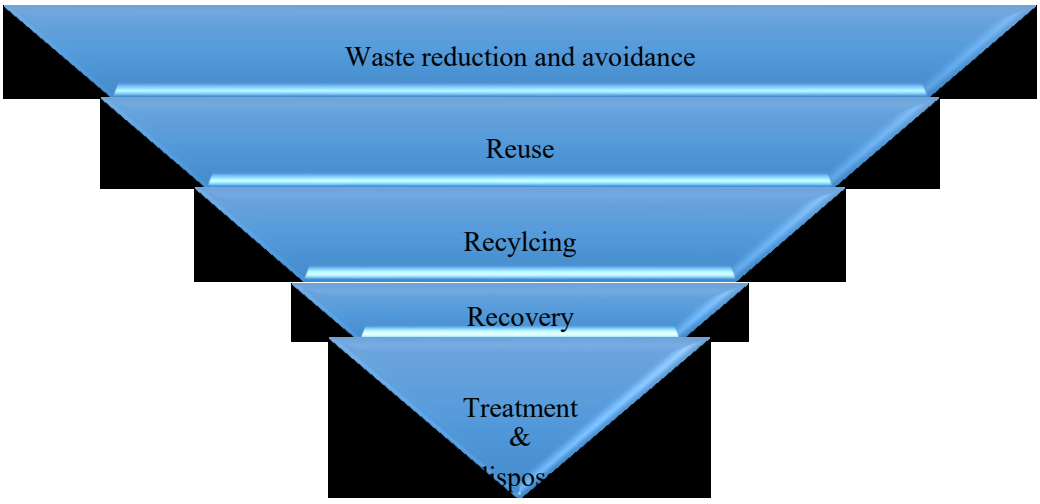

Figure 8: Waste management hierarchy as per the NWMS [94]

2.7.3.1.1 Institutional arrangements for green investments/business

Various institutions play important roles in waste management. The government is responsible for policy formulation, and targets, enforcement of regulations, waste service delivery, planning and waste disposal. Several associations and organizations also exist to foster partnerships and create an enabling environment for sustainable waste management in the country and these include the: Institute of Waste Management of South Africa (IWMSA); National Recycling Forum; Health Care Waste Forum; Packaging Council of South Africa; Recycling Actions Group; Plastics Federation; Paper Recycling Association of south Africa; Electronic Waste Association of South Africa; PET Plastic Recycling South Africa; Buy e-Bag; The Glass Recycling Company; Collect a Can; SAPRO; Recycling Association of South Africa; Responsible Packaging Management in South Africa; Recycling Industry Body; Rose Foundation; Tyre Recycling Association; and Scrap Metal Association. A number of non-governmental organizations (NGOs) also exist which include: WESSA; WWF; Groundworx; and Earthlife Africa.

2.7.3.2 Gaps and challenges hindering flourishing green investment/ business

The waste management sector is faced by multifaceted challenges. These challenges include increased volume of waste due to growing population and economy, increased complexity of the waste stream due to urbanization and industrialization, backlog of waste services for urban informal areas, tribal areas and rural formal areas, policy and regulatory environment that does not actively promote the waste management hierarchy, under-pricing of waste management services, few waste treatment options - making waste management more expensive than landfills. In addition, there is a lack of sufficient training on the different hierarchy of the waste management, lack of resources, political interference in decision-making, slow decision making, low priority afforded to waste, global market, government bureaucracy, and availability of waste for recycling in the sector [95-96].

Key informants from the survey also argued that the mainstreaming and coordination of green waste management is somewhat ineffective in the country, and the legal, policy, and regulatory framework does not support the circular economy. Requirements for a Waste Management license excludes many entrepreneurs in legally participating in green business initiatives.

These challenges are further complicated by the outbreak of the novel coronavirus; whose impacts are yet to be fully comprehended in this sector. Management of waste products especially from hospitals and affected areas of the community requires innovative approaches, which will curb the spread of the virus, while contributing to the sustainability and developmental agenda of the country.

