

DEPARTMENT OF TRANSPORT

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Department:
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Draft Green Transport Strategy: (2017-2050)



DRAFT GREEN TRANSPORT STRATEGY



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List of Acronyms

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ACSA	Airports Company of South Africa
BRT System	Bus Rapid Transit System
CO ₂	Carbon dioxide
CH ₄	Methane
COP	Congress of Parties
CBG	Compressed Biogas
CNG	Compressed Natural Gas
DAFF	Department of Agriculture, Forestry and Fisheries
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DoE	Department of Energy
DoT	Department of Transport
DPE	Department of Public Enterprise
DTI	Department of Trade and Industry
EVs	Electric Vehicles
GDP	Gross Domestic Product
GHG	Green House Gas
GTS	Green Transport Strategy
ICAO	International Civil Aviation Organisation
IDC	Industrial Development Cooperation
IMO	International Maritime Organization
ITP	Integrated Transport Plan
IPTN	Integrated Public Transport Network
IPPC	Intergovernmental Panel on Climate Change
ktCO ₂ e	kilo tonnes of Carbon Dioxide equivalent

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LPG	Liquefied Petroleum Gas
MRV	Measurable Reportable Verification
NAMA	Nationally Appropriate Mitigation Actions
NATMAP	National Transport Master Plan
NCCC	National Climate Change Committee
NCCRP	White Paper on National Climate Change Response Policy
NCRS	National Credit Regulator
NDC	Nationally Determined Contributions
NDP	National Development Plan
NT	National Treasury
PRASA	Passenger Rail of South Africa
RAF	Road Accident Fund
RTIA	Road Traffic Infringement Agency
RTMC	Road Traffic Management Committee
SAA	South African Airways
SALGA	South African Local Government Association
SANRAL	South African National Road Agency
SAMSA	South African Maritime Authority
SANEDI	South African National Energy Development Institute
SANTACO	South African National Taxi Association
SUT	Sustainable Urban Transport
TSU	Technical Support Unit
UNFCCC	United Nations Framework Convention on Climate Change

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MINISTERS STATEMENT

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South Africa is committed to providing a world class transportation system that reduces both the cost of transportation, the quantity of Green House Gases (GHG) and other pollutants that are emitted by the sector.

Emission from the transport sector account for 10.8% of the country's total greenhouse gas emissions, with road transport being responsible for 91.2% of these GHG emissions (DEA, 2010). In 2010, the transport sector was responsible for 10.8 percent of energy related emissions. Should these trends continue in the absence of mitigating legislation and policies, the transport sector is projected to emit a total of 136 Gg CO₂ eq by the year 2050 (DEA/GIZ:

Mitigation Report, 2007).

Our determination to improve the environment for benefits of present and future generations of humankind in accordance with our Nationally Determined Contributions, committed to by our government in Paris will be the foundation that the GTS is based on. The Department of Transport is therefore committed to making a significant impact in reducing GHG emissions and contributing to the reduction of South Africa's total GHG emissions by committing to a 5% reduction of emission in the transport sector by 2050.

These targets are very ambitious and require bold steps to be taken, as stipulated in the Department's National Climate Change Response Flagship Implementation Programme. These steps will include shifting passengers from private transport to public transport and freight transport from road to rail; switching to cleaner fuels and adopting new technologies such as alternative energy vehicles while making our cities and towns friendlier places for cyclists and pedestrians. The transformations that are required in the transport sector are challenging, but the benefits include a more efficient, less congested road network and improved air quality and public health.

Joe Maswanganyi

Minister of Transport

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EXECUTIVE SUMMARY

Transport and the need for transport has become an integral part of the daily lives of South Africans. The movement of goods and services in time and space defines and influences, and is impacted upon by economic activity. Demands for transport shape the urban landscape, and influence the spatial choices that the citizenry makes in relation to social and economic services such as place of residence, education and work. Business, in similar ways, makes locational choices based on market proximity and size, as well as considerations for ease of temporal and spatial mobility of labour, goods and services. These choices contribute to the well-being of individuals, households and businesses, or lack thereof (National Household Travel Survey, 2013:1).

Emissions from the transport sector in South Africa account for 10.8% of the country's total GHG emissions, in addition to these direct emissions arising from the combustion of fuels, indirect emissions also arise from the production, refining and transport of transport fuels process. The Department of Transport is therefore committed to making a significant impact in reducing GHG emissions and contributing to the reduction of South Africa's total GHG emissions.

To address the significant contribution of transport to national GHG emissions, the Department of Transport (DoT) has undertaken to develop a Green Transport Strategy (GTS) which aims to minimise the adverse impact of transport on the environment while addressing current and future transport demands based on sustainable development principles. The strategy will promote green mobility to ensure that the transport sector supports the achievement of green economic growth targets, and protecting the environment.

