Energy and Economic Growth
Applied Research Programme

Low-Carbon Transport in South Africa

Energy Insight

Nicholas Letchford and Ryan Hogarth

March 2020

Oxford Policy Management

UKaid
from the British people

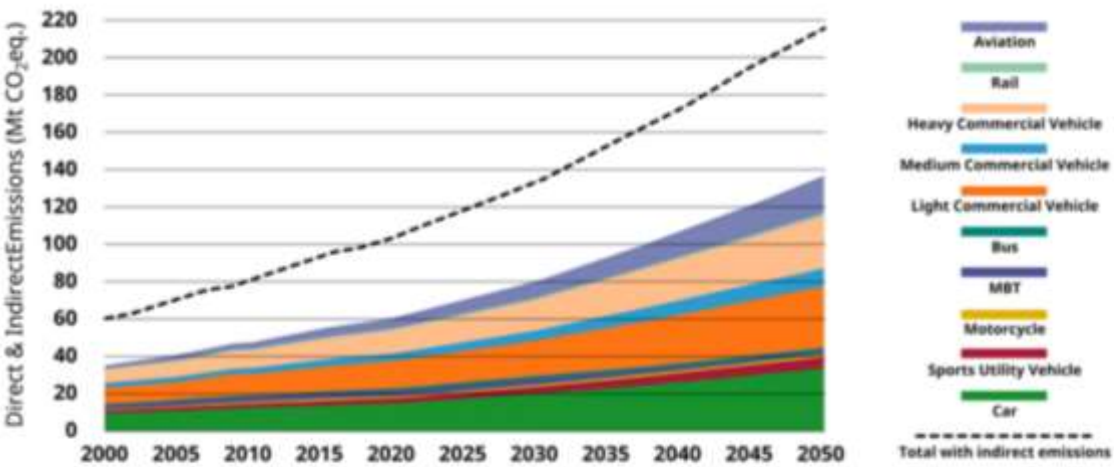
1. Introduction

South Africa is the 14th highest emitter of greenhouse gases in the world. The majority of its emissions come from coal-fired power plants, but transportation is also major contributor. In 2015 approximately 11% of South Africa's greenhouse gas (GHG) emissions came from transport, equalling a total of 46.3 $MtCO_2e$ (McSweeney and Timperley, 2018).

Given trends in the private, public, and freight transport modes across South Africa, GHG emissions are expected to quadruple in South Africa between 2010 and 2050, taking into account existing and planned policies as at 2014 (see Figure 1) (Department of Environmental Affairs, 2014). Total direct and indirect GHG emissions from the transport sector in South Africa are projected to reach approximately 220 $MtCO_2e$ per year by 2050. The majority of these emissions will be produced by private cars, and light and heavy weight commercial vehicles. Public bus and rail transport will emit relatively little.

Against this backdrop, in 2018 the South African Government released the Green Transport Strategy, the first national government policy aimed at reducing GHG emissions from the transport sector. The policy sets a long-term target of a 5% reduction of GHG emissions from the sector by 2050.

Figure 1: A projection of carbon emissions from the transport sector using policy structures from 2014 (Department of Environmental Affairs, 2014).



This paper provides an overview of the unique challenges faced by South Africa in transitioning to a low-carbon transport sector. It is based on findings from a scoping study conducted by the Energy and Economic Growth Applied Research Programme (EEG) in 2019 that aimed to identify priority challenges and research topics in South Africa related to low-carbon transport and electricity systems.

The next section presents the primary modes of transport that currently exist in South Africa, followed by Section 3, which presents alternative low-carbon transport options. Section 4 outlines South Africa's Green Transport Strategy. Section 5 presents the steps required to scale ambition to a low-carbon transport system, and Section 6 concludes.

2. Primary modes of transport in South Africa

2.1 Passenger transport

Private car ownership is a privilege available only to those in the highest income bracket in the country, yet private cars are some of the biggest emitters in the transport sector (World Wildlife Fund (WWF), 2016). According to Mokwena (2014), nearly half of people in the highest income quintile prefer a private or company vehicle over other forms of transport. In contrast, the remaining 80% of the population use private cars only 12% of the time, the majority opting to take taxis or to walk as an alternative. In contrast, public transport is utilised by only a small portion of each income bracket (Mokwena, 2014). These statistics are reflective of the significant income gap that exists between the wealthiest and poorest groups of people in South Africa. Owning a private car is also costly in terms of energy consumption, in that, on average, a private vehicle consumes five times more energy per-person than a minibus taxi (C. J. Venter and Mohammed, 2013). Venter and Mohammed (2013) conclude that 80% of energy consumption, amongst commuting vehicles, comes from 20% of the population.

Spatial planning policies from the apartheid era resulted in the forced displacement and disenfranchisement of targeted groups of people, leading to fragmented, inefficient, and often informal human settlements (Scorcia and Munoz-Raskin, 2019). Informal settlements are common, especially in developing countries where land use is generally less regulated, and consequentially modes of transport that service these settlements are also often informally established. India, which has an urban population eight times the population of South Africa, has a multitude of vehicle types operating as informal modes of public transport, ranging from three-passenger auto rickshaws to minibuses than can hold up to 20 passengers at a time (Kumar, Singh, Ghate, Pal, and Wilson, 2016). This is in contrast to South Africa, where the majority of informal public transport is provided by minibus taxis. Additionally, in India, informal public transport typically provides the first- and last-mile connectivity to formal transport modes. This level of integration between the formal and informal transport modes has not yet been achieved in South Africa's cities.