2.7.3.3 Opportunities to enhance the enabling environment

The overall waste management sector in the South African economy is valued at a minimum of R25 billion, which still remains largely unexploited. This sector has a high job creation potential due to the different chains of waste management ranging from primary collection to the large-scale recyclers and affords opportunities to several actors with different skills and financial resources to participate in sustainable waste management [73, 94]. According to the 2017 Green Economy Inventory for South Africa, more than 35 projects involved in recycling (30), food waste management (2), waste-to-energy (2), bio2watt, waste to animal feed, pallet

repurposing, and collection (1) were identified. In the NWMS, it has been clearly indicated that job creation and participation of MSMEs as well as disregarded communities will be stimulated. The NWMS gives commitment that the role of informal waste pickers will be formalized, the role of MSMEs in waste management will be expanded and new jobs will be created by investing in the areas of reusing, recycling and recovering. Government is also committed to facilitate financial and non-financial support to MSMEs and cooperatives in the waste sector through the South African Micro-Finance Apex Fund, Khula, and the IDCs small business fund.

The waste sector of South Africa provides approximately 36,000 formal jobs and up to 80,000 informal jobs. A large proportion of these employees are from large enterprises with 77.5% from the private waste sector and metropolitan municipalities contributing 64.9% of public sector employees. The minimum value of the formal waste sector was R15, 3 billion or 0, 51% of the GDP for both public and private enterprises. However, 88% and 80.4% of this revenue comes from large enterprises that is, private sector revenue and metropolitan municipalities respectively. Approximately 62% of the total revenue comes from companies that have been in waste management for more than 25 years and R188 million was generated by young companies that were less than five years. This comprehension of the South African waste management sector provides an opportunity for dialogue between the private and public sectors to further identify areas for investment that are alternatives for landfilling, creates a benchmark for further prioritisation of waste research and investment in development and innovation (REF No 63). Potential future investment sectors include cleaner production, industrial efficiency and design for environment, dismantling, refurbishment and reuse, collecting, sorting, reprocessing and manufacturing, waste-to-energy processing, landfill operation and research on innovative handling of waste [14, 89, 94-95].

2.7.3.4 Learning from the COVID-19 pandemic

The stockpiling of gloves, gowns, masks and other protective clothing and equipment in the advent of COVID-19 pandemic has resulted in a global waste emergency due to the unusual production of waste from both households and health facilities [97]. In South Africa, the crisis has further compounded challenges faced by the waste management sector. The landfills are filling up rapidly and the local recycling market going through a massive dip due to the Chinese ban on importing recycling material. South Africa should consider expanding its local recycling market rather than depending on exports.

2.8 Linkage and nexus among the sectors

There are relatively few green initiatives in South Africa that operate across more than one sector [14]. However, there are many opportunities to implement nexus projects in resource management in the country, for example in solar power generation, water reuse and recycling, and precision agriculture [98]. Nexus initiatives provide the opportunity to integrate key economic sectors so that developmental issues, which are multifaceted in nature, may be resolved from a transdisciplinary perspective. Thus, nexus initiatives could play an important role in South Africa's quest to achieve its developmental targets e.g. SDGs, NDC etc. [98]. Stimulating cross-sectoral or nexus projects would require support for innovative projects that enable and enhance collaboration between sectors and integration across sectoral policy frameworks [14].