The objectives of the GTS include:

1. Enabling the transport sector to contribute its fair share to the national effort to combat climate change in a balanced fashion, taking into account the DoT and the sector's primary responsibility of promoting the development of the efficient integrated transport systems to enable socio-economic development,
2. Promoting sustainable and cleaner mobility development; and
3. Engaging the low carbon transition of the sector, to assist with the aligning and developing policies which promote energy efficient and less carbon intensive mobility.
4. Facilitate the sector's just transition to a climate resilient and low carbon economy and society.

Road transport has been identified as the primary source of transport-related CO₂ emissions in South Africa, contributing to 91.2% of total transport GHG emissions. The heavy reliance of the sector on fossil fuels contributes significantly to total GHG emissions for the country. This justifies a focus on immediate and targeted interventions around road transport to result in the utmost impacts in the reduction of emissions in the transport sector as a whole. Therefore one of the main focuses of the implementation of the GTS will be to initiate immediate interventions in this sector to directly combat the emissions from this sector (GHG Inventory, 2014).

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An analysis of the incremental costs of mitigation actions indicates that significant long term finance and investment will be required, as well as supplementary work to prepare detailed business plans for finance and investment in transport-related mitigation (INDC, 2015). It is also important to recognise that mitigation actions taken within the transport sector will have significant co-benefits, such as improved access to employment opportunities for poor communities due to an improvements in public transport and public health benefits associated with improved air quality. Similarly, improvements in transport efficiency will have positive knock-on effects for all economic sectors that make use of transport.

The challenge of developing transport policies for sustainable development is to orient the sector towards a compromise that maximises the economic and social benefits of transport and minimises associated environmental, social and economic costs (Sustainable Transport policies, 2001: 17). Many of the measures required to achieve this balance are not new, the main difficulty is effective implementation and sufficient funding. The approach to achieving sustainable development of the transport sector requires a combination of regulatory instruments (particularly for vehicle emissions), restructuring of charges and taxes on the basis of marginal costs to provide incentives to reduce external costs to optimal levels, infrastructure development, as well as education and awareness to drive behavioural change. It will require improvement of the quality of transport, especially rail services (ensuring reliability and complete logistic services) and promotion of inter-modal services to achieve an integrated transit system.

Introducing change for the transport sector will be a challenging and costly exercise, especially when it comes to innovative industries or sectors where long-term investments needs to be made such in order to move the transport sector to becoming low carbon intensive. While the government can set appropriate policies, it is ultimately up to the private sector to buy into the large-scale uptake of green transport. As such, the policy framework as set by government should be supported by various drivers, enablers and barriers as perceived by the private sector. In practice, green transport enablers, barriers and drivers are typically placed in the context of social, economic and environmental impact.

In terms of the social impact, the need to increase sustainable mobility and counter the spatial disconnect from market and jobs for less privileged groups is especially urgent. When it comes to the environment, reducing air pollution, particularly in an urban context, is a direct short-term need, in addition to combatting climate change in the long run. Lastly, and in the context of a developing economy even more importantly, the economic proposition of green sustainable transport is a central factor to make green options commercially attractive towards the future.

South Africa is also fully committed to cooperative efforts to adapt to unavoidable adverse impacts of climate change, by committing to the core principles of International Conventions, such as the UNFCCC, and other Conventions especially the Chicago Convention for Aviation, and the IMO Convention for Maritime Transport.

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With further global negotiations, and entering into force of the “the Paris Agreement” the Department is committed to implementing the principles below to assist with combating the effects of global climate change:

- a) “Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.
- b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and
- c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.”

The global community has taken decisive action in addressing the effects of climate change, by aiming to reach “global peaking of greenhouse gas emissions as soon as possible”. The Paris Agreement has been described as both an incentive and a driver for fossil fuel divestment.

According to South Africa’s Greenhouse Gas Mitigation Potential Analysis Mitigation Report (2014), a range of potential mitigation measures have been identified for implementation within the transport sector to deliver emissions reductions and contribute towards South Africa’s GHG reduction targets by 2050.

The list of mitigation opportunities were categorised as follows:

- Implementation of the “Modal shift” notion;
- Demand reduction measures (*i.e. banking carbon taxes to fund e-mobility*);
- More efficient vehicle technologies (*Involve Internet of Things*);
- More efficient operations; and
- Alternative lower-carbon fuels

The GTS subsequently seeks to address and limit the negative environmental impacts of the transport sector in South Africa, by providing a clear and distinct route of environmental policy directives and a mapping of climate change initiatives for the sector that includes joint ventures with other spheres of government and the private sector.



