Mpumalanga

Renewable Energy and Sustainable Mobility Market Intelligence Opportunity Brief 2021

MPUMALANGA GREEN CLUSTER AGENCY

Mpumalanga Green Cluster Agency

Acknowledgements

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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviations & Acronyms	Meaning
APDP	Automotive Production and Development Programme
BAU	Business As Usual
BMS	Battery Management System
BRT	Bus Rapid Transport
BW	Bid Window
CO_2e	Carbon dioxide equivalent
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
DMRE	Department of Mineral Resources and Energy
DPE	Department of Public Enterprises
DTIC	Department of Trade, Industry and Competition
DWA	Department of Water Affairs
EAF	Energy Availability Factor
EC	Eastern Cape
EPC	Engineering, Procurement And Construction
ERA	Electricity Regulation Act
EV	Electric Vehicle

Abbreviations & Acronyms	Meaning
GDP	Gross Domestic Product
GTS	Green Transport Strategy
GW	Gigawatt
I&F	Infrastructure and Facilities
ICE	Internal Combustion Engine
IEP	Integrated Energy Plan
IPP	Independent Power Producer
IPPO	Independent Power Producers Office
IRP	Integrated Resource Plan
kW	kilowatt
kWh	kilowatt hours
KZN	Kwazulu Natal
MW	Megawatt
MWh	Megawatt hours
NAAMSA	The National Association of Automobile Manufacturers
NCCRP	The National Climate Change Response Policy
NERSA	National Energy Regulator of South Africa

Abbreviations & Acronyms	Meaning
NNR	National Nuclear Regulator
NT	National Treasury
O&M	Operation And Maintenance
OEM	Original Equipment Manufacturer
OES	Original Equipment Supplier
PPA	Power Purchase Agreement
PV	Photovoltaic
RE	Renewable Energy
REDZs	Renewable Energy Development Zones
REIPPPP	Renewable Energy Independent Power Producers Procurement Programme
SAAM	South African Automotive Masterplan
SABIA	South African Biogas Industry Association
SAESA	South African Energy Storage Association
SALGA	South African Local Government Association
SANEDI	South African National Energy Development Institute
SAPVIA	South African Photovoltaic Industry Association
SAWEA	South African Wind Energy Association
SSEG	Small-Scale Embedded Generation
TWh	TerraWatt hour

Exchange rates used:
1 US Dollar = R15.27 (August 2021)

EXECUTIVE SUMMARY

This market opportunity brief is part of a series of first-of-its-kind reports that highlight green economy investment opportunities in the green economy in Mpumalanga. It is written for investors who want to understand the opportunities for investment and job creation in green economy sectors in the province.

CLICK:
Celebrating green economy green shoots in Mpumalanga

Mpumalanga, the second-smallest province in South Africa after Gauteng, is located in the North-Eastern part of the country, bordering Swaziland and Mozambique. The provincial economy is mainly driven by farming, mining, heavy industry, and tourism attractions like the Kruger National Park, Sudwala Caves, and Blyde River Canyon.

Mpumalanga currently produces 76% of the total electricity generated in South Africa from 11 of Eskom's coal-fired power stations. The province is also the 4th largest GDP contributor to the South African economy because of its strong industrial economy.

Under the Paris Agreement, South Africa had pledged to reduce its emissions by 34% by 2020, and 42% below the business as usual (BAU) emission trajectory by 2025. This will see South Africa initiating a number of mitigation measures, including reduction in coal-based power generation. This will require pro-active measures for a Just Energy Transition.

Because of it reliance on coal mining and coal fired power generation Mpumalanga is going to be affected as coal fired power plants are gradually taken offline in the next 20 to 30 years. This presents an opportunity to convert the exisiting market and infrastructure to be powered by renewable energy technologies.

Emalahleni, one of Mpumalanga's municipalities, was declared as one of three new Renewable Energy Development Zones (REDZs) following the publication of a Government Gazette notice signed by Environment, Forestry and Fisheries Minister Barbara Creecy in 2021. The notice identifies Emalahleni as being strategic for the deployment of large-scale solar photovoltaic (PV) energy facilities.

There are four key opportunities in the province that have been identified for investors, original equipment manufacturers (OEMs), equipment suppliers, project developers, and technical advisers to look into:

- **Public offtake:** This is an immediate to medium term opportunity (0 – 10 years). It is estimated that the market will be to the order of ~2.6GW of the remaining 20.4GW to be procured nationally by 2030 under the public procurement process by the government and local municipalities, as guided by the 2019 Integrated Resource Plan (IRP). The power is procured under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) through a tendering process by the government through Eskom and municipalities.
- **Private offtake:** This is an immediate to medium term opportunity (0 – 10 years). The potential market size is ~500MW for rooftop solar PV under 1MW, and up to 2GW for ground mount renewable energy projects. Currently, this market is dominated by rooftop solar PV, given the competitive price, technical maturity, and ease of implementation of this technology. This market is expected to grow after the raising of the licence threshold for facilities to 100MW through an amendment to Schedule 2 of the Electricity Regulation Act in 2021. There are also opportunities in the biomass and biofuels sector, following recent policy changes supporting the use of waste-to-energy initiatives.
- **Energy storage:** This is a short to medium term opportunity (1 – 10 years). The continued growth in the renewable energy market, combined with more than 10 years of loadshedding, has led households, businesses and farmers to explore alternative means of energy security and resilience. On a larger scale, as set out in the Integrated Resource Plan (IRP), South Africa aims to procure an additional 2 088MW of energy storage nationally from 2023 onwards with a total installed capacity of ~5GW by 2030.
- **Sustainable transport:** This is a short to medium term opportunity (1 – 10 years). The public bus industry which is dominated by local municipality bus companies and the minibus taxi industry presents the best business case for electrification. This is especially true for the bus manufacturing industry that already produces buses largely for the domestic market. There is also a market potential in the battery-powered EVs and machinery in underground and opencast mining in Mpumalanga's more than 100 mines. This opportunity in underground mining is driven by the high costs of ventilation for clean air underground and temperature regulation.

Table 1 details the opportunities, drivers, and barriers within the renewable energy (RE) market in Mpumalanga

Table 1: Overview of the market opportunities, drivers, and barriers in the renewable energy market in Mpumalanga

Opportunity		Term	Key drivers	Barriers
Public offtake	Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)	Immediate to medium term (0-10 years)	• The Integrated Resource Plan's 26GW renewable energy target by 2030 for SA. Up to 20.4GW still to be procured until 2030. • Up to 2600MW/year procurement under REIPPPP for solar and wind nationally. • Re-purposing and re-powering of coal-fired power plants and mines.	• The bid rounds have not been consistent. Consistency is beneficial to build a strong project pipeline.
	Municipal power procurement	Short to medium term (3-10 years)	• Municipalities plan to increase the share of renewables in the energy mix on their distribution grid. • Localized power generation increases energy security. • Increased load shedding expected up until 2025.	• The development of the municipal Integrated Development Plans (IDPs) and procurement process will take a significant amount of work and time. • Municipalities may not be creditworthy and pose a risk of non-payment. • Only Gert Sibanda and Nkangala district municipalities received clean financial audits.
	Re-purposing and re-powering of coal-fired power plants and mines	Medium to long term (5-10 years)	• High-value electrical and transmission assets will be available at decommissioned power plants. • Localized manufacturing support through government interventions. • Local content requirements in REIPPPP.	• Roadmap to re-purpose and re-powering is not yet defined and clear. • Coal power plants useful life extension after the end of life date.
Private offtake	Rooftop solar PV	Immediate to medium term (0-10 years)	• Competitive cost of electricity and service from ESCOs for commercial and industrial customers. • Lower year-on-year tariff escalation rate compared to municipalities and Eskom tariffs. • Local and international finance houses offering low interest rates. • Continued loadshedding up to 2025.	• Only 4 out of 17 municipalities have defined SSEG procedures in Mpumalanga. • The municipal installation approval process takes at least four months.
	Ground mounted solar PV	Short to medium term (1-10 years)	• Generation licence cap increase to 100MW. • Wheeling opportunity through transmission and distribution network. • Growth of energy trading opportunities.	• Municipalities framework currently regulates up to 1MW and they have yet to update application procedures for plants larger than 1MW. • Only Eskom and Mbombela Municipality have wheeling and energy trading regulations in the province.