2.8.1 The water-energy-food

The water-energy-food (WEF) nexus is gaining recognition internationally as an intersectoral approach to resource management and sustainable development [99]. The Water Research Commission (WRC) of South Africa has identified the WEF nexus as one of its focus areas of research. The country has many opportunities to implement WEF nexus, e.g. in solar power generation, water reuse and recycling, and precision agriculture. However, there are a myriad of challenges that hinder the effective implementation of the WEF nexus in South Africa [99]. Firstly, as a developing country, South Africa's primary focus is on alleviating poverty, inequality, and corruption while attempting to increase economic growth. Secondly, resource management and policy development are generally sector-specific with little acknowledgement of adjacent sectors. Thirdly, data related to the three sectors, and especially their interactions, are frequently unavailable, inaccessible or unusable due to scale, unit or temporal differences. Further, WEF nexus implementation will be subject to its inclusion in national policies and standards, implying the integration of the water, energy and agricultural departments. A framework that considers the three sectors as well as technological innovations, human-wellbeing, SDGs and different drivers of the WEF nexus exists in the country. The development of a WEF nexus model, metrics and indices would help to unlock the value of such existing data and also guide the generation of new data sets.

2.8.2 Agriculture-energy nexus

The agriculture sector is highly reliant on energy inputs and therefore, is susceptible to fluctuations in energy prices. The South African National Energy Development Institute (SANEDI) and the Renewable Energy and Energy Efficiency Partnership (REEEP) are implementing the SWITCH Africa Green project titled "Sustainable Energy Consumption and Production in Agriculture and Integrated Waste Management." The project seeks assist local business communities and entrepreneurs as well as national and local government spheres in the agricultural sector to implement Sustainable Consumption and Production (SCP) practices, thereby offsetting carbon footprint. The program supports the development of green agro-businesses and eco-entrepreneurship via the use of SCP practices and equip MSMEs across the target sectors to seize green business opportunities, and in doing so, promotes transition towards an inclusive green economy. Further, it provides an opportunity for resource-efficient and cleaner production implementation and alignment with the 10-year framework of programmes on sustainable consumption and production patterns. The use of renewable energy and energy efficient technologies in the agricultural sector is still limited in South African and there are many gaps (including data, evidence, knowledge and awareness) that will need to be

addressed in order to develop the relevant enabling environment and stimulate the adoption of SECP practices.

2.8.3 Waste management-energy nexus

South Africa is endowed with plenty of biomass reserves with a potential for anaerobic digestion. Bioenergy contributes almost 10% of the total primary energy supply in South Africa. All of the bioenergy consumed in South Africa comes from solid biofuels (517 PJ), of which 274 PJ primary solid biofuels and 34 PJ charcoal are used in residential applications. This is mostly used in traditional way (cooking, heating, open fire); modern boilers are not common. There is a net export of 10 PJ charcoal. Bioenergy consumption is estimated to be stable around 515 PJ in the past 15 years.

A number of bioenergy projects implemented and/or supported by non-state institutions such as the GreenCape, Mpfuneko Community Support (MCS) and Netherlands Wild Goose Dutch Development Organisation, Biogas SA, BiogasPro, Global Energy and Bio2Watt are currently underway in the country, and these are important contributors to the national grid. For instance, the Bio2Watt project in Bronkhorstspruit, produces electricity from farming waste, which it powered into the South African grid. The government, through the Department of Energy, also provided support to this project as a benchmark for bioenergy initiatives. BMW is using the Bio2Watt system to supply energy to its Rosslyn plant. The Western Cape Industrial Symbiosis Programmes (WISP), a government funded project and run by GreenCape, acts as a bridge between companies to facilitate the exchange of under-utilised or discarded resources of one company that could be of benefit to another. To date, WISP has diverted over 94 600 tonnes of waste from landfills which amounts to a reduction of 264 735 tonnes in carbon dioxide equivalent emissions. The financial benefits of the programme are calculated at R110 million in the form of additional revenue, cost savings (R36.1 million) and private investments (R20.5 million). The programme has also created employment as follows: 69 permanent jobs; 34 temporary jobs; and 194 economy-wide jobs. However, although observed to be growing and developing, and acknowledged to be significant, the biogas technology expansion in South Africa is faced with a number of challenges such as high initial investment costs for constructing biogas digesters, inadequate expertise for construction and maintenance of the biogas digesters, and low efficiency of biogas.