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1. PROBLEM STATEMENT

Decarbonizing transport is a major challenge, as it is the one of the major sectors where emissions today are well above their 1990 levels, and continue to be on steady increase with around 33% over the same period. They have started falling only recently due to high oil prices and improved vehicle efficiency. More than two thirds of transport-related greenhouse gas emissions are from road transport. Emissions from the transport sector in South Africa account for 10.8% of the country's total greenhouse gas (GHG) emissions. This places the transport sector second only to the energy sector in terms of emissions volume. These figures represent direct emissions only, principally comprised of tailpipe emissions. If indirect GHG emissions associated with the transport sector were to be included, such as GHG emissions associated with fuel refineries and electricity generation for transport, these figures would be substantially higher.

GHG emissions and Climate Change

The overwhelming consensus of scientific opinion, as reflected in the Intergovernmental Panel on the Climate Change, is that climate change in the form of global warming is real and driven by emissions of greenhouse gases caused by human activity. The single most important GHG is carbon dioxide (CO₂) and the single most problematic GHG source is CO₂ emissions which majorly emitted from the production and consumption of fossil fuels.

Mitigating the extent and managing the impact of climate change is a global priority. As a water scarce country, South Africa is particularly vulnerable to the risks of increased average temperatures, drought and rainfall variability associated with global warming. At the same time, as a developing country with a historical dependence on its extensive coal deposits for energy, South Africa faces particular challenges in reorienting to a low carbon economy.

Transport activity levels are strongly related to socio-economic drivers, in particular growth in population and GDP – effective and accessible transport is an important enabling factor for economic growth. These drivers, in turn, influence social factors such as levels of vehicle ownership and the nature and frequency of journeys made (Mitigation Report, 2014). Research shows that car ownership and the demand for transport are increasing steadily in South Africa (GIZ, 2015).

Transport is also critical factor in urban spatial planning and the historical focus on the provision and maintenance of infrastructure to support the private car has led to unsustainable and inequitable outcomes. The spatial footprint of the private car is many times greater than that of public or non-motorised transport and results in the inefficient allocation of scarce urban space. The sector has also had to confront the legacy of apartheid spatial planning which has resulted in fragmented, unequal and

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inefficient transport systems that require the poor to commute long distances to reach their place of work. These travel patterns have a substantial impact on air quality and climate change. Interventions to transform the transport sector should therefore include reducing movement of goods and people; shifting to low-carbon modes of transport and improving energy and fuel efficiency.

As a result of continued growth within the sector, transport is likely to have an increasing impact on land resources, water quality, air quality and biodiversity. In urban centers transport is a major contributor to air quality issues and emissions include nitrous oxides and particulates, which contribute to the brown haze evident over many of South Africa's main cities. These pollutants have a significant impact on human health, causing increases risks of respiratory diseases, heart disease, lung cancer, and low birth weight (amongst others) – with children and the elderly particularly vulnerable – and burden the health care system with substantial medical costs.

Sustainable transportation is essentially the capacity to support the mobility needs of people, freight and information in a manner that is least damageable to the environment.

Sustainable development applied to transport systems requires the promotion of linkages between environmental protection, economic efficiency and social progress. Under the environmental dimension, the objective consists of understanding the reciprocal influences of the physical environment and the practices of the industry and all aspects of the transport industry address those environmental issues. Under the economic dimension, the objective consists of orienting progress in the sense of economic efficiency. Transport must therefore be cost-effective and capable of adapting to changing demands. Under the social dimension, the objective consists of upgrading standards of living and quality of life.

According to UNEP (2011), Green transport is hereby defined as one that supports **environmental** sustainability through e.g. the protection of the global climate, ecosystems, public health and natural resources. It also supports the other pillars of sustainable development, namely **economic** (affordable, fair and efficient transport that supports a sustainable competitive economy as well as balanced regional development and the creation of decent jobs) and **social** (e.g. allowing the basic access and development needs of individuals, companies and society to be met safely and in a manner consistent with human and ecosystem health, and promoting poverty reduction, equality and equity within and between successive generations) .

DoT is thus coming up with a strategy/implementation plan (the Green Transport Strategy) that will ensure that the South African transport sector begins to initiate transformational changes in thinking, policy, technology and investment, through a step-by-step approach. South Africa's transport sector will incrementally move to instituting efficient fuels, vehicle emission controls, sector related technology innovation, exploration of alternative energy sources, and gradually eliminates or minimizes the use of fossil-energy over time.

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1.1 Policy and Legislative Mandate

The mandate of the Department of Transport is

- to lead the development of **integrated efficient transport systems by creating a framework of sustainable policies, regulations and implementable models to support government strategies for economic, social and international development.**
- to **maximize the contribution of transport to the economic and social development goals of our country by providing fully integrated transport operations and infrastructure.**

The transport sector, especially in the context of environmental sustainability, is informed by a number of national policies, strategies and legislation, as well as international agreements to which South Africa is a signatory. Of particular importance in relation to the GTS is the National Climate Change Response Policy, which mandates the DoT to lead a Transport Flagship Programme:

“As part of the Transport Flagship Programme, the Department of Transport will facilitate the development of an enhanced public transport programme to promote lower-carbon mobility in five metros and in ten smaller cities and create an Efficient Vehicles Programme with interventions that result in measurable improvements in the average efficiency of the South African vehicle fleet by 2020.

