



MPUMALANGA
GREEN CLUSTER
AGENCY



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INDUSTRY BRIEF

Sustainable mobility: A viable lever for unlocking economic diversification in Mpumalanga

LIST OF ACRONYMS

BEV	Battery Electric Vehicle
CNG	Compressed Natural Gas
CO₂	Carbon Dioxide
DMRE	Department of Mineral Resources and Energy
DoT	Department of Transport
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
GHG	Greenhouse Gas Emissions
GTS	Green Transport Strategy
HEV	Hybrid Electric Vehicle
ICE	Internal Combustion Engine
LNG	Liquid Natural Gas
LPG	Liquid Petroleum Gas
PHEV	Plug-in Hybrid Electric Vehicle
SAF	Sustainable Aviation Fuel

MAIN INSIGHTS

Crude oil refining capacity in South Africa has been declining over time which creates supply chain vulnerability concerns due to an over reliance on liquid fuel imports.

Global geo-political factors negatively influence the price of imported fuel which impacts local energy security, inflation rates and economic growth.

Mpumalanga has the second highest provincial unemployment rate in South Africa at the time of writing and requires investment in new industries to stimulate job creation in the province.

The sustainable mobility transition in South Africa is an opportunity to develop localised energy security and stimulate new green industries in Mpumalanga:

There is a short term market opportunity for the use of electric vehicles in commercial vehicle fleets in public transportation, tourism, mining and agriculture with localised retrofitting and small volume manufacturing opportunities.

There is a medium term market opportunity for the production of biofuels from sugarcane and biodiesel from industrial hemp cultivated on contaminated mining land.

There is a long term market opportunity for the production of synthetic eFuels in Mpumalanga for the aviation and shipping industry in South Africa and possible export to the European market.

This industry brief outlines the viable investment opportunities that exist and are emerging over the next decade in the sustainable mobility value chain in Mpumalanga.

This brief is written for:

Investors and decision makers in the sustainable mobility value chain looking for viable business opportunities in electric mobility, biofuels and synthetic eFuels.

1 CONTEXT

The official unemployment rate in Mpumalanga was 38.4% in 2023¹. This is the second highest unemployment rate in South Africa and requires innovative thinking and creative industrial policy to stimulate new jobs and investment in the province. The green economy can be leveraged as a mechanism to decentralise and localise economic activity to enable socio-economic development. Mpumalanga's economic activity is primarily concentrated in the major industries of mining, agriculture, public transport and tourism. There is opportunity within these sectors to leverage the sustainable mobility transition to

create new green industries in the province.

Figure 1 below shows that liquid fuel sales in South Africa in 2022 amounted to 9.2 billion litres of petrol, 12.7 billion litres of diesel, 4.7 million litres of aviation gasoline and 1.5 billion litres of jet fuel. The decline of crude oil refining capacity in South Africa over time, as well as the shutdown of some local refineries has negatively impacted liquid fuel energy security in South Africa. This has increased a dependence on fuel imports and increased economic exposure to fuel price volatility and resulting inflationary pressures.