Chapter 3: Conclusion and Recommendations

3.1 Conclusion

The aim of the study was to strengthen measures and conditions to expand private sector investment in South Africa that will increase green growth while creating jobs. The focus was on dramatically unleashing the potential of the private sector to drive green growth in South Africa and create decent jobs in four key sectors of the economy i.e. energy, agriculture, manufacturing, and waste management. The study also sought to provide information that would ultimately strengthen the capacities of the different players with a role to play in greening the South African Economy. A number of initiatives are underway to promote the transition to a green economy in South Africa, from policy to practice. The government of South Africa has established a number of policies and several programmes to shift towards a green economy. This study has highlighted key challenges in four focal sectors (energy, agriculture, manufacturing and waste management) and detailed enablers and various opportunities for the private sector to leverage in each focal economic sector highlighted in Chapter 3, and some companies are already involved in green businesses initiatives. Although a range of stakeholders and institutions are involved in the green economy across the country in different value chains, more investments need to be made in fostering private-private and public-private collaborations and linkages.

3.2 Recommendations

3.2.1 General recommendations

Compared to most African countries, South Africa is at an advanced stage of development towards a green economy, and this presents great market opportunities across the continent, especially taking advantage of the recently launched AfCFTA. As one of the biggest economies in Africa, South Africa can position itself to become the test bed for green innovation in the continent. South Africa can utilise the Proudly South African campaign to brand home grown green economy products and services as a means to a healthy, safe, environmentally friendly, sustainable (reusable, recyclable), best technology (high or low), best value, advanced production standards, and a symbol of a *good life*.

Apart from involvement of innovation of multiple sorts – products, processes, services, organizations, institutions and policies, any successfully realization of a transition to a green economy will require a shift in the way of life. This paradigm shift to a green way of living should be anchored by lifestyle that shapes demand for green products and services, which, in turn, will create employment opportunities across all the sectors under this study.

Generally, it is important for the government to provide a systematically coherent policy framework that will strengthen and accelerate the green business initiatives at the same time influencing consumer values and lifestyle choices. Setting a clear direction for profitable green business would provide a driver for economic growth and job creation and unleash a wave of private sector investment that cannot be achieved with isolated policies. To develop evidence-

based and innovative policies that will influence consumers and businesses to respond, there is need for:

- Participatory and consensual policy formulation (government, business and society);
- Coherent and convergent regulation and fiscal policies;
- Empowering local governments for synergistic action in the green direction;
- A shift in practices, including public procurement;
- Commitment of public funds at all levels for green-related research and development, infrastructure and investment, giving signals to encourage private investments; and
- Skilling and re-skilling to follow through the commitments made in government strategies and policies.

3.2.2 Sector specific recommendations

3.2.2.1 Energy Sector

- There is need to decentralise the energy sector especially electricity supply that has been monopolised by Eskom before and after independence. The current vertical structure of Eskom is not financially viable and an economically sustainable approach enabling more renewable energy private sector players into the industry will fast track the JET process.
- There is need for government to strengthen and utilise the role of InvestSA One Stop Shop to improve coordination among government departments that play a role in the energy sector. This will subsequently minimise inefficiencies that seem to impede investment processes in the energy sector.
- The government and institutions such as SABS need to contextualise and adapt the localisation requirements that are currently superficial and unsustainable
- There is need for government to work with research institutions and determine the exact amount of investment required to unlock the transition to renewable energy in South Africa. There is currently no clarity in terms of required financial investment and that hinders evidence-based planning and execution.
- The grid infrastructure and electricity supply has been mapped out. There is now need to direct private sector investment into the specific energy clusters and fast track deployment of renewable energy.
- There is also a need to create awareness on renewable energy and its benefits to stimulate demand that will enhance market uptake and subsequently green economy sustainability. There is little awareness about renewable energy in South Africa thus compromising the level of demand required to draw in more investment.
- There is need for the government to work with the energy sector to adopt the concept of Just Energy Transition. This concept will insure that switching from fossil driven energy to renewable energy will have minimum negative impacts on the livelihoods of the workforce and communities that rely on the current unsustainable system. Explaining this concept to the communities that will be affected and labour unions from the coal mining sector in particular might enhance buy-in and minimise on likely antagonism in this process.