Furthermore, the planned rail re-capitalisation programme is considered an important component of this Flagship Programme in so far as it will facilitate both passenger modal shifts and the shift of freight from road to rail.

Initially led by the Department of Transport, the programme will also include a Government Vehicle Efficiency Programme that will measurably improve the efficiency of the government vehicle fleet by 2020. It will encourage new efficient-vehicle technologies, such as electric vehicles, by setting procurement objectives for acquiring such vehicles.”

1.1.1 International Agreements and Conventions

Climate change, linked with energy consumption and security of supply of fuel, is considered one of the most serious and pressing threats to sustainable development, with adverse impacts expected on human health, food security, economic activity, natural resources, physical infrastructure and the environment. The international political response to climate change began with the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. Accordingly South Africa has committed to take concrete measures to mitigate climate change, through economy-wide measures that include the transport sector.

In 2009, South Africa pledged a greenhouse gas (GHG) emissions reduction target of 34% by 2020 and 42% by 2025 below the business as usual trend. This target has been carried through in the White Paper on National Climate Change Response Policy and the National Development Plan. In line with this pledge, South Africa's Nationally Determined Contribution (NDC) commits the country to limiting its



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GHG emissions to peak at a range between 398 and 614 Mt CO₂eq over the period 2025-2030. This pledge is ambitious and will require a concerted effort to achieve, and is dependent on the financial, technical and capacity support from the international community.

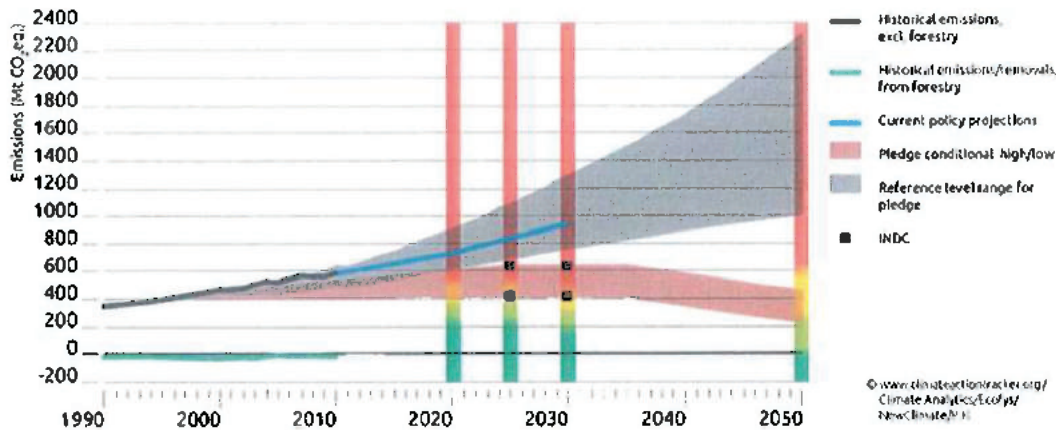


Figure 1: Analysis of South Africa's pledge to emission reduction targets based on the Department of Environmental Affairs figures for historical and projected GHG emissions

As can be seen from the above graphical representation of the Department of Environmental Affairs (DEA), the projections for GHG emissions based on existing measures, without new measures to curb GHG emissions South Africa will significantly exceed the emissions targets outlined in our NDC.

South Africa's Nationally Determined Contributions also includes the following estimates of incremental costs associated with mitigation actions in the transport sector in order to achieve the specified targets:

- Electric vehicles - US\$513 billion from 2010 till 2050.
- Hybrid electric vehicles: 20% by 2030 - US\$488 billion.
- Advanced bio-energy within transportation.
- Investment in public transport infrastructure

SECRET**1.1.2 Overview of National Policies**

The overview of the National Policies focuses on outlining the current policy and regulatory framework in the country that forms as a legislative foundation for the development of the GTS.

CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA: (The Constitution Act 108 of 1996)

Section 24 of the Constitution of the Republic of South Africa states that:

“Everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development.”

THE WHITE PAPER ON NATIONAL TRANSPORT, 1996

The National Transport Policy states the vision for the South African transport sector is a system which will “Provide safe, reliable, effective, efficient, and fully integrated transport operations and infrastructure which will best meet the needs of freight and passenger customers at improving levels of service and cost in a fashion which supports government strategies for economic and social development whilst being environmentally and economically sustainable”.