Opportunity		Term	Key drivers	Barriers
Private offtake	Biomass	Immediate to medium term (0-10 years)	• IRP 2019 targets of 500MW/year procurement from 2023 for distributed generation, CoGen, biomass and landfill. • Higher cost of disposal for organic waste at "landfills" for C&I and agriculture sectors. • Resource availability in Mpumalanga. • Large electricity and heat users in Mpumalanga.	• Municipalities have limited technical understanding of waste to energy and how to regulate the embedded generation process. • Higher R/kW investment than other renewables and longer ROI. • Limited project development funding. • Off-take agreements for the potential electricity.
	Biofuels	Short to medium term (3-10 years)	• South African Biofuels Regulatory Framework 2019. • South African Sugarcane Value Chain Master Plan to 2030. • Resource availability in Mpumalanga.	• The local and international concern on the land use management for food and energy crops – interventions would need to focus on waste use. • Lack of understanding with regards to current policies and legislation.
Energy storage	Commercial & Industrial (C&I) battery storage	Immediate to short term (0-5 years)	• Technology cost per kWh has been dropping year-on-year. • Batteries provide energy security during loadshedding. • Deferment of capacity upgrades. Some utility substations are at maximum capacity and companies have to look at on-site solutions to accomodate their energy demand. • The stacked benefit of time-of-use tariff management and demand charge reduction.	• Uncertainty and limited policy on battery integration. • Upfront cost per kWh is still relatively higher than conventional sources of emergency power.
	Utility scale battery storage	Short to medium term (3-10 years)	• IRP 2019 targets of additional 2088MW storage by 2030. • Increased grid stability. • Capacity upgrade deferment. • Energy storage arbitrage by peaker plants.	• Uncertainty and limited policy on battery integration. • Lack of investment in research and development to be able to manufacture batteries locally.

Opportunity		Term	Key drivers	Barriers
Sustainable transport	Public transport electrification	Short to medium term (3-10 years)	• Higher stake for mass public transportation system with an annual growth rate of 100% since 2013. • Reduction in prices of electric vehicles and lithium batteries making electric vehicles' cost-comparable with internal combustion engine vehicles by the middle of the decade irrespective of high import duties. • De-investment of liquid-based fuels as most financial institutions are directing investments towards sustainable transport. • South Africa already has a strong automotive industry. Buses are designated for 80% local content which would also apply if the bus is an electric bus.	• Absence of supporting infrastructure like charging stations and maintenance stations in Mpumalanga. • High upfront investment costs of the technology
	Electric vehicles in underground mining	Short to medium term (3-10 years)	• Push for sustainable underground mining transportation with lower emissions, higher efficiency and lower heating. • Cost of mining ventilation. • Cost of mining heat regulation. • Health and safety concerns. • Increasing combustion fuel costs.	• High upfront investment costs of the technology. • Availability of locally manufactured EV machinery.

1.

THE MPUMALANGA GREEN CLUSTER AGENCY

Introducing the Mpumalanga Green Cluster Agency

Clusters can create the context to build trust between sector players, and work to unlock new mechanisms to enhance competitiveness and resilience. The Green Economy, in particular, lends itself to collaborative ecosystem building approaches. Set in this system of rapidly changing technology, and the economics surrounding that technology, are commitments to social inclusion, and greater equality.

The opportunity to use a cluster to build trust, remove barriers and unlock jobs and investment has been recognised as an opportunity to make a contribution to the regional economy in Mpumalanga.

The Mpumalanga Department of Economic Development and Tourism, working with GreenCape and with support from the international development finance community, has set up the Mpumalanga Green Cluster Agency.

This cluster will focus on unlocking and unblocking economic opportunities in the green economy, with the aim of making a contribution to regional economic diversification and job creation efforts.

The Mpumalanga Green Cluster Agency's mission is to stimulate a vibrant green economy for communities in the Mpumalanga province, underpinned by a collaboration between government, business and academia. The vision is a vibrant, green and sustainable economy in the Mpumalanga province, that leverages the province's rich natural resources and heritage to create a legacy for South Africa low carbon economic growth.

Collaboration through clustering on a local scale to build competitiveness on a global scale will support the growth of the green economy in Mpumalanga, and determine the green cluster in Mpumalanga's success. To become a member of the Mpumalanga Green Cluster Agency, please sign up here.

Green Economy Market Opportunity Briefs

This market opportunity brief is part of a series of first-of-its-kind reports that highlight green economy investment opportunities in the green economy in Mpumalanga. It is written for investors who want to understand the opportunities for investment and job creation in green economy sectors the province.

Each brief provides an overview of the market within a sector, including key developments and achievements, the key players, legislation and regulation, market opportunities and challenges, and funding opportunities.

This brief focusses on the green economy investment opportunities in the water sector. To access the other sector briefs, please visit: http://www.mpumalangagreencluster.co.za/

2.

SECTOR OVERVIEW

This Mpumalanga market intelligence opportunity brief is written for investors, original equipment manufacturers (OEMs), equipment suppliers, project developers, and technical advisers. It highlights current investment opportunities in the Mpumalanga renewable energy and sustainable mobility sectors.

2.1.

The South African electricity landscape

South Africa's electricity demand is currently dominated by coal-fired power generation stations, primarily owned and operated by Eskom, the national power utility. Mpumalanga produces 76% of the total electricity generation in South Africa from 11 of Eskom's coal-fired power stations. Eskom supplies ~95% of South Africa's total electricity demand. The remaining 5% of demand is met through municipalities (distribution utilities), imports and independent power producers (IPP).

Eskom is also responsible for all of the electricity transmission in the country. As the primary distribution utilities in South Africa, most of this electricity is distributed to end users by metropolitan- and local municipalities (~60% of customers). The remaining 40% is distributed directly by Eskom.

Over thirteen years, a historical supply and demand imbalance in South Africa's single buyer model[1] has resulted in intensive loadshedding[2] experienced country-wide from 2008 to 2014 and intensifying in 2019 and 2020. An estimated 1.3 TWh was load shed over the period of 2019 and 2020.

Despite concerted efforts to reduce loadshedding, 2021 is expected to be the worst year to date, breaking previous annual loadshedding records within the first six months of the year. Given the time required to increase generation capacity, conservative estimates predict loadshedding will continue until 2024/25, creating significant economic challenges and opportunities in renewable energy for South Africa's economic growth.

The Integrated Resource Plan (IRP) was adopted in 2019. This is the official long-term government plan for generation capacity additions contributing to the overall energy mix. The IRP2019 includes a strong reliance on renewable energy as 42% of the total added capacity, up until 2030, should be renewable, equating to additional renewable energy amounting to 20 400 MW (excluding distributed generation of 4 GW).

The primary mechanism by which renewable energy has been brought onto the grid, to date, is through the government-led auction process, i.e. several bidding rounds to procure renewable energy under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). By 2030, the electricity generation mix is set to comprise of 33 364 MW (42.9%) coal, 17 742 MW (22.8%) wind, 8 288 MW (10.6%) solar photovoltaic (PV), 6 380 MW (8.2%) gas or diesel, 5 000 MW (6.4%) energy storage, 4 600 MW (5.9%) hydro, 1 860 MW (2.4%) nuclear and 600 MW (0.8%) concentrating solar power (CSP).

Sustainable mobility

South Africa already has a strong market for the assembly of internal combustion engine (ICE) vehicles. The automotive sector is a key player in the country's economic landscape, contributing 6.4% of GDP and 27.6% of manufacturing output in 2019. Total revenue from this sector was more than R500 billion (US$35.6 billion) in 2019, with the industry employing up to 900 000 people directly and indirectly – including downstream in wholesale, retail trade, and maintenance. Globally, the momentum for electric mobility has increased exponentially as evidenced by the number of sales over the period 2013 to 2020. There are substantial environmental, economic, and social opportunities for South Africa in the transition to a low-carbon trajectory, enabled by a green mobility transition.

[1] The single buyer model facilitates the balancing and matching of electricity supply and demand given that Eskom is responsible for real time dispatch, as well as the exclusive right to buy from IPPs or generators and to sell to distributors

[2] The interruption of an electricity supply, on a rolling blackout basis, to avoid excessive load on the generating fleet.

2.2.

The Mpumalanga renewable economy potential

As mentioned in Section 2.1, the majority of South Africa's coal-fired electricity generation is concentrated in the Mpumalanga region. The coal mining, power generation, and petrochemical industries are the cornerstones of the province's economy. According to the Mpumalanga Spatial Development Framework, more than 60% of the province's land surface, particularly in the Highveld region, is either being mined or has prospecting rights issued over it.