3.2.2.2 Agriculture sector

- The agricultural sector is already contributing significantly to environmental degradation and climate change. There is therefore an urgency for government to continue enhancing and adapting policies that ensure an enabling environment for investment in green

agriculture. There is also a need to enforce regulations like carbon tax but at the same time incentivise farmers that adopt green agricultural practices.

- There is need for the adoption of the fair value system for the agricultural commodities particularly for smallholder farmers and entrepreneurs who want to adopt green economy technologies in the sector. This will incentivise more farmers to adopt green agricultural practices. The government can play a pivotal role in regulating a fair value system in consultation with all value chain actors in the agricultural sector.
- Government and the private sector need to support farmers, rural smallholder farmers in particular, with necessary resource such as access to finance, infrastructure, information and fair value markets to adopt green agricultural practices. Agri-Parks are a good example of such infrastructure that can be combined with a plethora of other support services required by smallholder farmers. This kind of infrastructure will, however, need to be extensively socialised or alternatively built to be compatible with the level of capacity of the rural smallholder farmers and gradually upscale as capacities increase as well. Agri-Parks are currently underutilised and vandalised in some instances as the kind of equipment and technology as beyond the capacities of rural smallholder farmers in some cases.

3.2.2.3 Manufacturing sector

- There is need to increase awareness of how the manufacturing sector can switch to a green economy, the available opportunities and incentives therein. This may minimise change resistance and attract more investment and entrepreneurial enterprises in the sector.
- The manufacturing sector will need support in form of funding and technical capacity building to switch to green manufacturing. There are high costs associated with switching to green manufacturing at the initial stages and a significant reskilling of the work force will be required.
- An enabling policy environment and supportive mechanisms such as subsidies will be required to ensure a smooth and just transition to green manufacturing.
- There is need for the government working with the private sector to develop clear benchmarks and standards to guide the greening of the manufacturing sector.
- The manufacturing sector will need to urgently adopt green manufacturing approaches. A phased approach might be a less risky way to adopting the green manufacturing systems. As more pressure to meet environmental sustainability obligations is applied across the globe, the sectors that are adopting green approaches will be at an economic advantage, while those that are not complying with the trends will be left behind.

3.2.2.4 Waste management Sector

- Greening the waste management sector needs to be informed by current demographics and economic trends that are showing an increase in population and economic growth. This ultimately translates to increased volumes of waste requiring management hence more opportunities in this sector.
- Improved waste management systems taking into account the circular economy approach will need to be adopted to green the waste management sector. There is increased complexity in the waste stream due to urbanization and industrialization that also requires sophisticated approaches.
- The government needs to utilise the backlog of waste services for urban informal areas, tribal areas and rural formal areas as an avenue for increasing private sector investment into the sector.
- The policy and regulatory environment needs to be revised to prioritise and effectively promote opportunities in the waste management value chain. There should be autonomy

in greening the waste management sector with minimum political interference in decision-making that often lead to bureaucracy.

- Waste management services also need to be priced at a fair value across the whole value chain. The current pricing system is on the lower bracket and does not attract business investment and might compromise the appetite to switch to green waste management.
- There is need for profiling and promoting alternative waste management options to that of land fill which is the most common way of managing waste in South Africa. This profile should include green waste management options including cost and benefit analysis of each option.
- There is need to capacitate service providers in the waste management value chain green approaches. The is currently a lack of sufficient training on the different hierarchy of the waste management.

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Annexes

Annex 1: Inception Report

Annex 2: Questionnaire