WHITE PAPER ON ENERGY POLICY, 1998

The White Paper on Energy Policy sets out five policy objectives: increasing access to affordable energy services; improving energy governance; stimulating economic development; managing energy-related environmental and health impacts; and securing supply through diversity.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT 107 OF 1998 (NEMA)

The National Environmental Management Act (NEMA) seeks to promote the protection of the environment and its resources for the benefit of present and future generations through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development as stated in Section 24 of the Constitution.

THE NATIONAL FREIGHT LOGISTICS STRATEGY, 2005

The National Freight Logistics Strategy sets the strategic framework for institutional reform and industrial structuring to ensure a more efficient freight system allowing improved system access to marginalized service providers and cargo owners, while applying downward pressure on prices and transit times.

SOUTH AFRICA’S LONG TERM MITIGATION SCENARIOS (LTMS), 2007

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The Long Term Mitigation Scenarios (LTMS) process took place in South Africa between 2005 and 2008. This was a Cabinet-mandated process led by the Department of Environmental Affairs and Tourism. The LTMS arose out of the realisation that South Africa would need to contribute its fair share to mitigation.

PUBLIC TRANSPORT STRATEGY, 2007

The Public Transport Strategy has two key focus areas, namely Accelerated Modal Upgrading and Integrated Rapid Public Transport Networks. The Public Transport Strategy is a key driver of other strategies developed within the transport sector.

NATIONAL LAND TRANSPORT ACT, 2009

The National Land Transport Act prescribes that any measures relating to public transport must promote the efficient use of energy resources and limit adverse environmental impacts in relation to land transport.

WHITE PAPER ON NATIONAL CLIMATE CHANGE RESPONSE POLICY, 2011

The National Climate Change Response Policy (NCCRP) White Paper presents the South African Government's vision for an effective climate change response and the long-term, just transition to a climate-resilient and low-carbon economy and society. The NCCRP also outlines a National Climate Change Response Flagship Programme for the transport sector.

NATIONAL STRATEGY FOR SUSTAINABLE DEVELOPMENT AND ACTION PLAN (NSSD 1) 2011–2014

One of the key implementation plans towards a green economy focuses on "Sustainable transport and infrastructure". The aim of this intervention is to reduce the transport sector's carbon footprint.

THE SPATIAL PLANNING AND LAND USE MANAGEMENT ACT 16 OF 2013 (SPLUMA)

SPLUMA provides a new framework to govern planning permissions and approvals. It sets parameters for new development and lawful land uses in South Africa. SPLUMA is a framework law, which means that the law stipulates processes and provides broad principles spatial planning decisions by local and provincial authorities.

NATIONAL DEVELOPMENT PLAN VISION 2030

The National Development Plan emphasizes that by 2030 investments in the transport sector will ensure that it serves as a key driver in empowering South Africa and its people by enabling and improving the access to economic opportunities, social spaces and services, by bringing geographic distances closer in an affordable, reliable and safe manner.

PETROLEUM PIPELINES ACT

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The Act aims to promote the efficient, sustainable and orderly development, operation and use of petroleum pipelines, loading and storage facilities. Also, the Act aims to facilitate investment in the petroleum pipelines industry, provide for the security of pipelines and related infrastructure as well as promote companies in the petroleum pipeline industry that are owned or controlled by historically disadvantaged South Africans (DTI, 2016).

PETROLEUM PRODUCTS AMENDMENT ACT

The objectives of the Act are to govern the production, transporting and trading in petroleum products. The government can limit the number of licenses allocated. The Act prohibits manufacturers and wholesalers from holding a retail license except for training purposes. Also, it aims to facilitate transformation of the South Africa's petroleum and liquid fuels industry, ensure system for allocation of licenses, prescribe offences and penalties, and provide for appeal and arbitration as well as annexure the liquid fuels charter (DTI, 2016).

REGULATION REGARDING PETROLEUM PRODUCTS WHOLESALE LICENCES

The regulations define "petroleum products" as being "aviation gasoline, biofuels, diesel, jet fuel, liquefied petroleum gas, paraffin and petrol" (DTI, 2016).

REGULATION ON PETROLEUM PRODUCTS SITE AND RETAIL LICENCES

The regulations define "petroleum products" as being "liquefied petroleum gas used for the propulsion of vehicles, petrol and diesel". In this regard, it is persuasive that the saving Regulations define "petrol" as being "any mixture of petrol with any other product, which can be used as fuel for the operation of a spark ignition engine" (DTI, 2016).

REGULATION REGARDING PETROLEUM PRODUCTS MANUFACTURING LICENCES

The regulations define "biofuel" as being "a biodegradable and renewable petroleum product or petroleum product component extracted from vegetable matter" and a "manufacturing facility" as being "plant or equipment that is used to manufacture petroleum products"(DTI, 2016).