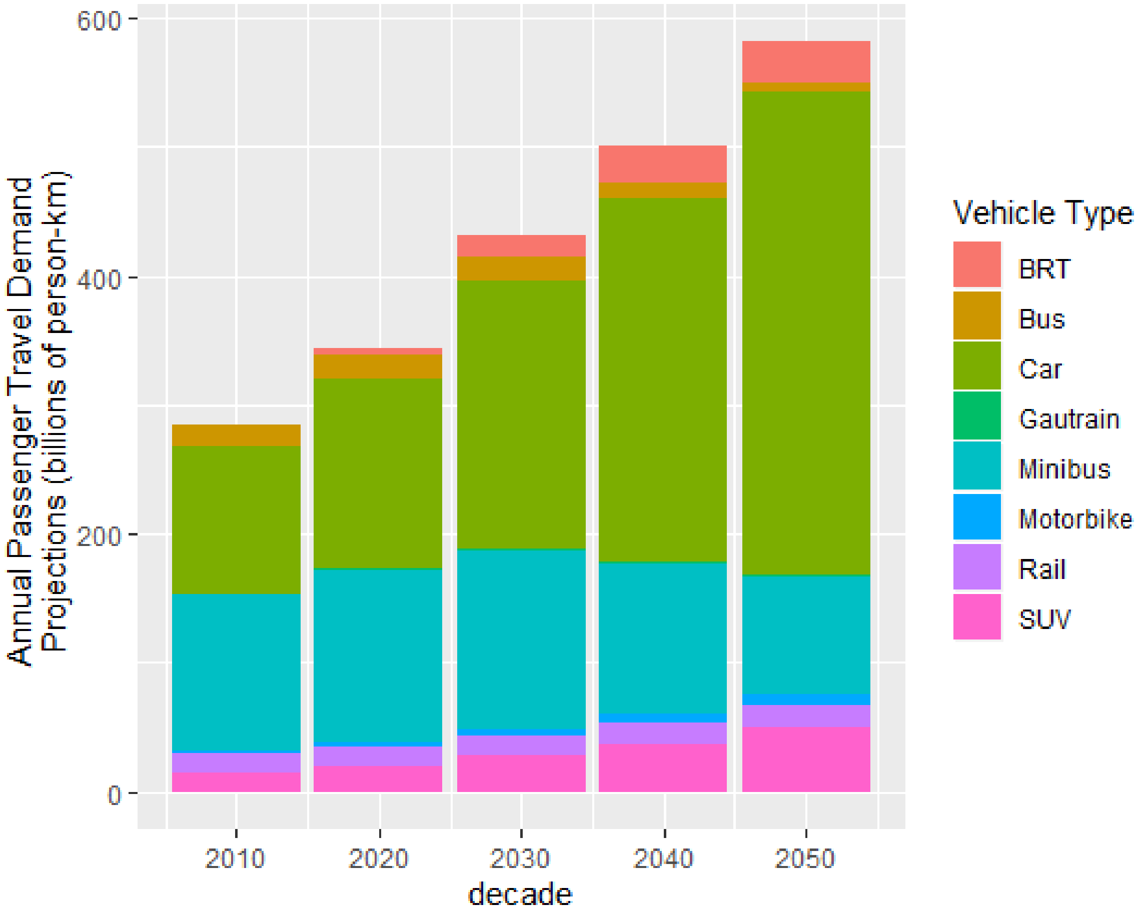
Many cities in Latin America have developed a network of roads intended to be used solely by buses (Scorcia and Munoz-Raskin, 2019), commonly referred to as the Bus Rapid Transit (BRT). Inspired by the BRT in Latin America, South Africa implemented similar measures across its major cities, but with limited success. The low utilisation of the BRT is mainly attributed to the low population density and sparsity of South Africa's cities, and the direct competition the BRT faces from the minibus taxis.

The minibus taxis industry rose to satisfy the demand for people living in South Africa's informal settlements, known as townships in South Africa, to commute to their place of work. The minibus taxis offer a door-to-door service, catering for the needs of people living in townships. Hence, minibus taxis are the most popular form of transport in the country, transporting up to 70% of the national workforce on a daily basis. Their large commuter base grants the minibus taxis industry an incredible degree of political strength, with an estimated value of South African Rand (ZAR) 16.5 billion (Chiloane-Tsoka, 2016). However, despite their political power, minibus taxis receive approximately 1% of direct public transport spending, through a scrap-and-replacement scheme for old taxis (Kerr, 2015). Additionally, the minibus taxis industry is largely fragmented between individual taxi associations, which have a long history of violent turf wars. The national government has attempted to intervene several times, including through recapitalisation schemes, first in 1999 and again in 2014; however, neither were successful (Chiloane-Tsoka, 2016; Sekhonyane and Dugard, 2004).

Going forward, it is expected that car ownership will continue to grow rapidly in South Africa. Car ownership is perceived as a symbol of social status by many South Africans (Mokwena, 2014). As the burgeoning middle class grows, the growth in the private vehicle market will continue to expand, contributing further to congestion in cities, which are already heavily congested.

Based on existing policies, passenger travel demand is expected to grow from roughly 350 billion person-kms in 2020 to nearly 600 billion person-kms in 2050, as shown in Figure 2 (Merven, Stone, Hughes, and Cohen, 2012). Figure 2 depicts expected passenger travel broken down by mode. By 2050, Merven, Stone, Hughes, and Cohen (2012) predict that over 60% of passenger travel will be by car, with a steady increase in SUVs. After cars, the second most common form of transport will be minibuses; however, post-2030 they expect the passenger demand for minibuses to decline. Other forms of public transport, such as the BRT, Gautrain, or rail occupy an increasing percentage of passenger travel demand given the current policy scenario. However, these modes of transport represent a far smaller share of the demand in comparison to private vehicles. Therefore, in order to reduce traffic congestion, policies that promote forms of public transport over private vehicles are essential.

Figure 2: Projections of annual passenger demand for different modes of transport in South Africa (Merven *et al*., 2012).