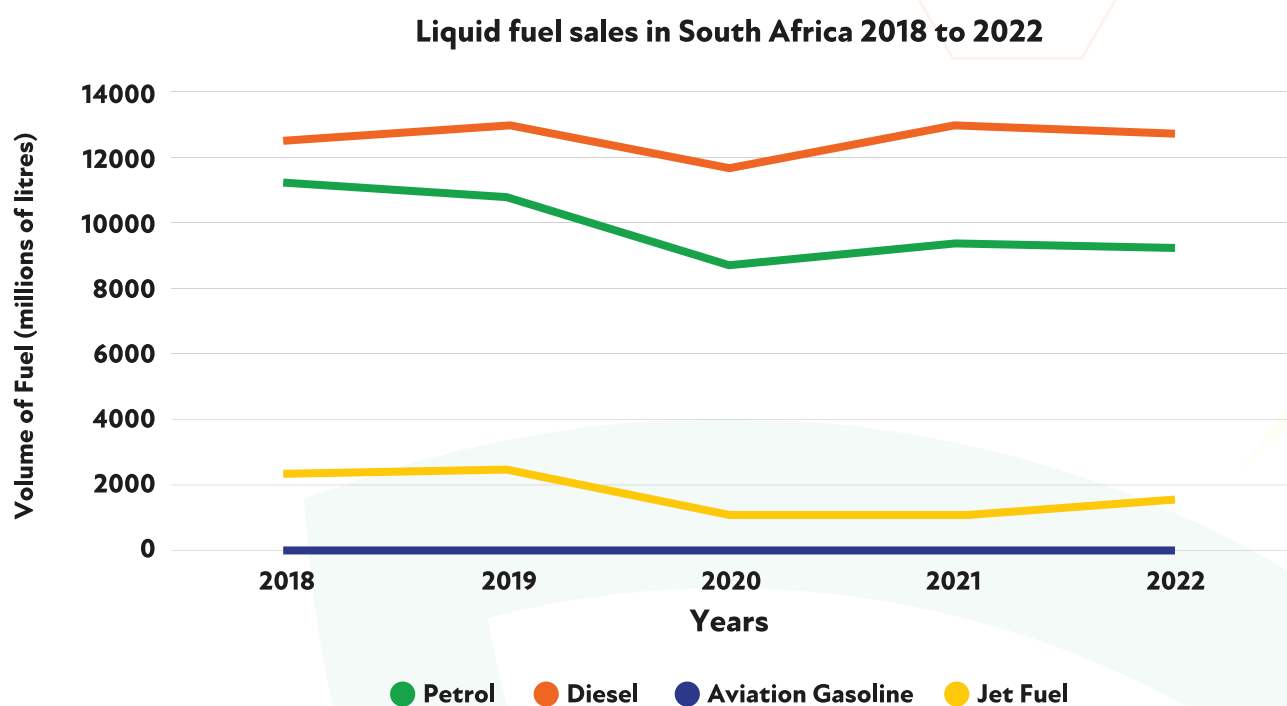


Figure 1: Liquid fuel sales in South Africa (2018 to 2022)²

¹ Source: Statistics South Africa, 2023 <https://www.statssa.gov.za/publications/P0211/Presentation%20QLFS%20Q2%202023.pdf>

² Source: https://www.energy.gov.za/files/media/media_SAVolumes.html

The transition to sustainable mobility in South Africa, presents a unique opportunity for Mpumalanga to position itself as a renewable energy and green industrial hub. A multi-pronged approach is required to reduce transport related GHG emissions in South Africa by 50% by 2050 as per the South African Green Transport Strategy (GTS). Green industrialisation is an important lever that can be used to stimulate jobs and investment in Mpumalanga to address the high unemployment rate in the province.

Economic diversification through investment in green infrastructure and manufacturing can support the province in the energy transition. Mpumalanga has legacy industries in the mining, agriculture, public transportation and tourism which can stimulate a sustainable mobility transition. With a strong industrial base in Mpumalanga there is also a manufacturing opportunity on the back of the sustainable mobility transition.

2 OPPORTUNITIES FOR ECONOMIC DIVERSIFICATION

The sustainable mobility transition in South Africa presents numerous opportunities for the creation of new green industries in Mpumalanga. The province is at the centre of the just energy transition conversation in South Africa with available grid generation connection capacity to take on new large-scale renewable energy projects. The renewable energy development zone that has been established in eMalahleni and the abundance of rehabilitated mining

land that is available for the planting of energy crops are drivers for the attraction of new investment in electric mobility, biofuels and synthetic eFuels. **Figure 2** below shows the decarbonisation pathways that exist to reach net-zero through sustainable mobility. Three investment opportunities have been highlighted in this industry brief namely electric mobility, biofuels and synthetic eFuels.