Mpumalanga is divided into three district municipalities, which are further subdivided into 17 local municipalities. The provision of electricity services is shared between these local municipalities and large mining and electricity generation facilities.

Globally, and in South Africa, there are urgent imperatives for low carbon development through a green economy. South Africa's commitment to a low carbon future is manifest in the National Development Plan 2030 (NDP 2030) and various policy and strategy documents. As the country reduces its dependence on coal, there will be marked impacts on specific regional economies, especially the Mpumalanga province, which houses most coal power stations and coal mining activities. The province has an opportunity to be proactive in exploring opportunities in the energy sector. This could enable opportunity-led growth that could enable a transition to a green-focused regional economy. In Mpumalanga, much of the employment links to the coal value chain, from mining to power generation. The region also faces many socio-economic and environmental challenges arising from resource- and carbon-intensive economic activities, e.g. negative impacts on air quality, water quality and negative health outcomes which damage the competitive potential of the area. Mpumalanga has vast natural resources to drive a transition to a green economy.

While the country's coastal, desert or hilly regions are typically more attractive for the installation of wind turbines or solar power (see Figure 1 and Figure 2), it is important to secure a wide geographical spread of renewable energy facilities to ensure that supply can be maintained. On 26 February 2021, Minister Barbara Creecy published Government Notice No. 142, 144 and 145 in Government Gazette No. 44191 which identified Emalahleni as one of the three additional REDZs for implementation, as well as the procedures to be followed when applying for environmental authorisation for electricity transmission or distribution infrastructure or large scale wind and solar photovoltaic energy facilities in these REDZs.

The REDZs were identified through the undertaking of 2 strategic environmental assessments, the first being finalised in 2015 and the second being finalised in 2019.

As technologies advance to become more efficient, the wind and solar resources in Mpumalanga create an attractive investment opportunity. Regions of Mpumalanga with mean wind speeds at 100m above ground level are indicated in Figure 1. Wind resources assessments are underway by developers in several areas in Mpumalanga. While the wind speeds are generally not as competitive as some other areas of South Africa, there is sufficient resource for commercial viability using the hub heights available with current wind turbine technology.

Figure 1: Wind resources map for South Africa highlighting Mpumalanga (Source: CSIR)

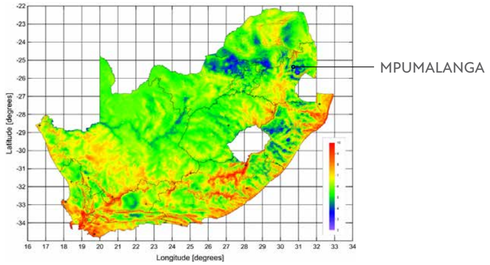
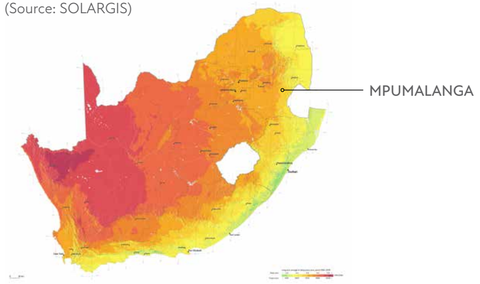
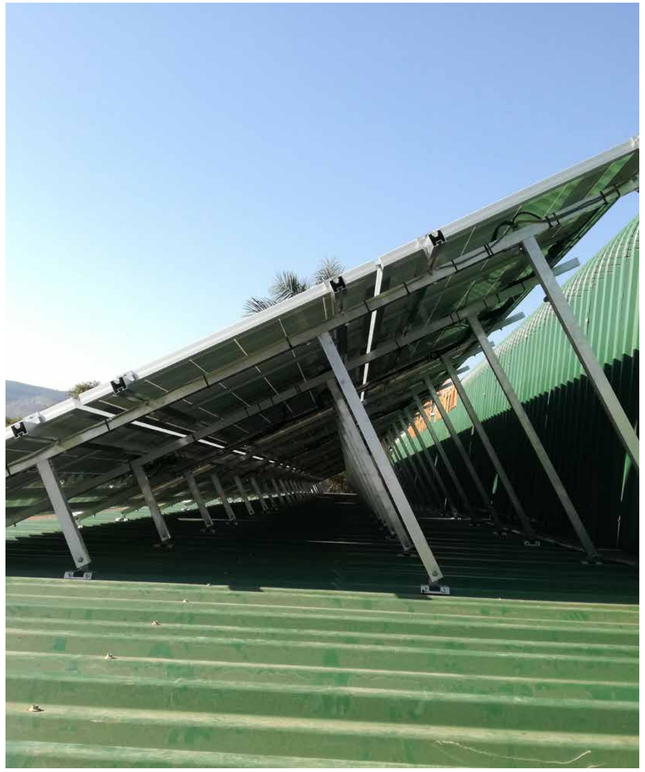


Figure 2: Solar irradiation map for South Africa highlighting Mpumalanga (Source: SOLARGIS)





According to the Department of Mineral Resources and Energy (DMRE), most areas in South Africa average more than 2 500 hours of sunshine per year, and average solar radiation levels range between 4.5 and 6.5kWh/m2 in one day. As shown in Figure 2, the global horizontal irradiation in Mpumalanga ranges between a daily long term average of 4.8kWh/m2 and 5.6kWh/m2. Approximately 2 576 hours of sunshine are counted in Mpumalanga throughout the year.

Beyond the wind and solar resources, the province is also blessed with fertile soil and a strong agriculture sector giving it the potential to be the hub for biomass production in South Africa, with 41% of the country's plantations being located here[3]. This creates substantial bioenergy opportunities (see section 3.2.3).

2.3.

Key players in the renewable energy and sustainable mobility value chains

2.3.1. Renewable energy

Key players or types of companies involved in the renewable energy market are described in Table 2 below, indicating the project development phase in which they are typically involved.

Table 2: Typical company types involved at different stages of renewable energy projects

IPP:	Independent power producer or project developers. IPPs or project developers are responsible for project inception and development, land acquisition, sourcing finance, and bid submission. IPPs or project developers may sometimes be a project sponsor or may submit a bid with the backing of such an entity. In the small scale renewable energy market, this role is often played by an engineering, procurement and construction (EPC) company. **Project stages involved:** Project development, project construction, project operation and maintenance.
OEM:	Original equipment manufacturer. Suppliers of key technology e.g. the manufacturer of the selected turbine in a wind farm. The company will play a major role in determining the technology partners that will constitute a project, and may also play the role of O&M (see below). **Project stages involved:** Project construction, project operation and maintenance.
O&M:	Operation and maintenance (O&M) company. It is usually the main equipment supplier or a technical entity well-versed in the specific technology. **Project stages involved:** Project construction, project operation and maintenance.
EPC:	Engineering, procurement and construction. Typically this player is managing the various sub-contracts in the construction phase of a project. It may also be involved in the design and development phase of the project. **Project stages involved:** Project development, construction and O&M.

[3] For more information on the agriculture sector in Mpumalanga please see the Sustainable Agriculture Market Intelligence Opportunity Brief

2.3.2. Sustainable mobility

Globally, the momentum for electric mobility has increased exponentially as evidenced by the number of sales over the period 2013 to 2020. This global shift has been primarily driven by national emission reduction commitments stemming from the Paris Agreement on climate change, growing urban air pollution concerns, and continued crude oil price volatility. The transport sector has been identified as a key contributor to global greenhouse gas (GHG) emissions because of its reliance on fossil fuels. 15% of global greenhouse gas emissions can be attributed to the transport sector. It is the fastest-growing source of GHG emissions in South Africa, accounting for 91.2% of the increases over the past decade (NAAMSA, 2020).

As of November 2020, the Paris Agreement, obliging signatories to reduce their emissions[4] has been signed by 196 countries (including South Africa) and the European Union (EU), and ratified by 187 countries. EVs provide an alternative to traditional internal combustion engines (ICE) vehicles, and they can be powered by renewable energy. To achieve our current environmental and climate commitments and targets, South Africa has to reduce its carbon emissions by at least 32% in the next ten years.

Figure 3 details the various key players across the value chain who are collectively shaping the South African electric vehicles (EV) market. The exact dynamics of the EV industry are still emerging, and the timing of key tipping points are unknown. Notwithstanding, car manufacturers and charging infrastructure companies are the most active investors in the market, with very limited activity currently from the battery companies.

2.4.