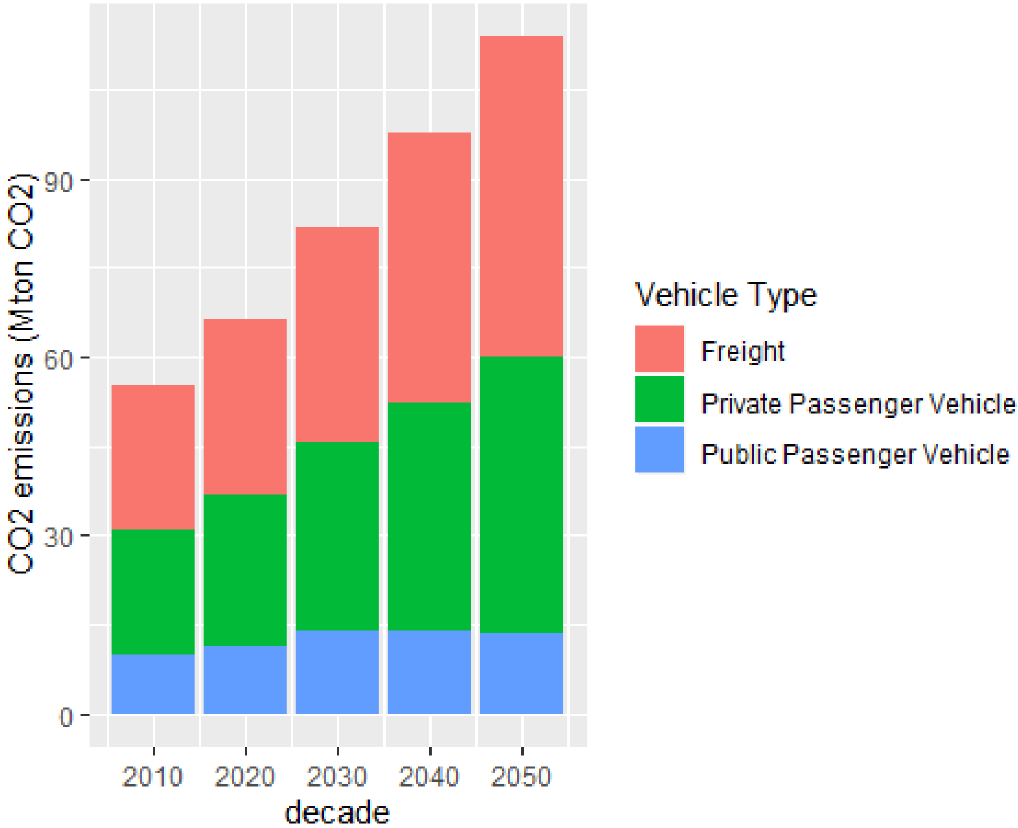


2.2 Freight

Unlike many other countries with a large coastline, South Africa's main industrial hub, Johannesburg, is located approximately 600 kilometres from the ocean, necessitating substantial volumes of long-distance overland freight. The majority of freight is transported via road. As a result, nearly half of South Africa's transport-related GHG emissions are attributable to freight (see Figure 3).

Merven, Stone, Hughes, and Cohen (2012) expect CO_2 emissions to double between 2010 and 2050, given the existing and planned policies, reaching over 110 $MtCO_2e$ in the final decade. Their predictions estimate that freight transport will contribute nearly 50% of all carbon emissions, consistently for each year, with private passenger vehicles following closely behind.

Figure 3: CO_2 emissions equivalent per private, public, and freight transport (Merven *et al*., 2012).



3. Alternative modes of low-carbon transport

3.1 Non-motorised transport

A number of non-governmental programmes have aimed to promote non-motorised transport in South Africa, such as cycling and walking. For example, Open Streets Cape Town (OSCT) is a non-governmental organisation focused on increasing sustainable urban mobility though regular activities including advocacy campaigns, interventions, street closures, and public dialogues (Robinson *et al*., 2018). OSCT has promoted investments in sidewalks, cycle lanes, dropped curbs. and bicycle storage, among other measures, to make commuting by walking or cycling easier and safer. Between 2011 and 2016, 32 projects were completed, with an additional 10 projects scheduled to completed by the end of 2020. OSCT notes that, as at 2017, 440 kilometres of cycle lanes had been built. Despite this progress, cycling remains uncommon in South Africa.

The Low-Carbon Passenger Transport Project (LCPT), funded by the WWF Nedbank Green Trust, also trialled a variety of interventions, with the aim of challenging the mind-set of commuters in major cities by getting them to think about how to reduce their carbon footprint by using alternative means of transport. The LCPT project focused on particular groups of commuters – those who travel to a place of learning or their place of work. For those travelling to school, scholars were encouraged to cycle or walk to work in groups, termed 'buses', under the supervision of parents, carers, or community volunteers. For those commuting to work, the WWF engaged with a variety of companies but found that many were not interested in participating in a low-carbon transport scheme. The LCPT project noted that the issue of the safety of public transport was a significant concern among commuters. This finding suggests that until the safety of commuters can be guaranteed, non-motorised transport will remain underutilised in South Africa.

3.2 Electric vehicles

Globally, the manufacturing of electric vehicles has increased dramatically in the past 10 years, with China dominating the market (Bullard, 2019). However, South Africa has been relatively slow in the uptake of electric vehicles, with only 1,000 electric vehicles in the country as at 2019. Cruz *et al*. (2011) note that the lack of electric vehicle pilot projects in South Africa is largely due to limited funding and government investment.