REGULATION REGARDING PETROLEUM PRODUCTS SPECIFICATIONS AND STANDARDS

The aim of the regulation is to recommend the tightening of fuel specifications by further reducing the levels of Sulphur in both petrol and diesel as well as the reduction of benzene and aromatic levels in petrol to levels equivalent to Euro 5 emissions standard (DTI, 2016).

DEFINITION OF GAS FOR TRANSPORT

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The aim of the Act is to promote the orderly development of the piped gas industry, establish a national regulatory framework and establish a National Gas Regulator as the custodian and enforcer of the national regulatory framework (DTI, 2016).

INJECTION OF BIOGAS (I.E. BIOMETHANE) INTO THE GAS PIPELINE NETWORK (I.E. WHEELING)

Currently, there are no examples of biogas projects that have connected to the gas grid. Although NERSA has been mandated with this task, no specific regulations have been developed yet to facilitate the opening of the few long-distance pipelines and urban fine grids in Gauteng (DTI, 2016).

FUEL ECONOMY AND CO₂-LABELLING

The government specifies mandatory labelling for new passenger cars, indicating fuel economy (l/100km) and CO₂ emissions in (g/km) of the type of vehicle per a certain predetermined format (DTI, 2016).

PROCUREMENT RULES FOR LOCAL CONTENT IN THE BUS SECTOR

Preferential Procurement Regulations prescribe a 70% and 80% locally-made content of the bus body for, respectively, city and commuter busses (DTI, 2016).

CLASSIFICATION AND REGISTRATION

The government has in place several requirements for fuel and vehicle classifications and registration (DTI, 2016).

AIR QUALITY STANDARDS

The Act aims to protect and enhance the air quality in South Africa, prevent air pollution and ecological degradation and secure ecologically sustainable development while striking a justifiable balance between economic, social and environmental development (DTI, 2016).

TRANSPORTATION OF DANGEROUS GOODS

The transport of dangerous goods is regulated by the national standard SANS, which legislates the design, construction, testing, approval and maintenance of road vehicles and portable tanks. SANS complies with the latest edition of the ADR, which is the European Agreement concerning the international carriage of dangerous goods by road. The ADR stipulates that a spark-ignition engine shall not be used for transportation of such goods (DTI, 2016).

RESALE OF ELECTRICITY FOR EV USE

The resale of electricity in the SA electricity supply industry (ESI) is a growing business. The Electricity Regulation Act, 2006 makes provision for the licensing of generation, transmission, distribution, export or import and trading activities with regard to electricity by the Energy Regulator. Electricity resale falls under trading activities, which need to be licenced (e.g. municipalities) or registered (e.g. high density

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housing complexes, shopping malls or commercial property). Several requirements apply, including with regard to mark-up on cost (DTI, 2016).

BIOFUELS REGULATORY FRAMEWORK

The Biofuels Regulatory Framework provides for mandatory blending requirements for petrol and diesel of between 2-10% v/v bioethanol and 5% v/v biodiesel. The legislation has been gazetted with the operation date to be determined by the Minister. It is uncertain if the regulation will be implemented, with the result that the private sector currently is largely unwilling to invest in the production of biofuels to generate cleaner fuels (DTI, 2016).

GOVERNMENT EV PROCUREMENT POLICY

The Electric Vehicle Industry Road Map plans to introduce a policy to ensure that 5% of total annual fleet requirements by both the State and State Owned Enterprises comprise of EVs, increasing by 5% thereafter until 2020 (DTI, 2016).

NATIONAL TRANSPORT MASTER PLAN, 2016

The National Transport Master Plan (NATMAP 2050) aims to achieve an integrated, smart and efficient transport system supporting a thriving economy that promotes sustainable economic growth, supports a healthier life style, provides safe and accessible mobility options, socially includes all communities and preserves the environment. Of particular relevance and important to the Green Transport Strategy is Strategic Pillar 7 " Preservation of the environment" linked to its Chapter 9 of the NATMAP Report.

The objective of the NATMAP, of particular to environment is to protect the environment by:

- Reducing greenhouse gases and other emissions;
- Minimising transport's impact on the environment;
- Reducing traffic congestion; and
- Minimising environmental impact through promoting public passenger transport, choosing optimal transport modes, using low-carbon-emitting energy sources and renewable energy resources.

THE INDUSTRIAL POLICY ACTION PLAN/S (IPAPS)

The IPAP is informed by the vision set out for South Africa's development provided by the National Development Plan (NDP). The overriding goal of the IPAP is to prevent industrial decline and support the growth and diversification of South Africa's manufacturing sector.

1.2 Approach

The approach used to develop the Green Transport Strategy included both primary and secondary research. Primary research included gathering and collating information and input from an Expert

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Reference Group and inter-governmental stakeholder workshops. Secondary research consisted of desktop research involving both national and international literature reviews has been conducted.