Relevant legislation

Several governance structures, acts, regulations, and policies guide the electricity and sustainable mobility sectors. These are detailed below.

2.4.1. Governance

National and local government partnering with several industry associations guide the development of the energy and mobility sectors in South Africa.

2.4.1.1. National government

As shown in Table 3, several government departments and institutions guide the development of the energy and mobility sectors.

[4] The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016.

Figure 3: Electric vehicle value chain in South Africa

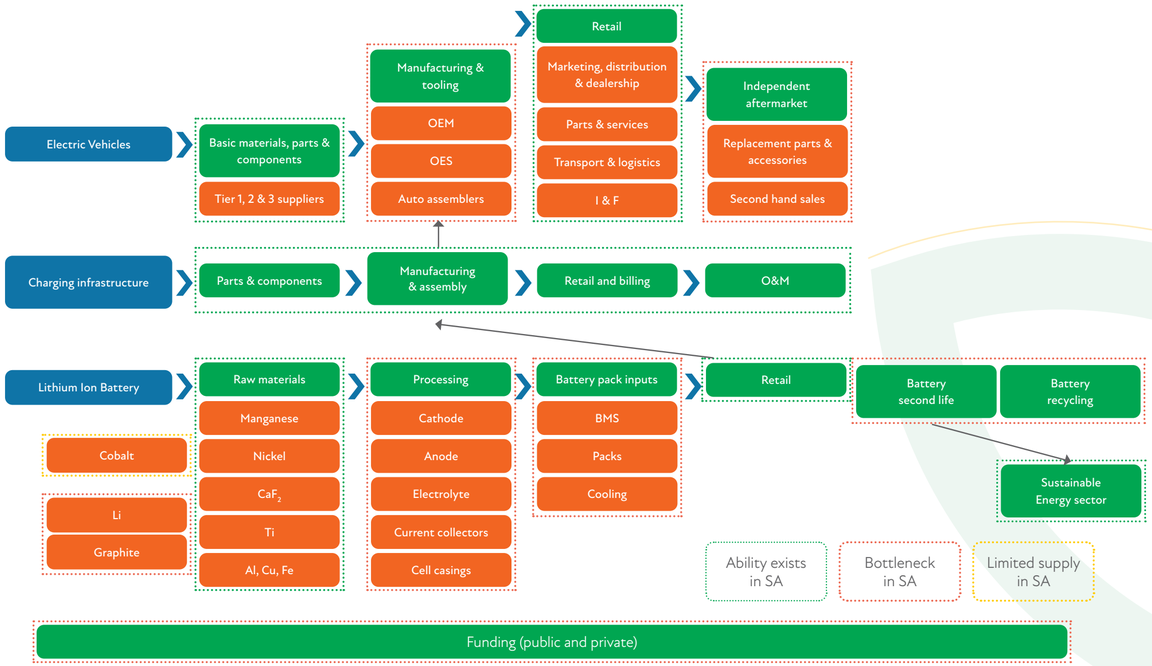


Table 3: Institutions that guide the development of the energy and mobility sectors

Energy	
Department of Mineral Resources and Energy (DMRE)	The mission of the DMRE is to regulate and transform the sector for the provision of secure, sustainable and affordable energy and the promotion and regulation of minerals and mining. This includes the electricity sector, which is governed mainly through the Electricity Regulation Act 4 of 2006. This department was previously referred to as the Department of Energy (DoE).
National Energy Regulator of South Africa (NERSA)	NERSA issues licences for the operation of generation, distribution, and transmission infrastructure; regulates imports, exports, and trading of electricity; determines and approves electricity prices, tariffs, and the conditions under which electricity may be sold.
Independent Power Producers Office (IPPO)	IPPO is a key procurement vehicle for delivering on the national renewable energy capacity building objectives. It provides the following services:procurement management services, professional advisory services and monitoring, evaluation and contract management services.
National Nuclear Regulator (NNR)	NNR regulates the operation of nuclear power stations, such as Koeberg and all elements of the South African nuclear energy value chain. Its role is to protect people, property, and the environment against nuclear damage.
Department of Public Enterprises (DPE)	The Minister of Public Enterprises is the shareholder representative of the South African government and has oversight responsibility for Eskom.
National Treasury (NT)	NT is responsible for financial and reporting oversight for Eskom (as a state-owned entity) and has played a pivotal role in providing government loans and guarantees in favour of Eskom.
Department of Water and Sanitation (DWS)	DWS oversees water allocations and ensures adequate water supply infrastructure, among others, for the South African electricity sector.
Department of Forestry, Fisheries and the Environment (DFFE)	DFFE ensures adherence to environmental compliance and rights protection in preventing pollution, ecological degradation, promoting conservation, and securing ecologically sustainable development. It is also responsible for the allocation or renewable energy development zones (REDZ).
Department of Trade, Industry and Competition (dtic)	Responsible for ensuring industrialisation through the REIPPPP's economic development component, especially local content and black economic empowerment and development of small businesses.
Mobility	
The Department of Transport	The Department of Transport aims to lead the development of efficient integrated transport systems by creating a framework of sustainable policies and regulations; and implementable models to support government strategies for economic, social and international development.

2.4.1.2. Local government

The local (municipal) government is the arm of government closest to the end-users. Municipalities are responsible for a large portion of electricity distribution in the country.

2.4.1.3. Industry bodies

Southern African Biogas Industry Association (SABIA) is a registered non-profit organisation that represents and lobbies for the interests of the biogas industry in South Africa.

South African Energy Storage Association (SAESA) is an association that aims to represent, promote and aid the energy storage industry in their business development goals in South Africa and Africa.

South African Photovoltaic Industry Association (SAPVIA) is a not-for-profit organisation that represents the solar PV industry in South Africa. It ensures that solar PV is the generation technology of choice in South Africa and Sub-Saharan Africa, supporting its socio-economic development targets.

South African Wind Energy Association (SAWEA) is a not-for-profit, member-driven association that aims to enable a commercial wind power industry in South Africa.

The National Association of Automobile Manufacturers (NAAMSA) is an association that represents the non-competitive interests of the motor vehicle manufacturing, importation and distribution industry in South Africa. All major multinational automotive companies and corporations are members.

2.4.2. Legislation and regulation

Electricity Regulation Act 4 of 2006 as amended by the Electricity Regulation Amendment Act 28 of 2007 (ERA). These regulations guide the issuance of licences for generators and transmitters, wheelers, and distributors of electricity.

National Energy Act 34 of 2008: The National Energy Act was promulgated to ensure that diverse energy resources are available to the South African economy in sustainable quantities and at affordable prices to support economic growth and poverty alleviation. The Act takes into account environmental management requirements and interactions among economic sectors. It develops the Integrated Energy Plan (IEP) and informs the basis of the South African National Energy Development Institute (SANEDI).

The Carbon Tax Act, No 15 of 2019 was gazetted in May 2019 and came into effect on 1 June 2019. The carbon tax will be applied over two phases: Phase 1 will be from 1 June 2019 to 31 December 2022, and phase 2 will be from 2023 to 2030. Phase 1 will not have an impact on electricity prices. The carbon tax rate will be imposed at R120 per tonne of carbon dioxide equivalent (tCO2e) emitted. However, taking the tax-free thresholds into account, this rate will range closer to R6 and R48 per tCO2e. This rate will increase by CPI +2% per year until 31 December 2022. The Act has assumed a 'polluter pays principle' to the tax. This relatively low tax rate and range of tax-free allowances in Phase 1 are designed to incentivise large emitters to transit to a low carbon profile before Phase 2. Once the tax results have been reviewed at the end of Phase 1, changes to rates and tax-free thresholds will be applied before the next phase begins. This would especially affect businesses with high fuel and electricity consumption. The impact of the carbon tax on the uptake of solar and other renewable forms of energy (which present a case for carbon offsetting by emissions generators) is still to be determined and will be monitored.

2.4.3. Policy and white papers

White Paper on Energy Policy of 1998: This paper identifies the need for energy demand-side management and the promotion of energy efficiency in South Africa. Appropriate and supportive energy policies are required to attain the energy efficiency and conservation targets embodied in the Integrated Resource Plan (IRP) framework, detailed below. The white paper effectively supports the national Department of Mineral Resources and Energy's (DMRE) mandate to ensure safe and sustainable energy provision for socio-economic development by suggesting that it pursue energy efficiency programmes as one of the lowest cost options for reducing energy consumption.