Electric vehicles have the potential to significantly reduce the carbon produced by the transport sector, provided South Africa's energy supply is decarbonised. A standard city car in South Africa produces an estimated 45 kg of CO_2 per 100 km (taking the carbon cost of fuel production into consideration as well). In comparison, an electric vehicle using electricity from the fossil fuel power stations currently in operation in the country produces 39 kg of CO_2 per 100 km (Cruz *et al*., 2011), a relatively insignificant difference. To achieve substantial emissions reductions through electric vehicles, it will be critical for South Africa to invest in renewable electricity in tandem with introducing electric vehicles for widespread public use.

There is significant concern amongst policymakers and the general public about the suitability of electric vehicles in the South African context. Many electric vehicles face significant drawbacks, including a limited range due to insufficient battery technology, higher upfront costs in comparison to similar cars due to the cost of the battery, an inconsistency in charger designs amongst car manufacturers, and the few and dispersed locations of charging stations throughout South Africa (Tyilo, 2019).

The lack of charging stations is being addressed by a number of different players:

- GridCars, an entrepreneurial company, has distributed over 200 electric charging stations across South Africa, connecting major cities including Cape Town, Johannesburg, and Durban.
- The Electric Vehicle Industry Association (EVIA) is a network of organisations and companies whose aim is to promote the future course of e-mobility in South Africa (SANEDI, 2017). Since its inception in 2016, EVIA has held a series of conferences and working groups on charging infrastructure, batteries and battery recycling, policy incentives, and vehicle systems, to name a few topics.
- The uYilo E-Mobility Programme was established in March 2013 to ready South Africa for the introduction of e-mobility by creating new business opportunities and the required infrastructure to support electric vehicles. The programme's focus is on the overall e-mobility ecosystem defined by renewable energy generation into smart grids, charging networks, local standardisation, battery technology, electric drive train components, and smart connectivity.

One option to kick-start the electric vehicle market domestically is to first target capture fleets to showcase the technology. For example, the City of Tshwane has committed to converting 40% of its bus fleet to electricity by 2020, and is in the process of installing charging stations throughout the city. In addition to this target, the City of Tshwane recently opened two publicly available, solar-powered electric vehicle charging stations. The electric vehicle charging stations were funded by the United Nations Industrial Development Organization (UNIDO) as part of the Low-Carbon Transport project (Low-Carbon Transport South Africa, 2019).

3.3. Alternative fuels: hydrogen fuel cells

Hydrogen fuel cells present an alternative mode of renewable transport for electric vehicles yet are relatively unexplored. They have significant potential to reduce GHG emissions within the transport sector, offering a viable alternative to electric vehicles. Currently, hydrogen fuel cell vehicles are limited to a small number of applications, including buses, trucks, and material-handling devices, such as forklifts. However, due to their long driving range they have the potential to revolutionise heavy vehicle transport in ways electric vehicles are struggling to do (Molloy, 2019). Despite these benefits, hydrogen fuel cell technology is underdeveloped and unproven on a large scale.

At the moment, the production of hydrogen fuel cells require a series of mineral resources, most notably platinum. Given that the largest platinum reserves are found within South Africa, this presents a potentially valuable source of revenue for the national government. To stimulate the hydrogen fuel cell manufacturing industry in South Africa, the Department of Science and Technology established Hydrogen South Africa (HySA) to engage and inform the public regarding hydrogen and fuel cell technologies. However, the Department is cautious regarding the domestic adoption and use of hydrogen fuel cell technologies in South Africa, taking the view that the country's role in the hydrogen fuel cell industry is to manufacture hydrogen fuel cell vehicles for export to overseas markets (Moumakwa, 2013). However, the role hydrogen fuel cell vehicles may fill within South Africa is yet to be seen, and further research is required in this area.

3.4 BRT and metro systems

Regardless of whether it is powered by fossil fuels or alternative energy sources, public transport can provide a lower-carbon alternative to cars by reducing the fuel consumed per passenger. In the last two decades, public transport systems in South Africa have improved significantly. The Rea Vaya BRT in Johannesburg, the first of its kind in South Africa, was inspired by the success of the system in various cities in Latin America. The Rea Vaya BRT is a bus transit system which utilises a dedicated and separate road network specially meant for buses, allowing buses to significantly reduce transit times between destinations. More recently, other cities in South Africa have adopted the BRT model, including Nelson Mandela Bay in 2010, Cape Town in 2011, Tshwane in 2014, George in 2015, Rustenburg in 2016, and Durban in 2018. Similarly, the Gautrain – a rapid electric rail network connecting Pretoria, Johannesburg, Sandton, and the Olivier Tambo International Airport, have reduced road congestion in major cities, created jobs, and cut carbon emissions significantly.

However, these public transport alternatives are not without their woes. According to Scorcia and Munoz-Raskin (2019), nearly 1,400 passengers use the Rea Vaya BRT per km of road used by the bus system. While this number may seem considerable, it is significantly less than its counterparts in South America, many of which achieve between 5,000 and 8,000 passengers per km. This difference can largely be attributed to the spatial planning legacies of the apartheid era. Cities in South Africa generally have a low population density, with the poorest communities located far from the economic centres. Commuters must travel long distances to get to work. This spatial pattern presents a challenge for the efficient operation of public transport systems. Not only must buses travel greater distances, at peak times there is also high utilisation in one direction and low utilisation in the other (C. Venter and Hayes, 2017).