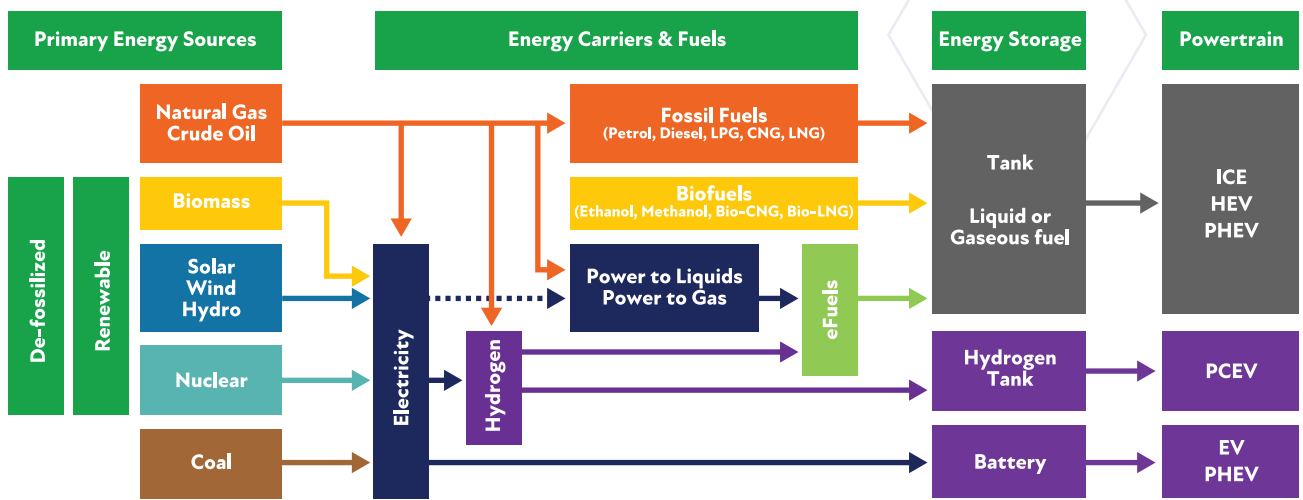


Figure 2: Sustainable mobility transition pathways & industrialisation opportunities for Mpumalanga

3 ELECTRIC MOBILITY

Battery electric vehicle technology charged with renewable energy presents a strong business case for the electrification of commercial vehicle fleets despite the higher CapEx cost. This is due to the much lower cost of renewable electricity needed for charging compared to the cost of fossil fuels. Electric vehicles are still more expensive than their ICE counterparts due to the high import duties (25%) and ad valorem

taxes (18% to 30%) which is applied to all vehicles imported into South Africa at a value of greater than R600 000. The average cost of an electric private passenger vehicle in South Africa is approximately R1 million. There are 458 687³ private passenger vehicles in Mpumalanga, a 1% market penetration would be 4 587 EVs valued at R4.6 billion.

³ Source: National Traffic Information System: Live vehicle population 2023

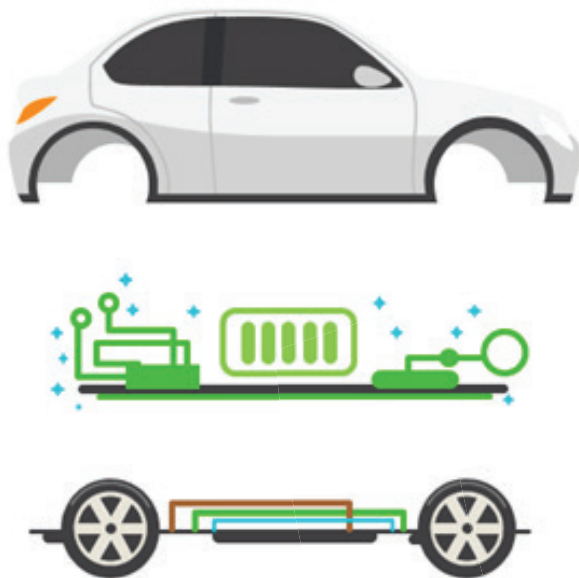


Due to the socio-economic conditions in Mpumalanga there is a stronger business case for the electrification of commercial ⁴ vehicle fleets in mining, agriculture, public transportation and tourism. Electrification of the public transportation industry in Mpumalanga is an untapped market with 8 171 buses and 28 069 minibuses in Mpumalanga ⁵. Buscor is a large public transport operator in Mpumalanga with 400 train buses that could be electrified. The cost of an electric bus is approximately R7 million, therefore the electrification of the Buscor fleet would be valued at R2.8 billion. The cost of an electric minibus taxi is around R1.5 million. A 1% market penetration of the minibus taxi industry in Mpumalanga would be valued at R421 million.

Electric vehicle retrofitting is the process of removing the internal combustion engine and fuel tank from an ICE vehicle and replacing it with an electric powertrain (electric motor, drive train and battery pack) as shown in **Figure 3** below: The vehicle outer body is retained

with the original vehicle chassis remaining in place. This technology is a sustainable, circular, decentralised approach towards vehicle electrification which can be done locally, at small production volumes.

There is a growing market for electric vehicle retrofitting in Mpumalanga which is primarily focussed on the electric conversion of game viewing safari vehicles for the eco-tourism industry. Electric safari game viewing vehicles are valued due to their quiet operational nature, which does not disturb the surrounding fauna. The reduction in direct tail-pipe emissions is also valued by game parks with eco-tourism campaigns. There are 15 game viewing safari vehicles which have been retrofitted to date in Mpumalanga at an average cost of R2 million each. A market penetration of 100 retrofitted game viewing safari vehicles in Mpumalanga would have a market value of R200 million.