The National Climate Change Response Policy (NCCRP) 2011; is the key policy document guiding climate change response across all government departments. It recognises that response should be of a departmental, cost-effective, and integrated nature.

Integrated Energy Plan (IEP) 2016: Outlines the general energy plan for the country up to 2050. The IEP looks into energy security, access to energy, reducing the cost of energy supply, energy efficiency, localisation and sustainability in all energy matters.

Integrated Resource Plan (IRP) 2019: First promulgated in 2011, the IRP guides electricity provision in South Africa. Its custodian is the DMRE. The IRP, a living document that the DMRE is to update every two years, is developed in the context of the IEP. The IRP provides 1) an overall plan indicating the quantities of various electricity sources to meet the country's electricity demand until 2030 (the typical planning horizon) and 2) guidance for future energy infrastructure investments. Thus it largely determines the country's generation mix. After a long wait, the IRP 2019 was gazetted in October 2019.

Automotive Production and Development Programme (APDP) 2013-2020: The APDP was implemented on 1 January 2013 and was in place until 2020, after which has been replaced with the South African Automotive Masterplan (SAAM) in 2021 until 2035

The South African Automotive Masterplan (SAAM) 2021 – 2035; guides policy on growing and supporting the domestic automotive industry from 2020 to 2035. It replaces the APDP, addressing some of the latter's shortcomings. This masterplan, which came into effect in 2021, has adapted the Vehicle Assembly Allowance (VAA) to the Volume Assembly Localisation Allowance (VALA). The difference is that VAA was based on the wholesale selling price of the vehicle produced in South Africa, irrespective of local content (whether parts were locally produced or imported). VALA, on the other hand, has changed this so that the incentive is no longer based solely on the wholesale selling price. Rather, OEMs have to deduct the value of imported content from the vehicle's

Green Transport Strategy (GTS) for South Africa 2018 – 2050: To address the significant contribution of transport to national greenhouse gas (GHG) emissions, the Department of Transport (DoT) has developed a green transport strategy.

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Solar PV installation at Alzu, Mpumalanga Province.

3.

EMERGING OPPORTUNITIES, DRIVERS AND BARRIERS

The evolving South African energy landscape creates opportunities for investors, financiers, project developers, component manufacturers, and suppliers in the Mpumalanga renewable energy and sustainable mobility sectors.

The following emerging opportunities have been identified through engagement with an array of green economy stakeholders. Each opportunity is outlined in detail below, with unique market size, term, trends and barriers.

3.1.

Public offtake of renewable energy generation

This opportunity falls under the public procurement process by the state and local municipalities. South Africa's above-inflation electricity price rises; national energy insecurity; decreasing technology costs; supportive policies, regulations, and tariffs; and well-adapted finance options have all played an important role in driving the growth of the renewable energy market. The following opportunities have been identified:

3.1.1. Renewable Energy Independent Power Producer Procurement Programme

The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) was established in 2010 to facilitate the uptake of renewable energy in South Africa.

Since the establishment of the REIPPPP, 6 422 MW of electricity had been procured from 112 RE Independent Power Producers (IPPs) in seven bid rounds[5]; 5 078 MW of electricity generation capacity from 79 IPP projects has been connected to the national grid; 59 761 GWh of energy has been generated by renewable energy sources procured under the REIPPPP since the first project became operational in November 2013. The REIPPPP is on Bid Window 6 which is expected to open with call for proposals from IPPs from 28 September 2021 to develop a new generation capacity.

Under the IRP2019, approximately 26GW of renewable energy will be procured by 2030 of which almost 5.6GW has already been procured between Bid Window 1 to Bid Window 4. Mpumalanga currently has two projects procured through REIPPPP with the biggest project being Ngodwana Energy's 25 MW in Bid Window 4 . These projects equate to ~30MW or just less than 1% of all procured projects. According to the latest IPPO report released in March 2020, this has resulted in R 2.1 billion investment and 2 709 job years in Mpumalanga.

Bid Windows 4 and 5 saw an increased interest in Mpumalanga as a location for bioenergy projects. Given the strong Just Transition focus in South African policy, and the declaration of Emalahleni as a Renewable Energy Development Zone for solar PV, it can be assumed that Mpumalanga will receive additional bids in future rounds of the REIPPPP. Assuming a 5-10% allocation of IRP2019 target to Mpumalanga there is a potential of ~2,6GW of public market for REIPPPP projects in Mpumalanga.

Table 4 below outlines the drivers and barriers for this opportunity.

[5] Bid windows 1, 2, 3, 3.5, 4 and smalls BW1 (1S2) & smalls BW2 (2S2)

Table 4: Drivers and barriers for utility scale renewable energy under the REIPPPP

Key Drivers	Barriers
• Integrated Resource Plan's (IRP) 26GW target for renewable energy by 2030 for South Africa. Up to 20.4GW yet to be procured until 2030. • Up to 2600MW/year procurement under REIPPPP for solar and wind nationally. • Re-purposing and re-powering of coal-fired power plants and mines.	The bid rounds have not been consistent. Consistency is beneficial to build a strong project pipeline.

3.1.2. Municipal power procurement

In 2021, The Department of Mineral Resources and Energy (DMRE) amended the Electricity Regulations Act on New Generation Capacity, which enables municipalities in good financial standing to procure new generation capacity (from IPPs) and develop their power generation projects. This has created a new market for utility-scale renewable energy outside of the REIPPPP[6]. The Section 34 Determination enables the DMRE to undertake procurement of additional electricity capacity in accordance with the Integrated Resource Plan (IRP 2019).

For a municipality to apply to the Minister of the DMRE to establish new generation capacity as per the Integrated Resource Plan, the application must be accompanied by a detailed feasibility study as contemplated in a sub-regulation of the Act, demonstrate good financial standing of the Municipality; and be aligned to the Integrated Development Plan (IDP) of that Municipality.
A significant amount of work is needed to unlock this market, with municipaities having to demonstrate good financial standing; and update their Integrated Development Plans (IDPs).

Table 5 below outlines the drivers and barriers for this opportunity.

Table 5: Drivers and barriers for utility scale renewable under municipal power procurement

Key Drivers	Barriers
• Municipalities plan to increase the share of renewables in the energy mix on their distribution grid. • Localized power generation increases energy security. • Increased load shedding expected up until 2025.	• The development of the municipal Integrated Development Plans (IDPs) and procurement process will take a significant amount of work and time. • Municipalities may not be creditworthy and pose a risk of non-payment. • Only Gert Sibanda and Nkangala district municipalities received clean finacial audits in the province.

[6] It is not yet clear how this market will impact the technology allocation that will be procured through REIPPPP, but likely it will decrease the size of future REIPPPP bid windows.

Based on the 5-10% estimated REIPPPP allocation for wind and solar and market demand in Mpumalanga, the market size for this opportunity is an estimated 260MW in the short to medium term. This is depending on which municipalities are eligible and actively drive this opportunity.

3.1.3. Re-purposing and re-powering of coal-fired power plants and mines

Eskom is set to decommission up to 11GW of coal fired generation by 2030. There are plans to re-purpose and re-power coal power plants. About 80% of the total production of coal in South Africa is undertaken in Mpumalanga. Consequently, most of Eskom's coal-fired plants are also located in the province. Eskom is currently considering decommissioning four power plants by 2026, namely Camden, Grootvlei, Komati, and Hendrina, and also potentially a single unit at Arnot. According to a World Bank study in 2020, Eskom's vision for re-purposing the power plants with cleaner technology is based on four principles:

- Reuse of the existing power transmission infrastructure.
- Development of new generation capacity needed for the upcoming years.
- Providing relevant ancillary services to the system.
- Mitigate socio-economic impacts of the proposed site and operational asset changes.

The extent of the planned decommissioning will provide space for an entirely different energy mix, focusing on incremental capacity addition (modular) and flexible technology to complement the existing installed large scale base load capacity.

Table 6 below outlines the drivers and barriers for this opportunity:

Table 6: Drivers and barriers for re-purposing and re-powering of coal-fired power plants and mines

Key Drivers	Barriers
• High-value electrical and transmission assets will be available at decommissioned power plants • Localized manufacturing support through government interventions. • Local content requirements in REIPPPP.	• Roadmap to re-purpose and re-powering is not yet defined and clear. • Coal power plants useful life extension after the end of life date.

The re-purposing and re-powering of coal-fired power plants is a long term opportunity because the scheduled decommissioning plans are not yet concluded. According to IRP2019, 5 400MW of electricity from coal generation by Eskom will be decommissioned by 2022, increasing to 10 500MW by 2030, 28GW by 2040 and 35 000MW by 2050.