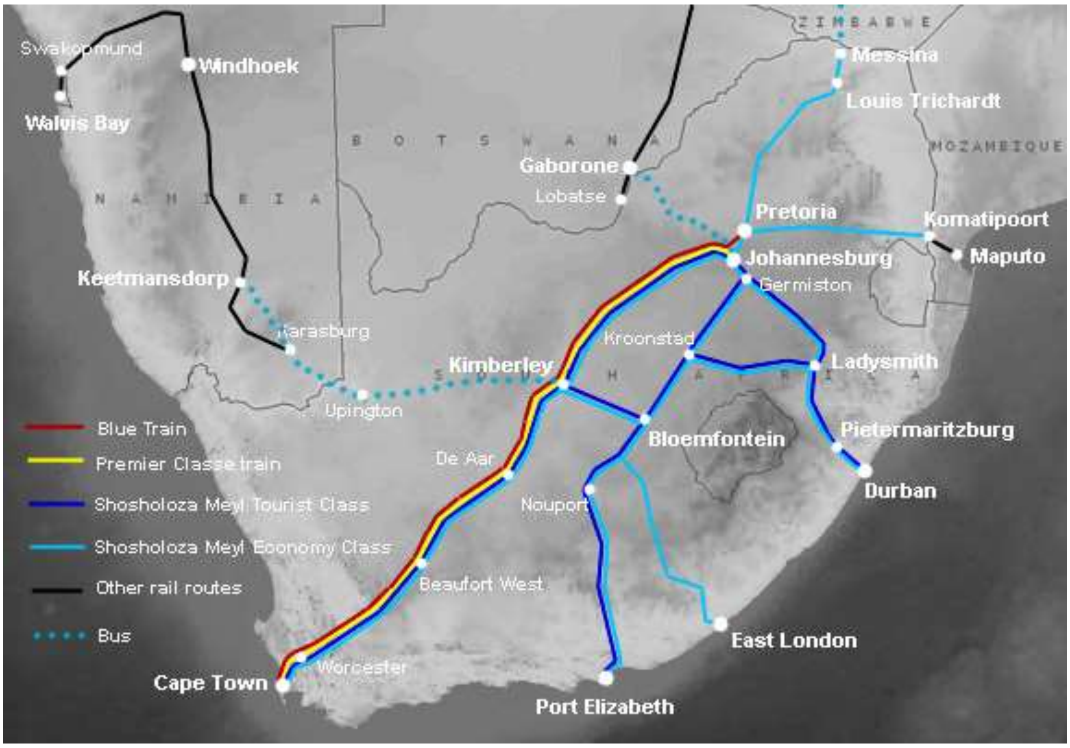
A second challenge, specific to South Africa, is the competition that public transport systems face from minibus taxis. Facing political pressure from taxi organisations, the national government was forced to push up costs relating to the Rea Vaya BRT (*ibid.*). To overcome this issue, researchers have urged government officials to formally integrate the minibus taxis and other transport systems into a single unified network. Although safety is a significant concern regarding public transport in South Africa (Berti, 2019), we found no indication that the BRT specifically was considered unsafe. However, safety concerns with regard to public transport systems as a whole are still significant in South Africa.

3.5 Inter-city rail systems

Passenger and freight rail also offer a significant reduction in carbon emissions, when compared with the competition, namely passenger and freight road transport. However, since the 1980s, the passenger rail system in South Africa has undergone a period of divestment, resulting in a decaying metro fleet (*ibid.*). In addition, vandalism and arson attacks targeting the fleets have caused an estimated ZAR 520 million in damages. These conditions have contributed to a worsening state of Cape Town's rail system, motivating passengers to find alternative ways to commute to work, favouring buses and taxis. The Passenger Rail Agency of South Africa (PRASA) has taken steps to address these issues, including establishing the Rail Enforcement Unit to tackle the issue of safety. However, it has been reported that measures taken by PRASA have only touched the surface of these problems.

As at October, 2019, a joint French–South Africa company, Gibela, had been contracted to replace South Africa's ageing passenger fleet. Its aim is to produce 600 modern commuter trains before 2030 in its manufacturing facility outside Johannesburg (Bailey and Scott, 2019). In addition, the national government has announced an investment of ZAR 900 billion by 2027 to improve the rail infrastructure, in an effort to boost domestic and regional trade. Figure 4 shows the national rail network, administered by PRASA, currently in use.

Figure 4: National passenger rail network (Lowe and Thompson, 2020)



As for freight rail, South Africa's freight rail was developed to support the growth of the mining sector and other heavy industries, in addition to large-scale agriculture and forestry (Price Waterhouse Coopers, 2012). However, similar to the passenger rail network, freight rail in South Africa is experiencing the effects of underinvestment since the 1980s. The average age of the fleet is 30 to 40 years, with a maximum life span being 46 years.

These problems offer an opportunity in terms of reducing carbon emissions. The Department of Environmental Affairs estimates that making the conversion from road freight to rail may reduce the national carbon budget by as much as 3 $MtCO_2e$ by 2050 (Department of Environmental Affairs, 2018). The improvement in emissions standards may be attributable to the fact that, unlike road transport, over 80% of railway infrastructure has been electrified (Lowe and Thompson, 2020). When sourced from renewable energy alternatives, rail transport has the potential for zero carbon emissions.

4. Green Transport Strategy

The Green Transport Strategy (Department of Transport, 2018) is the first national government policy aimed at reducing GHG emissions from the transport sector. The policy sets a long-term target of a 5% reduction of GHG emissions from the transport sector by 2050. It also sets out a series of short-term objectives to be implemented over the next five to seven years:

- a 30% modal shift from road to rail freight transport, and a 20% shift in passenger transport from private to public transport and non-motorised transport;
- convert 5% of public and national fleets to cleaner alternative fuels, such as CNG, biogas, biofuels, and renewable energy; and
- invest in green energy infrastructure, such as biogas filling stations, electric charging points, etc.

The Department of Transport plans to implement a series of policies to achieve the targets stated above, including the following:

- Congestion tax: Introducing a congestion charge on private vehicles that enter central business districts in cities. The Green Transport Strategy also notes the importance of supportive infrastructure, such as an integrated bus transit or bike scheme in combination with the congestion charge.