The overarching approach has been to identify a short term draft of GHG mitigation interventions that are most cost effective, practical, and deliver the best social and economic returns, based on a survey of international best practice and domestic research, including South Africa's Greenhouse Gas Mitigation Potential Analysis (the Mitigation Report) undertaken by the Department of Environmental Affairs. In particular, Appendix E of the Mitigation Report contains detailed estimates of the impact and costs of a range of potential mitigation measures in the transport sector.

All interventions or measures identified in the strategy have been designed to be:

- **Specific** – the scope of the proposed activities should be clear.
- **Measurable** – the benefits and outcomes of the proposed activities should be quantifiable.
- **Achievable and Realistic** – given the practical constraints of capacity, available technology and resources.
- **Timely** – the proposed interventions must provide measurable outcomes with a specified time frame.

The Department's approach has been informed by the need to avoid the overinvestment of resources in technologies that are likely to be redundant in a future low carbon economy and the need to plan for the potential of new technologies that may result in disruptive, transformative change.

2. TRANSPORT RELATED ENVIRONMENTAL TAXATION AND FISCAL POLICY INSTRUMENTS

Petrol, diesel and biodiesel are classified as fuel levy goods in terms of the Customs and Excise Act, No. 91 of 1964, and are therefore subject to fuel taxes and levies, but are zero rated for VAT purposes. The general fuel levy is determined by the Minister of Finance in the annual budget (Budget tax, 2006). It is used to finance general government expenditure programmes. The Road Accident Fund Levy is an earmarked tax used to compensate victims of motor vehicle accidents (NT, 2017). The Equalisation Fund Levy is an earmarked levy primarily used as a mechanism to smooth retail fuel prices in times of significant price shocks. The Customs and Excise levy is imposed as a source of funding for the member countries of the South African Customs Union (SACU).

2.1 Fuel Taxation

The current fuel tax regime in South Africa applies to petrol, diesel and biodiesel based on volume (per litre) to help achieve various policy objectives. Petrol, diesel and biodiesel are classified as fuel levy goods and zero-rated for value added tax (VAT) purposes.

The current fuel taxes imposed include the fuel levy (FL), the Road Accident Fund (RAF) levy, and the customs and excise levy (C&E) which is collected in terms of an agreement by the Southern African

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Customs Union (SACU). These taxes seek to achieve both revenue raising objectives (for general government expenditures and to compensate victims of vehicle accidents) and environmental objectives by ensuring that the negative environmental externalities associated with fossil fuel use are incorporated into fuel prices (NT, 2017).

2.2 Carbon taxation

Government has proposed the carbon tax policy as a key mitigation instrument in South Africa's broader climate change policy response to internalise the negative externality costs of GHG emissions (NT, 2017). The introduction of a carbon price will change the relative prices of goods and services, making emission-intensive goods more expensive relative to those that are less emissions-intensive (Carbon tax, 2016). A carbon tax seeks to level the playing field between carbon intensive (fossil fuel based firms) and low carbon emitting sectors (renewable energy and energy efficient technologies) and provides an incentive for consumers and businesses to adjust their behaviour, resulting in a reduction of emissions. GHG emissions arising from transport fuels will be covered by the carbon tax regime and incorporated into the current fuel tax regime as an add-on.

The design of the carbon tax aims to contribute to a meaningful and permanent reduction in greenhouse emissions whilst, at the same time, to minimise any potential adverse impacts on low income households and industrial competitiveness. The provision of tax-free emissions thresholds and allowances ranging from 60 per cent to 95 per cent will result in a relatively modest carbon tax rate ranging from R6 to R48/tonCO_{2eq} during the first phase of the carbon tax up to the end of 2020 (Carbon tax, 2016). The carbon tax in the case of GHG emissions from the use of petrol and diesel will be an add-on to the current fuel tax regime. The proposed carbon tax will result in a higher effective tax on diesel than on petrol due to the higher carbon intensity of diesel fuel relative to petrol. Fuels used by the international aviation and international maritime sectors will initially be excluded from the carbon tax as these are covered by international agreements. Greenhouse Gas resulting from the use of such fuels will be priced in terms of the international agreements that are currently being developed. It is proposed that domestic aviation will be subject to the domestic carbon-related fuel taxation taking into account climate policies proposed under the ICAO.

South Africa has a number of environmentally-related taxes already in place (see Table 1). Together, these tax instruments account for approximately 2 per cent of GDP and just under 10 per cent of total tax revenue. Environmentally-related tax revenue trends are heavily influenced by the general fuel levy, which accounts for over 70 per cent of the revenue collected from this group of instruments.