3.2. Private offtake of renewable energy generation

A strong business case for solar PV in rooftop and ground mount applications continues to drive high competition levels and open the market to more players. The rooftop market is linked to the growth of the provincial economy which is mainly driven by farming, mining, heavy industry, and tourism. The market opportunity has fostered the growth of innovative ideas offering clients the great products and services with the favourable terms, as evidenced by the growth of offerings in the region.

Support services like metering, engineering, design and project services are expected to grow as the RE technologies are adopted more widely.

3.2.1. Increased uptake of rooftop solar PV

The private sector demand for renewable energy is largely driven by price and supply security. Currently, this market is dominated by rooftop solar PV, given the competitive price, technical maturity, and ease of implementation of this technology.

The national embedded generation market for installations, operation and maintenance of rooftop solar PV has been identified as an important part of the country's immediate efforts towards energy security. The province has currently registered ~25-30MW[7] of rooftop solar PV projects according to a South African Local Government Association (SALGA) report in 2020. With 10% of the registered SSEG in the country based in Mpumalanga, this market is expected to grow by 40-50MW/year of rooftop PV projects (mostly ~1MW) in the agriculture, commercial and industrial sectors up to 2030.

This market growth potential is linked to the ability of local distribution utilities to allow grid access and pay a basic feed-in tariff. Mpumalanga municipalities capable of driving and leading the Solar PV market are Mbombela, Msukaligwa, Emalahleni and Govan Mbeki as they have SSEG procedures in place.

[7] Gauteng has recorded 129MW and Western Cape has recorded 64.3MW of SSEG systems

Green Hydrogen in South Africa

According to the *A Super H2igh Road Scenario for South Africa* report developed by IHS Markit, there is a feasible scenario in which the manufacture and use of hydrogen, using available low-carbon technologies, will support South Africa to progress to deeper decarbonization than current policies envisage.

The economics of early domestic hydrogen use, especially in Just Transition Hotspots (i.e. communities impacted by the coal transition), remain challenging. South Africa needs to position itself to compete effectively for export-focused foundation projects as this market grows.

Although there is a lot of excitement around this opportunity, there is still significant uncertainties. It has therefore not been included as a feasible opportunity until more clarity is avalaible.

The Super H2igh Road scenario is consistent with improved overall economic performance and is net positive for job creation. The scenario involves the manufacture of 3.8 million tonnes per annum (Mtpa) of hydrogen, mostly from water electrolysis, by 2050 (0.75 Mtpa by 2030).

Table 7 below outlines the drivers and barriers for this opportunity.

Table 7: Drivers and barriers of rooftop solar PV

Key Drivers	Barriers
• Competitive cost of electricity and service from ESCOs for commercial and industrial customers. • Lower year on year tariff escalation rate compared to municipalities and Eskom tariffs. • Local and international finance houses offering low interest rates. • Continued loadshedding up to 2025.	• Only 4 out of 17 municipalities have defined SSEG procedures in Mpumalanga. • The municipal installation approval process takes at least four months.

3.2.2. Increased uptake of ground mounted Solar PV

The DMRE has gazetted the amendment to Schedule 2 of the Electricity Regulation Act, which will enable private entities to generate up to 100MW of "distributed" or self-generated electricity without a licence[8].

The newly gazetted amendment includes the following breakdown:

- Systems of up to 100kW - No registration with The National Energy Regulator of South Africa (NERSA) needed, no generation licence needed, approval required from the distribution utility (either Eskom or a municipality).
- Systems from 101kW to 100MW – must be registered with NERSA; no generation licence needed approval required from the distribution utility (either Eskom or a municipality).
- Sytems greater than 100MW – A normal generation licence needed from NERSA.

Ground mount allows for bigger solar systems that are not limited by available roof space, although smaller solar systems can be installed on ground mount technology. This opportunity is relevant for generation systems on load sites and generators to wheel electricity[9] to end-use customers.

In both cases, the generators are exempted from licensing even though they will integrate or connect directly to the transmission or distribution network instead of being embedded on a load site. There is no wording in the amendment that suggests that feed-in tariffs are only applicable up to the previous 1MW cap. These uncertainties still need to be clarified by the DMRE.

This regulation change has removed barriers facing independent power producers in getting project approvals and accessing additional off-take opportunities (i.e. electricity wheeling and trading). Energy Intensive Users, including mines in Mpumalanga, can now generate their power without a licence behind the meter and access or sell electricity through wheeling.

This market is expected to increase by 100MW/year in the short to medium term.

Table 8 outlines the drivers and barriers for this opportunity.

[8] Noted that the revised Schedule 2 has no implications for how distribution utilities process grid-connected applications (e.g. the NRS097-2-3 is still used as normal, and grid studies are still required for SSEG over 350kVA)

[9] Wheeling is the transportation of electrical energy from a generator to a separate electrical load, by making use of municipal or Eskom grid infrastructure and Power Purchase Agreements (PPAs).

Table 8: Drivers and barriers of ground mounted PV

Key Drivers	Barriers
• Generation licence cap increase to 100MW. • Wheeling opportunity through transmission and distribution network. • Growth of energy trading opportunities[10].	• Municipalities framework currently regulates up to 1MW and they have yet to update application procedures for plants larger than 1MW. • Only Eskom and Mbombela Municipality have wheeling and energy trading regulations.

3.2.3. Biomass

There is a waste-to-energy opportunity in Mpumalanga and significant infrastructure in the electricity (co-located transmission infrastructure) and agriculture sector through the valorisation of biomass (which includes organic waste residues derived from biological sources, woody materials and residues).

The Southern African Biogas Industry Association (SABIA) estimates the national market energy potential for biogas to be 1GW in the long term. In addition, IRP2019 allocates 4GW nationally by 2030 for other distributed generation, co-generation, biomass (combustion and biogas) and landfill. Mpumalanga houses substantial agricultural residues and invasive alien plant resources, and this is an attractive general location for bioenergy development. The market potential for Mpumalanga is relatively high and yet to be established.

There are applications in household and industrial markets such as charcoal for heating or power generation via mono or multiple feedstock sources. The wood, paper, brewing and sugar industry use biomass by-products to generate their own steam and electricity. Mpumalanga resources for biomass to energy are dominated by bagasse (from sugar industry) and black liquor (from pulp & paper industry).

Table 9 on the next page outlines the drivers and barriers for this opportunity.

[10] Energy trading is the buying and selling of energy between two or more grid-connected parties

Table 9: Drivers and barriers for energy from biomass

Key Drivers	Barriers
• IRP2019 targets of 500MW/year procurement from 2023 for distributed generation, CoGen, biomass and landfill. • Higher cost of disposal for organic waste at "landfills" for C&I and agriculture sectors. • Resources availability in Mpumalanga. • Large electricity and heat users in Mpumalanga.	• Municipalities have limited technical understanding of waste to energy and how to regulate the embedded generation process. • Higher R/kW investment than other renewables and longer ROI. • Limited project development funding. • Offtake agreements for the potential electricity.

3.2.4. Biofuels

Like other developing countries, South Africa recognises that first-generation (crop-based) biofuels can reinvigorate the declining agricultural sector. Globally, the use of biofuels as a transport fuel is enabled by national mandatory blending policies to reduce the negative environmental impact of fossil-based transport fuel use.

On 13 December 2019, Cabinet approved the South African Biofuels Regulatory Framework. The draft mandatory blending regulations came into effect in October 2015 to create certainty of biofuels demand by compelling licensed manufacturers and wholesalers of petroleum products to buy and blend locally produced bioethanol and biodiesel at a minimum of 2% of their petrol and 5% of their diesel market demand, respectively.

Based on the total national fuel pool of over 23 billion litres per annum, at a penetration rate of 2% through mandatory blending, this translated to a biofuels demand of at least 460 million litres per annum nationally.

Mpumalanga, Kwa-Zulu Natal (KZN) and Eastern Cape (EC) are expected to receive their share of this opportunity to produce biofuel due to substantial amounts of sugar cane, sweet sorghum cultivation, maize and oil-bearing crops such as groundnuts and sunflower being grown in these provinces.

Table 10 provides a breakdown of the drivers and barriers for this opportunity

Table 10: Drivers and barriers for biofuels

Key Drivers	Barriers
• South African Biofuels Regulatory Framework 2019. • South African Sugarcane Value Chain Master Plan to 2030. • Resource availability in Mpumalanga.	• The local and international concern on the land use management for food and energy crops – interventions would need to focus on waste use. • Lack of understanding with regards to current policies and legislation.