- Environmental levy: A review of the environmental levy on motor vehicles' GHG emissions, expanding the tax to include commercial vehicles.
- Licensing system: Introducing regulations for an annual vehicle tax based on the vehicle's estimated GHG emissions.
- Car life limits: Introducing limitations on the life of cars. This is expected to take a similar form to the taxi-recap system, in that a car with an engine that has more than 400,000 km should be either banned from driving or scrapped.
- Freight transport: Introducing regulations that ensure freight vehicles may only enter urban hubs in off-peak hours. Additional research into the viability of road freight permits, the price of which reflects the emissions per tonne cargo of freight vehicles, is also of interest to the Department of Transport.

5. Steps required to scale ambition towards a low-carbon transport system

To date, only a limited number of policies that aim to achieve the targets set out in the Green Transport Strategy have been implemented. This section provides an assessment of the policy interventions that have already been implemented in efforts to achieve the targets laid out in Green Transport Strategy, and propose a series of additional measures that are likely be required to transition South Africa to a low-carbon transport economy.

Fiscal measures alone are likely to be insufficient to promote a transition to low-carbon transport.

South Africa has mainly focused on fiscal instruments to promote low-carbon transport. Included in this list is a purchase tax on private passenger vehicles (introduced in 2010), and the addition of a carbon tax component to the fuel levy (introduced in 2019) (Averchenkova, Gannon, and Curran, 2019). As part of the Green Transport Strategy, the Department of Transport stated its intention to revise the vehicle emissions levy on new car sales (first introduced in 2010); however, the size of the new levy has not yet been specified.

The effectiveness of these fiscal measures in reducing GHG emissions, in isolation, is questionable. Averchenkova *et al.* (2019) argued that the carbon tax on fuel adds an additional cost that is so insignificant it is largely unnoticed by consumers. The purchase tax on private passenger vehicles has also been shown to be largely ineffective, as it only applies to a limited number of cars on the road and the estimated reduction in GHG emissions would be insignificant in relation to the growth in the vehicle market (Vosper and Mercure, 2016).

Curran (2019) argues that the carbon tax alone will not significantly reduce GHG emissions. To be effective, it must be introduced in combination with a variety of policies that, as well as disincentivising the use of GHG-intensive options, promote the uptake of low-carbon transport alternatives. Such policies could take the form of incentives to use public transport, electric vehicles (and the supporting network of charging stations), or non-motorised transport, or improvements to the rail network. In order to be politically viable, it may be prudent to focus these policies on the lowest socio-economic households and businesses, thereby enabling them to travel with little environmental impact.

Public transport solutions will be critical in ensuring that the Green Transport Strategy is politically viable and equitable.

According to the 2013 South Africa National Travel Survey, on average a black South African spends 102 minutes commuting each day (Kerr and Wittenberg, 2013). In comparison, a white South African's commute is typically at least 30 minutes shorter, and comparable to that of someone in the UK (BBC News, 2016). This discrepancy is an example of the lasting impact of the spatial planning laws enacted during the apartheid era, in that disenfranchised communities were forced to relocate to designated townships. A crucial step to decongest South Africa's cities is to make public transport accessible, affordable, and attractive for people living in the townships. The Green Transport Strategy recognises the importance of making public transport more accessible and affordable for all. However, details as to how, when, and what form this will take remain to be seen.

Currently, the public transport network and minibus taxis in South Africa operate on separate and uncoordinated schedules. The minibus taxi industry, which comprises a multitude of taxi associations across all the major cities, represent a fragmented and discordant mode of transport that is largely unregulated by the Government. In many cases, minibus drivers are unlicensed, drive an unsafe number of hours, and drive in reckless conditions. They have limited training, are often underpaid, and have no employment rights as their work is rarely formalised with a contract (Fourie, 2003). The minibus taxi industry's largest competitors are public transport, including the BRT and rail services. Public transport, on the other hand, experiences low rates of utilisation, as it is generally less convenient and accessible than minibus taxis.

Introducing regulations that formalise the minibus taxi industry would resolve these issues, allowing the taxi and public transport network to work cooperatively instead of competitively against each other. This would lead to an overall reduction in vehicle kilometres travelled, and consequentially a reduction in the GHG emissions from those vehicles. Fourie (2003) suggests such a system, where public transport such as rail or the BRT would form the 'backbone' of the network, with minibus taxis operating as feeders or distributors to and from the station. Formalisation of the minibus industry would also allow for a single, digital ticketing system that could be integrated across all services (Walters, 2014). However, taxi owners may only agree to formalise their operations if it is financially profitable for them, and so any legislation must take this into consideration.

The Green Transport Strategy aims to promote an integrated transport network across all major South African cities. However, no hard targets and no timeline have been set. Such a policy has not been successfully implemented before in South Africa, and would be fraught with many difficulties, most notably getting the support of the minibus industry. Relatively little is known about the potential benefits from integrated transport networks in South Africa, making it a potentially fruitful area for future research.

Further incentives to stimulate electric vehicle and charging infrastructure are required to stimulate uptake.

For electric vehicles to make a significant reduction to the national GHG budget the country must also transition to clean and renewable energy. Even with clean electricity, additional changes in legislation and in the public's perception of electric vehicles are required for South Africa to achieve widespread electric vehicle use. To encourage domestic manufacturing of electric vehicles, electric vehicles imported from foreign car manufacturers are taxed at a rate of 43% (Low-Carbon Transport South Africa, 2017). Since manufacturing electric vehicles within South Africa is in the earliest stages of development, there are few domestic electric vehicles available and owning one is impossible for the majority of the country's residents.

Amis, Montmasson-Clair, Lugogo, and Benson (2018) note the lack of incentives in South Africa to stimulate an increase in the uptake of electric vehicles or electrical charging infrastructure. It is estimated that, given the current policy environment in South Africa, electric vehicles sales (at best) may reach the projected levels for the 'rest of the world' forecasts (1% electric vehicle share of new car sales by 2020 and 40–50% share by 2040 (McKerracher, 2018)). Without substantial change, it is highly likely that internal combustion engines will remain the majority of new car sales in South Africa over the period 2035–2050.