01 Vehicle outer body is retained



Original vehicle body

02 Electric Powertrain is retrofitted



Electric motor, drivetrain & battery pack

03 Vehicle Chassis is retained



Original vehicle frame and wheels

Figure 3: Electric vehicle retrofitting process

⁴ Commercial vehicle fleets are defined as a fleet of vehicles owned and operated by a business to transport goods or people, to conduct business or assist with daily business activity.

⁵ Source: National Traffic Information System: Live vehicle population 2023



There are also additional applications for the electric conversion of underground mining locomotives, mine haulage trucks and agricultural vehicles such as tractors. In the underground mining industry, electric locomotives reduce the need for ventilation and cooling in underground mining shafts which results in operational savings for mining companies. There are 122 heavy mining operations in Mpumalanga, an estimated 30% mining vehicle market penetration rate would be valued at R1.23 billion (Approximately R8 million per mining truck). In the agricultural sector the conversion of tractors to electric is driven by the

improved mechanical performance of battery electric tractors compared to ICE equivalents, in addition to significant operational fuel savings. There is a market size of 8 048 ⁶ tractors in Mpumalanga which could potentially be retrofitted to electric.

Retrofitting a 100 of these tractors to electric would have a market value of R400 million. The cost of retrofitting a large tractor to electric is around R4 million. **Table 1** below details the barriers, key drivers and investment term for electric mobility in Mpumalanga.

Barriers	Key Drivers	Investment Term
Limited public electric vehicle charging infrastructure	Low operational costs	Short Term
High capex cost of electric vehicles due to import duties (25%) and ad valorem taxes (18% to 30%)	Low maintenance costs	
Electric retrofits must be re-homologated and pass a safety test before they can be sold to a new owner	Zero-direct tailpipe emissions	

Table 1: Barriers, key drivers & investment term for electric mobility in Mpumalanga

4 BIOFUELS

Mpumalanga has an existing sugarcane industry which has been negatively impacted by falling global demand for sugar and resulting lower export prices. According to the South African Sugarcane Growers Association, there are 7 393 people employed in the sugarcane industry in Mpumalanga with an estimated 3.96 million tonnes of sugar cane crushed per year at the Malelane and Komati sugar mills. Nationally, South Africa produces an estimated 20 million tonnes of sugarcane annually and is worth around R20 billion to the South African economy. According to the Food and Agriculture Organisation, using a good quality cane molasses, an estimated 240 litres of ethanol can be produced from one tonne of sugarcane. This means that 950.4 million litres of ethanol could be produced in Mpumalanga.

There is a need to transition towards manufacturing a higher value product from the sugarcane that is produced in Mpumalanga. Bio-ethanol production from sugarcane in Mpumalanga represents an emerging opportunity to address the falling global demand for sugar and decreased crude oil refining capacity in South

Africa. **Table 2** below details the barriers, key drivers and investment term for biofuel production in Mpumalanga. There is an opportunity to develop a regional bio-refinery plant in Mpumalanga to process existing sugarcane resources into bio-ethanol. The South African Biofuels Regulatory Framework recommends a 2% blending ratio of biofuels with petrol and a 5% blending ratio of biodiesel with diesel where there is availability of biofuel supply.

The mandatory biofuel blending regulations have not been successful as it is only binding where there is sufficient market supply to meet the blending mandate requirements. The regulatory framework further states that the retail price of biofuels should be pegged to the price of mineral petrol or diesel for blending purposes. This regulation was created to act as a form of subsidy with the assumption that the cost of biofuel production would always be below the cost of mineral petrol and diesel.

⁶ Source: <https://www.statssa.gov.za/publications/Report-11-02-09/Report-11-02-092017.pdf>

Barriers	Key Drivers	Investment Term
Due to food security implications the use of food crops as an energy source is limited to sugarcane.	Sugar Tax in South Africa and the falling global demand for sugar	Medium Term
The large-scale cost of producing biofuels from energy crops has not been proven to be cheaper than that of fossil fuels and would require a subsidy.	Falling local crude oil refining capacity in South Africa which is increasing reliance on fuel imports	
The cultivation of energy crops for biofuel production consumes a large amount of freshwater resources.	Mandatory biofuel blending regulations of 2% for petrol and 5% for diesel supplies.	
Energy crops can only be grown for biofuels on contaminated land such as landfills and rehabilitated mines.	Availability of large amounts of rehabilitated mining land in Mpumalanga for the cultivation of energy crops	

Table 2: Barriers, key drivers and investment term for biofuel production in Mpumalanga

In 2022, approximately 9.2 billion litres of petrol and 12.7 billion litres of diesel were sold in South Africa (DMRE, 2023). This liquid fuels market is valued at R219.88 billion (petrol) and R309.88 billion (diesel). Using a 2% blending ratio for petrol, the market size for biofuels in South Africa is 184 million litres of biofuel which is valued at R4.4 billion ⁷. With a bioethanol production potential of 950,4 million litres of biofuel, using existing sugarcane resources in Mpumalanga, this target is achievable.