Mpumalanga Bio-Energy Cluster is an initiative of the Mpumalanga Department of Economic Development and Tourism and was established in 2012. The Cluster's objectives are:

- To create a common vision amongst the cluster members regarding the implementation of bio-energy in Mpumalanga Province,
- To provide guidance, play an advisory role & provide leadership in driving the sector in the Province (through its Cluster Committee)
- Share expertise and knowledge that will assist in the implementing of this sector

Mpumalanga Bio-Energy resources are dominated by biomass, municipality solid waste (MSW), bioethanol and biodiesel and the Cluster is there to ensure the potential market is converted into a reality

3.3. Energy storage

The continued growth in the renewable energy market combined with more than 10 years of loadshedding has led households, businesses and farmers to explore alternative means of energy security and resilience. On a larger scale, as per the Integrated Resource Plan 2019 (IRP2019) , South Africa aims to procure an additional 2 088MW of energy storage from 2023 onwards with a total installed capacity of ~5GWs by 2030.

3.3.1. Commerical & Industrial (C&I) battery storage

Developments such as battery storage options are emerging as the latest trends that will influence the private sector market in short to medium term (5-10 years). Similar to the growth in the renewable energy market, growth in this space is driven by rising electricity costs, increased financial returns from storage investments, and growing need for energy security.

There are several technologies making inroads in the South African energy storage sector. Lithium-ion (Li-ion) and lead-acid battery technologies are the most tried and tested. They remain the leaders in this market, with the former emerging as a dominant choice due to its performance and proven operational stability.

Table 11 shows the average cost of a battery backup system with Lithium-Ion phosphate technoogy

Table 11: Cost of battery energy storage

Technology	Benefits	Barriers	Capital cost range
Lithium-Ion Phosphate	Low maintenance, high energy density.	Higher cost.	<15 kWh: R6 000 – R10 000 R/kWh <800 kWh: R5 000 – R9 000 R/kWh >800 kWh: R4 000 – R8 000 R/kWh

Beyond a handful of private customers that have invested in battery technology to ensure energy security for their operations, the price is not yet right for behind-the-meter (BTM) applications. However, energy storage is expected to become the keystone of the future small scale embedded generation (SSEG) market.

The potential market will depend on the growth of the solar PV market, however, market size is expected to be upto 26MWh (R208 Million) per year. This estimate assumes that 30% of all Rooftop PV (40MW) will have at least 2hr storage which results in an estimated 13MW storage demand or 26MWh of backup energy to be installed current and short term period.

Table 12 provides a breakdown of the drivers and barriers for this opportunity.

Table 12: Drivers and barriers for commercial and industrial (C&I) battery storage

Key Drivers	Barriers
• Technology cost per kWh has been dropping year on year. • Batteries provide energy security during loadshedding. • Capacity upgrade deferment. • The stacked benefit of ToU tariff management and demand charge reduction.	• Uncertainty and limited policy on battery integration. • Upfront cost per kWh is still relatively higher than conventional sources of emergency power.

3.3.2. Utility-scale battery storage

The IRP2019 allows for 2 088MW additional energy storage to be procured by 2030.

Given the DMRE's aim of reusing the existing power transmission infrastructure while mitigating the socio-economic impacts of the proposed site and operating asset changes, the Mpumalanga region is expected to be a prime location for future energy storage opportunities.

However, it is unclear how the 2 088MW will be allocated between storage technologies and where they will be located in the country.

Table 13 provides a breakdown of drivers and barriers for this opportunity.

This is a short to medium-term opportunity with a market size potential in Mpumalanga that is yet unknown but promising to be substantial because of the existing power transmission infrastructure available.

Table 13: Drivers and barriers for utility-scale battery storage

Key Drivers	Barriers
• IRP 2019 targets of additional 2088MW by 2030. • Increased grid stability. • Capacity upgrade deferment. • Energy storage arbitrage for peaker plants.	• Uncertainty and limited policy on battery integration. • Lack of investment in R&D to manufacture batteries locally.

3.4. Sustainable transport

Globally, the momentum for electric mobility has increased exponentially, as evidenced by the number of electric vehicles sales from 2013 to 2020 (InsideEVs, 2020). This global shift has been primarily driven by national emission reduction commitments stemming from the Paris Agreement on climate change, growing urban air pollution concerns, and continued crude oil price volatility.

Public transport electrification and electric vehicles for use in underground mining have been identified as opportunities in this sector in Mpumalanga.

3.4.1. Public transport electrification

The public bus industry which is dominated by local municipality bus companies and the minibus taxi industry presents the best business case for electrification in South Africa. Mpumalanga has the third highest number of buses after Gauteng and Kwa-Zulu Natal provinces.

Bus companies in Mpumalanga will be looking at replacing a portion of their estimated 4 000 diesel-powered buses with electric buses in stages in the medium to long term.

This potential business case is driven by:

- peak travel patterns (when and where people travel) [11]
- long-standing/idle times that coincide with current AC charging times
- reduced operation and maintenance costs across bus/minibus fleets over internal combustion engine (ICE) technology.

Table 14 provides a breakdown of the drivers and barriers for this opportunity.

[11] Most EV charging in other countries typically occurs at night and during the weekends, when passenger vehicles are often not being used. However, public transport would need to charge during the day and even during peak demand periods, which could create a strain on the electricity system.

Table 14: Drivers and barriers of public transport electrification

Key Drivers	Barriers
• Higher stake for mass public transportation system with an annual growth rate of 100% since 2013. • Reduction in prices of EV's and lithium batteries making EV's cost-comparable with ICE vehicles by the middle of the decade. • Deinvestment of liquid-based fuels as most financial institutions are directing investments towards sustainable transport. • South Africa already has a strong automotive industry.Buses are Designated for 80% local content which would also apply if the bus is an electric bus.	• Absence of supporting infrastructure like charging stations and maintenance stations in Mpumalanga. • High upfront investment costs of the technology.

3.4.2. Electric vehicles in underground mining

According to the DMRE's Mineral Policy and Promotion, Mpumalanga accounts for 83% of South Africa's coal production. Current mining projects in Mpumalanga include 68 Coal, 19 Industrial, 4 Platinum Group Metals, 13 Gold, 5 Nickel, 3 Iron Ore and 1 Chrome.