Reinvesting in rail is required to promote cross-country mobility and to achieve a modal shift from road to rail freight transport.

Investing in inter-city passenger rail and freight rail infrastructure has the potential to significantly reduce GHG emissions while de-congesting South Africa's cities. However, both passenger and freight rail infrastructure across South Africa has experienced a period of underinvestment, beginning as early as the 1980s (Price Waterhouse Coopers, 2012). This limited investment in rail infrastructure is disappointing, as both passenger and freight rail offer significant reductions in GHG emissions compared to their road competitors.

Urban planning should promote the use of non-motorised transport within South Africa's cities.

The issue of car ownership in South Africa, the status symbol associated with it, and the sprawling nature of country's largest cities has contributed significantly to congestion and a car-dominated society. Additionally, the spatial planning policies of the apartheid era resulted in public spaces being out of reach for the majority of the population, as they would generally have to travel long distances to get to them. These factors, along with the car culture which dominates in South Africa, have also contributed to a lack of interest in, and under-utilisation of, many public spaces, leaving them unsafe for pedestrians or other non-vehicle road users, such as cyclists (Robinson *et al.*, 2018). These notions of access to and use of public spaces must be challenged in urban planning, which could include incorporating safe public spaces into all communities regardless of their socio-economic status, and promoting the use of non-motorised transport, e.g. cycling or walking. The benefits of establishing such spaces are not limited to improved public health (World Health Organization, 2016) but also include reducing congestion and reducing GHG emissions, due to fewer cars being on the roads (Albalate and Fageda, 2019; Wen, Kenworthy, Guo, and Marinova, 2019)

6. Conclusion

The Green Transport Strategy, along with other national policies, aims to reduce GHG emissions in the transport sector. However, the policies currently being implemented are incompatible with this vision, for it is expected that South Africa will continue to rely heavily on fossil fuels, especially in the case of the transport sector, up to 2050 (Hood, 2018).

The Green Transport Strategy has the vision of reducing GHG emissions within the transport industry by 5% by 2050. The strategy also sets short-term targets to be achieved in the next five to seven years. However, the Government lacks a clear set of policies, and a timeline in which to implement those policies, in order to achieve its 2050 vision. Without a comprehensive and detailed roadmap, the Government risks falling short of its targets, while at the same time spending public money on ineffective policies.

For South Africa to achieve its emissions reduction targets, the transport sector needs to move quickly. With a low adoption rate for electric vehicles (including a high dependence on coal for electric production), under-utilisation of the public transport network, and a long history of spatial planning policies that have made it impossible for most people to commute via non-motorised transport, there are multiple issues that need to be addressed. In a sector that is generally slow to change, due to a variety of factors (including infrastructure commitments, policy development, and changing people's behavioural choices), early actions are required to assist in the transition to a low-carbon future.

References

Albalate, D. and Fageda, X. (2019) 'Congestion, road safety, and the effectiveness of public policies in urban areas', *Sustainability* 11(18), pp. 1–21. https://doi.org/10.3390/su11185092

Amis, A., Montmasson-Clair, G., Lugogo, S., and Benson, E. (2018) 'The Green Economy Barometer 2018 South Africa', Green Economy Coalition, retrieved from www.greeneconomycoalition.org

Averchenkova, A., Gannon, K. and Curran, P. (2019) 'Governance of Climate Change Policy: A Case Study of South Africa', Grantham Research Institute.

Bailey, S. and Scott, E. (2019) 'The Train Company Rebuilding South Africa's Commuter Fleet', *CNN*, retrieved from https://edition.cnn.com/2019/10/07/business/gibela-trains-south-africa-intl/index.html

BBC News (2016) 'Two-hour Daily Commute "on Rise Among UK Workers"', *BBC News*, retrieved from www.bbc.co.uk/news/uk-38026625

Berti, A. (2019) 'Cape Town: Will the City Ever Rebuild its Railway?', retrieved from www.saferspaces.org.za/understand/entry/the-state-of-public-transport-in-south-africa

Bullard, N. (2019) 'Electric Vehicle Market So Far Belongs to China', *Bloomberg*, retrieved from www.bloomberg.com/opinion/articles/2019-09-20/electric-vehicle-market-so-far-belongs-to-china

Chiloane-Tsoka, G. E. (2016) 'Factors affecting the implementation of the Taxi Recapitalization Project: The Department of Transport', *Problems and Perspectives in Management* 14(4), pp. 25–32, https://doi.org/10.21511/ppm.14(4).2016.03

Cruz, R., Kuzwayo, S., Huizenga, C., Barrett, J., Valentyn, C., Eloff, B., ... Snyman, C. (2011) 'A Guide to Low-Carbon Transport', Republic of South Africa.

Department of Environmental Affairs (2014) *Mitigation Report: South Africa's Greenhouse Gas Mitigation Potential Analysis*, Department of Environmental Affairs, Republic of South Africa.

Department of Environmental Affairs (2018) 'Freight shift from road to rail', Department of Environmental Affairs, Republic of South Africa.

Department of Transport (2018) *Green Transport Strategy for South Africa (2018–2050)*, Department of Transport, Republic of South Africa.

Fourie, L. J. (2003) *Rethinking the Formalisation of the Minibus- Taxi Industry in South Africa*, University of Pretoria.

Hood, L. (2018) 'South Africa's new energy plan is imminent'.

Kerr, A. (2015) 'Commuting costs the poor dearly', *Mail and Guardian*, retrieved from https://mg.co.za/article/2015-11-15-commuting-costs-the-poor-dearly

Kerr, A., and Wittenberg, M. (2013) 'Southern Africa Labour and Development Research Unit Job Creation and Destruction in South Africa', *SALDRU, University of Cape Town* (92).