Using a blending ratio of 5% for diesel, the market size for biodiesel in South Africa is 635 million litres of biodiesel which is valued at R15.5 billion ⁸. Biodiesel can be produced from industrial hemp seed oil, which is gaining popularity in Mpumalanga for use as a regenerative crop. This can be used for the rehabilitation of contaminated soil such as decommissioned mines and mine dumps. Industrial hemp is able to draw out the heavy metals in the contaminated soil, produce sustainable fibres for the textiles industry as well as high quality biodiesel from the hemp seed oil. It is estimated that hemp can produce up to 800 litres of biodiesel per hectare per year. This would require 793 750 hectares of mining

land to produce enough biodiesel to match demand.

Mpumalanga has 50% of South Africa's total high potential arable land, in addition 60% of Mpumalanga's surface area is subject to mining rights or prospecting applications. Approximately, 4.59 million hectares of land in Mpumalanga either contains mining activity or could be subject to mining activity in the years to come. Agricultural production is constrained by mining activities and would require extensive rehabilitation (post-mining) to return to productive farmland. The commercial farming of industrial hemp on contaminated mining land is a feasible method of regenerating the soil, whilst securing liquid fuel energy security for the province.

It is important to note that the price of biofuels is pegged to the price of the petrol and diesel that it is blended to. Therefore, there is no operational cost saving that is accrued by the consumer as is the case with battery electric vehicles. The primary driver for the adoption of this technology would be economic diversification and a decreased reliance on liquid fuel imports into South Africa.

⁷ The cost of petrol is R23.90 per litre as of November 2023 according to the Automobile Association of South Africa.

⁸ The cost of diesel is R24.40 per litre as of November 2023 according to the Automobile Association of South Africa.



5 SYNTHETIC EFUELS

The production of synthetic liquid fuels from coal (using the Fischer-Tropsch process) is an established industry in Mpumalanga. Sasol's production facility in Secunda has an annual production capacity of 150 000 barrels of fuel per day. The transition to renewables in Mpumalanga has created an opportunity to diversify this important industrial sector through the production of cleaner, carbon neutral synthetic fuels. eFuels are synthetic hydrocarbon fuels that are produced from green hydrogen and carbon captured

from the atmosphere or other biogenic sources. The European Union has banned the sale of new ICE vehicles beyond 2035 unless they run on carbon neutral synthetic eFuels.

This is a potential export opportunity for the residual ICE vehicle market in Europe post 2035. **Table 3** below describes the barriers, key drivers and investment term for synthetic eFuels production in Mpumalanga.

Barriers	Key Drivers	Investment Term
Limited availability and high cost of input resources required to make eFuels	Decreased crude oil refining capacity in South Africa has resulted in a growing dependence on fuel imports	LongTerm
eFuels are currently more expensive than fossil fuels and would require a subsidy to reach price parity.	Existing expertise of the Fisher-Tropsch process in Mpumalanga	

Table 3: Barriers, key drivers and investment term for synthetic eFuels production in Mpumalanga

The aviation and shipping industry is difficult to decarbonise due to the limited applicability of battery electric technology in aircraft and long distance maritime transport. This is another potential growth market for synthetic eFuel production in Mpumalanga. In 2022, 4.7 million litres of aviation gasoline and 1.5 billion litres of jet fuel were sold in the South African market. According to WWF South Africa, a future sustainable aviation fuel (SAF) industry in South Africa

could produce 4.5 billion litres of fuel for local consumption and export. A future SAF industry has the potential to create 90 thousand jobs in Mpumalanga. It is estimated that 75% of coal hauling jobs in Mpumalanga can be transitioned to biomass transport due to an overlap in coal and biomass supply chains. SAF implementation is projected to improve South Africa's balance of trade by R81.5 billion to R170 billion per annum.

6 CONCLUSION

The transition to sustainable mobility in South Africa, presents a unique opportunity for Mpumalanga to position itself as a renewable energy and green industrial hub. Green industrialisation is an important lever that can be used to stimulate jobs and

investment in Mpumalanga to address the high unemployment rate whilst ensuring liquid fuel energy security for South Africa. Investment opportunities in electric mobility, biofuels and eFuels have been identified in Mpumalanga.



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