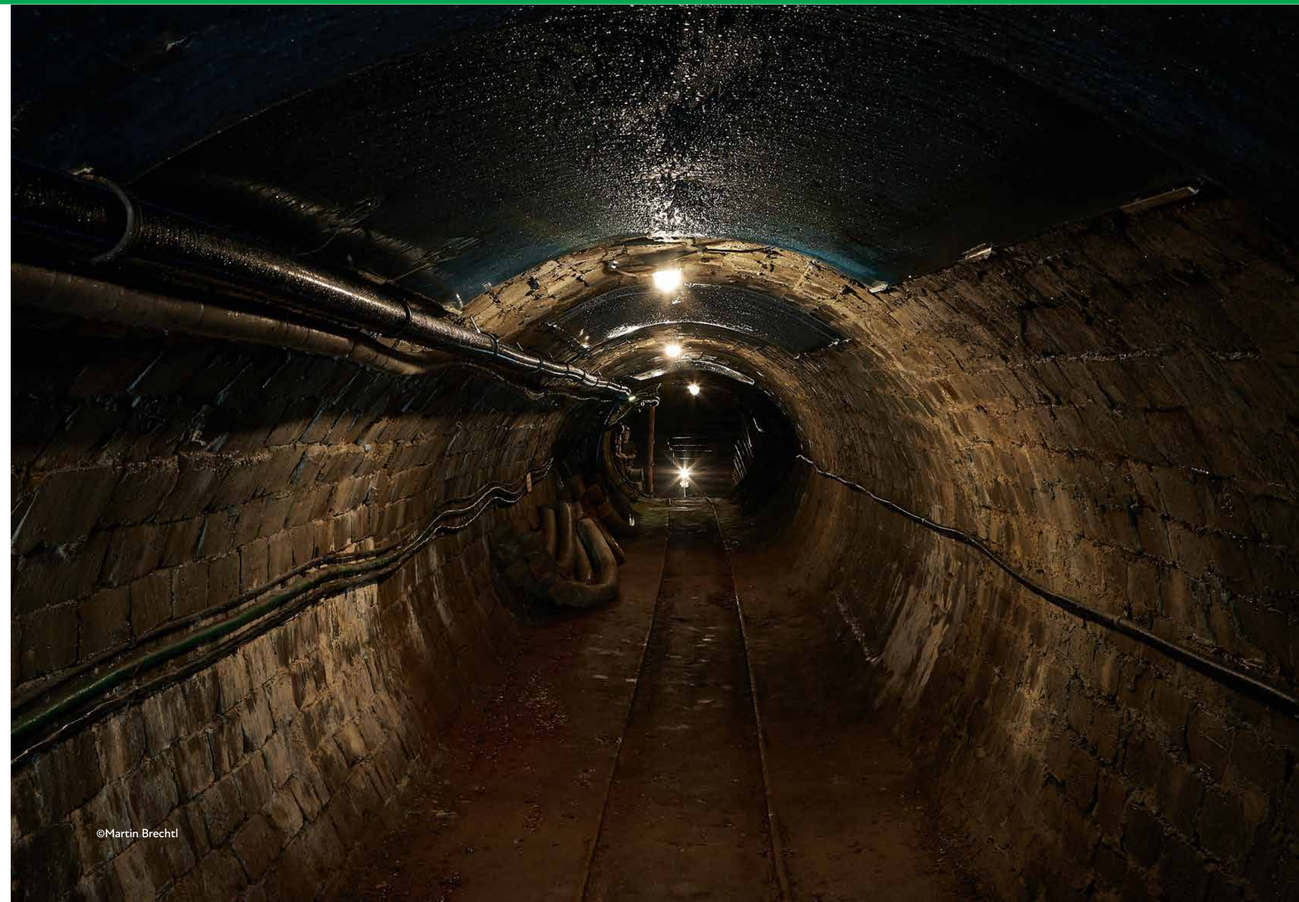
There is a medium- to long-term opportunity for battery-powered EVs and machinery in underground and opencast mining in Mpumalanga. The opportunity in underground mining is driven by the high costs of ventilation for clean air underground and temperature regulation. Both of these costs are closely linked to the use of Internal Combustion Engine (ICE) vehicles and machinery.

Compared to ICE applications, electric mining equipment/vehicles produce no fine particular matter (PM2.5) from diesel and other tailpipe emissions, thereby necessitating less ventilation, lower costs, and safeguarding health for miners. Additionally, EV mining equipment produces less heat because of the higher efficiency of converting mechanical energy from electricity than from diesel.

Table 15 provides a breakdown of the drivers and barriers for this opportunity.

Table 15: Drivers and barriers to electric vehicles in underground mining

Key Drivers	Barriers
• Push for sustainable underground mining transportation with lower emissions, higher efficiency and lower heating. • Cost of mining ventilation. • Cost of mining heat regulation. • Health and safety concerns. • Increasing combustion fuel costs	• High upfront investment costs of the technology. • Availability of locally manufactured EV machinery.



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4.

FUNDING AND INCENTIVES

South Africa ranks as one of the top 15 nations in the world in terms of driving the green growth agenda (ahead of Australia, Singapore, and Finland). This drive is on the back of a range of funding solutions and tax incentives available to green technology manufacturers and service companies, as well as those who use or procure such goods and services.

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

General database web page
The GreenCape Finance Desk hosts a web page with a number of Green Finance resources that cover funding and incentives available to companies operating in the green economy.
A few of the available database are highlighted below.

> The Green Finance Desk (GFD) primarily acts as a facilitator in the financing of green projects and green business. The GFD works across all sector desks at GreenCape. For more support please contact jack@greencape.co.za

Green Finance Database
GreenCape maintains a database of funding sources and incentives that may be relevant to green economy investors. The database contains information on more than 150 funding opportunities, including an overview of the opportunity and relevant contact details and links. It is ideal for any entity seeking a broad range of funding solutions and financial incentives, with South African institutions being the main source of opportunities. The database is available to view and download online[12].

Government funding and incentives database
An updated document focused on South African government funding and incentives is available to view and download online[13]. These incentives cover local manufacturing, critical infrastructure grants, small enterprise development and a diverse set of sector specific incentives (i.e. Aquaculture Development and Enhancement Programme).

Finfind database
Finfind[14] is an innovative online finance solution that brings together SMME finance providers and finance seekers. With a focus on finance readiness, Finfind has more than 200 lenders and over 350 loan products available to SMEs. The database is ideal for South African SMMEs who are seeking funding and/or business advisory services, and those who want to improve their understanding of finance.

AlliedCrowds database
AlliedCrowds[15] is the first complete aggregator and directory of alternative finance providers in the developing world. Sign-up is free and allows users to access a global database where one can filter for sector (including greentech, agriculture and social impact), type of capital (equity, lending, grant), and type of funding (crowdfunding, angel investing, venture capital, impact investing). In addition:

- Themed databases around the Sustainable Development Goals (SDGs) and the World Green Economy Organisation (WGEO) are available.
- Reports, including a number specifically about African funding sources, can also be downloaded for free.
- Businesses / organisations can also contact Allied Crowds to create a customised funding database. This resource is ideal for any entity seeking a broad range of financial solutions on a global scale.

[12] https://www.green-cape.co.za/content/focusarea/green-finance-databases
[13] https://www.greencape.co.za/assets/Uploads/Government-Funding-and-Incentive-Booklet.pdf
[14] https://www.finfindeasy.co.za/
[15] https://alliedcrowds.com/

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REFERENCES

©Pxhere

Adefarati, T. and Obikoya, G.D. 2019. Evaluation of wind resources potential and economic analysis of wind power generation in South Africa. The University of Pretoria. Available from: https://repository.up.ac.za/bitstream/handle/2263/73570/Adefarati_Evaluation_2019.pdf?sequence=1 Accessed August 2021

A Super H2igh Road Scenario for South Africa Public Report July 2021 Accessed July 2021

Department of Energy. 2019. Draft Integrated Resource Plan (Draft IRP 2019). October 2019. Independent Power Producers Office (IPPO). 2020. Independent Power Producers Procurement Programme, an Overview. June 2020

Department of Mineral Resources and Energy. 2019. South African biofuels regulatory framework. Available from: https://www.gov.za/sites/default/files/gcis_document/202002/43003gon116.pdf Accessed July 2021

DMRE Mineral Policy and Promotion in Mpumalanga. Available from: https://www.dmr.gov.za/mineral-policy-promotion/operating-mines/mpumalanga Accessed August 2021

DMRE Renewable Energy Sources. Available from http://www.energy.gov.za/files/esources/renewables/r_solar.html Accessed August 2021

eNaTIS 2020. Live vehicle population as per the National Traffic Information System. http://www.enatis.com/ Access June 2021

Minerals Council of South Africa. 2020. Facts and Figures Pocket Book 2020. Available from: https://www.mineralscouncil.org.za/industry-news/publications/facts-and-figures Accessed July 2021

Hugo, W (Ed), 2016. BioEnergy Atlas for South Africa – Synopsis Report, Department of Science and Technology, Pretoria, South Africa. Available from: https://bea.saeon.ac.za/wp-content/uploads/2021/03/Bio-Energy-Atlas.pdf Accessed August 2021

Independent Power Producers Office (IPPO). 2020. Independent Power Producers Procurement Programme, an Overview. June 2020.

IASS/UfU/IET/CSIR. 2020. Making the Paris Agreement a success for the planet and the people of South Africa. Unlocking the co-benefits of decarbonising South Africa's power sector. COBENEFITS Policy Report. Potsdam/Pretoria. www.cobenefits.info

Mpumalanga Provincial Government and Department of Cooperative Governance and Traditional Affairs. 2019. Spatial Development Framework Available from: https://cogta.mpg.gov.za/documents/SpatialDevFramework/PSDF%20Final%20Report.pdf Accessed August 2021

SALGA. 2020. Status of small scale embedded generation (SSEG) In South African Municipalities. Available from: https://www.sseg.org.za/wp-content/uploads/2019/03/Status-of-Small-Scale-Embedded-Generation-in-Municipalities-October-2018.pdf Accessed July 2021

Southern African Biogas Industry Association 2021. SABIA Market Position Paper. Available from: https://www.worldbiogasassociation.org/wp-content/uploads/securepdfs/2021/03/SABIA_MARKET-POSITION-PAPER.pdf Accessed July 2021

Wind Atlas for South Africa. 2021. Available from: http://www.wasaproject.info/