Kumar, M., Singh, S., Ghate, A. T., Pal, S. and Wilson, S. A. (2016) 'Informal public transport modes in India: A case study of five city regions', *IATSS Research* 39(2), pp. 102–109. https://doi.org/10.1016/j.iatssr.2016.01.001

Low-Carbon Transport South Africa (2017) 'Electric vehicle industry getting momentum in SA', Low-Carbon Transport South Africa.

Low-Carbon Transport South Africa (2019) 'UNIDO partners with the City of Tshwane to promote electric vehicles', Low-Carbon Transport South Africa.

Lowe, C. and Thompson, L. (2020) 'South Africa – Transportation and Telecommunications'.

McKerracher, C. (2018) 'Electric Vehicle Outlook 2018', *Bloomberg New Energy Finance* 12(1), p. 18, retrieved from https://about.bnef.com/electric-vehicle-outlook/

McSweeney, R. and Timperley, J. (2018) 'The Carbon Brief Profile: South Africa', *Carbon Brief*, retrieved from www.carbonbrief.org/the-carbon-brief-profile-south-africa

Merven, B., Stone, A., Hughes, A. and Cohen, B. (2012) 'Quantifying the energy needs of the transport sector for South Africa : A bottom-up model', Energy Research Centre, University of Cape Town.

Mokwena, O. H. (2014) 'Travel Demand Management for South African Cities: Managing Externalities'.

Molloy, P. (2019) 'Hydrogen Fuel Cell trucks can decarbonise heavy transport', *Energy Post*, retrieved from https://energypost.eu/hydrogen-fuel-cell-trucks-can-decarbonise-heavy-transport/

Moumakwa, D. (2013) 'Fuel Cells and the Future Role of South Africa Through Its Platinum Resources'.

Price Waterhouse Coopers (2012) *South Africa Logistics Industry Report*, retrieved from www.pwc.com/gx/en/transportation-logistics/publications/africa-infrastructure-investment/assets/south-africa.pdf

Robinson, B., Jokazi, S., Casas, M., Franceschi, M., Motala, M. and Williams, R. (2018) 'TUMI Initiative's Transforming Stories'. City Of Cape Town.

SANEDI (2017) 'Electric Vehicle Industry Association (EVIA)', SANEDI.

Scorcia, H., and Munoz-Raskin, R. (2019) 'Why South African cities are different? Comparing Johannesburg's Rea Vaya bus rapid transit system with its Latin American siblings', *Case Studies on Transport Policy* 7(2), pp. 395–403. https://doi.org/10.1016/j.cstp.2019.01.010

Sekhonyane, M. and Dugard, J. (2004) 'A violent legacy: The taxi industry and government at loggerheads', *South African Crime Quarterly* 10, pp. 13–18, https://doi.org/10.17159/2413-3108/2004/v0i10a1026

Tyilo, M. (2019) 'How geared up is South Africa for electric vehicles?', *Daily Maverick*.

Venter, C. and Hayes, G. (2017) 'South Africa needs to revamp its new public transport system', *The Conversation,* retrieved from https://theconversation.com/south-africa-needs-to-revamp-its-new-public-transport-system-84930

Venter, C. J. and Mohammed, S. O. (2013) 'Estimating car ownership and transport energy consumption: A disaggregate study in Nelson Mandela Bay', *Journal of the South African Institution of Civil Engineering* 55(1), pp. 2–10.

Vosper, S. J. and Mercure, J. F. (2016) 'Assessing the effectiveness of South Africa's emissions-based purchase tax for private passenger vehicles: A consumer choice modelling approach', *Journal of Energy in Southern Africa* 27(4), pp. 25–37. https://doi.org/10.17159/2413-3051/2016/v27i4a1436

Walters, J. (2014) 'Public transport policy implementation in South Africa: *Quo vadis*?' *Journal of Transport and Supply Chain Management* 8(1), pp. 1–10. https://doi.org/10.4102/jtscm.v8i1.134

Wen, L., Kenworthy, J., Guo, X. and Marinova, D. (2019) 'Solving Traffic Congestion through Street Renaissance: A Perspective from Dense Asian Cities', *Urban Science* 3(1), p. 18. https://doi.org/10.3390/urbansci3010018

World Health Organization (2016) 'WHO report shows urban green spaces deliver multiple health benefits', World Health Organization.

WWF (2016) 'Transport Emissions in South Africa', WWF South Africa.

About the authors

Nicholas Letchford is an Assistant Consultant with the Cross-Cutting Portfolio. He works on projects across a variety of sectors, most recently with Health, Nutrition, Poverty and Social Protection and EEG. Nicholas holds a DPhil (PhD) in Mathematics from the University of Oxford, where he used mathematical modelling techniques to investigate the processes of cavitation in lubricant films. He also holds an MSc in Health Technology Assessment from the University of Glasgow and undergraduate degrees in Mechanical Engineering and Mathematics from the University of Tasmania.

Ryan Hogarth is an OPM consultant, with expertise in energy access and renewable energy policy. Ryan helps coordinate EEG research activities to address pressing policy questions in Sub-Saharan Africa and South Asia's energy sectors. His previous experience includes work for the Overseas Development Institute, and for Oxford University's Smith School of Enterprise and the Environment, where he helped the Government of Rwanda develop a National Green Growth and Climate Resilience Strategy. Ryan holds a DPhil from the School of Geography and the Environment at the University of Oxford, and a MSc in Development Management from the London School of Economics and Political Science. He has researched and published on a wide variety of topics, including energy access, renewable energy policy, climate finance, low-carbon transitions, and financing low-carbon infrastructure.

Front cover image: imageBROKER / Alamy

The views expressed in this Energy Insight do not necessarily reflect the UK government's official policies.