Table 1: Overview of environmentally related taxes and charges in South Africa

SECTOR	LEVY (Charge)	LEVEL	APPLICATION	TAX RATE
Transport Fuels	General Fuel Levy	National	Petrol Diesel Biodiesel	167.5 cent per litre 152.5 cent per litre 72 cent per litre
	Road Accident Fund Levy	National	Petrol, Diesel, Biodiesel	72 cent per litre

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	Equalisation Fund	National	Petrol, Diesel, Biodiesel	Currently zero
	Custom and Excise Levy	National	Petrol, Diesel, Biodiesel	4 cent per litre
Vehicle Taxation	Ad Valorem Custom & Excise Duty	National	All passenger and light commercial vehicles	Graduated rate based on the vehicle price with an upper ceiling of 20 per cent
	Specify Tax on CO ₂ Emissions of New Passenger Motor Vehicles	National	All new passenger Vehicles	R75 gCO ₂ /km effective from 1 September 2010
	Road Licensing Fees	Provincial	All registered vehicles	Fees vary between different provinces-usually based on weight
Aviation Taxes	Aviation Fuel Levy	National	Aviation fuel sales	1.5 cent per litre on all fuel sales excluding foreign operators
	Airport Charges	National	Landing, parking and passenger service charge	Charges imposed to fund the operation of South Africa Civil Aviation Authority (SACAA)
	Air Passenger departure tax	National	International travel from SA	R150 per passenger R80 per passenger BLNS Countries

Source: EFR Policy: National Treasury: 2010

Since the majority of existing environmentally-related taxes were introduced with the primary intention of raising revenue, there exists the potential to improve the environmental outcomes and behavioural incentives created by these instruments. From a fiscal point of view, the idea of using environmentally-related taxes as part of a tax shifting exercise also needs to be explored.

2.3 Vehicle taxation

Value added tax (VAT) is imposed on all motor vehicle sales and an *ad valorem* customs and excise duty, based on the price of the vehicle, is imposed on all passenger and light commercial vehicle purchases. Medium and heavy commercial vehicles are exempt from *ad valorem* customs and excise duties.

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Provinces have exclusive responsibility under the Constitution for provincial road management and traffic control. The Road Traffic Act of 1996 with its relevant regulations empower provincial

Energy costs and pricing, taxation and subsidies

The market for transport is currently distorted in several ways:

- First, the impacts of motorised transport are in most cases not accounted for in transport costs.
- Second, roads, fuels and in certain instances vehicles are subsidised in many countries.

This results in unsustainable transport patterns and is a major barrier to the introduction of green transport models. These subsidies can be substantial and their elimination may impact disproportionately on poorer households, with little access to alternate sources of energy. UNEP argues that targeted subsidies towards lower income groups may offset such impacts.

According to Hayashi and Kato (2000), **transport taxes can be applied at three different points: car purchase, car ownership, and car use (example, fuel tax, road user charge, and parking charges)**. In many European cities, taxing car use together with providing high quality public and non-motorised transport alternatives appears to be effective in limiting car use.

The re-introduction of *“Road Freight Permits”* will also be analysed within the current South African context, with permit pricing reflecting the emissions for tonne cargo of freight vehicles, as well as road-use charges to internalize the externalities of possible overloading from freight haulers

Develop systems to enhance the regulatory regime of *“licensing authorities”* to include a **3 yearly test** on vehicles that covers roadworthiness and **“tailpipe exhaust emissions”**. The test certificate with need to be produced every 3 years of car licensing renewal and the test scores will be used to adjudicate a price relative to safety and emissions performance.

Congestion charging is a fee charged to a motorist for entering a zone prone to heavy congestion. This may be an important part of a more comprehensive energy price rationalisation in the longer term.

The use of **vehicle fuel economy norms and standards** to label vehicles in terms of their fuel efficiency and emission standards will continue, and baseline studies on the **implementation of more stringent fuel economy standards** (such as Euro V) should lead to the adoption of appropriate greener standards.

In addition, changes in pricing are essential in promoting green transport. Revenues from a full cost priced transport systems can be used to invest in green transport. Especially in developing countries where coverage of all transport costs is difficult due to existing structures, one option may be to initially price the variable operational and maintenance costs. Pricing private modes of transport will also ensure a level playing field for public transport.

Source: UNEP (2011) Transport: Towards Energy and Resource Efficiency.

governments to impose certain road traffic fees. The Road Traffic Act fees are divided into the following categories: motor vehicle licenses that include all categories of vehicles; operator licenses that include learners and driver's licenses; roadworthy; and motor vehicle registration. There are different categories of motor vehicle license fees, which are based on the weight of the vehicle. Provinces have the authority to set the level of these fees and appoint registering agents to collect the fees on their behalf. Provinces

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also charge fees for road traffic regulation services besides those in the Road Traffic Act (for example, vehicle registration fees upon change of ownership)

Two types of environmentally friendly alternative fuels from biomass have reached technical maturity and acceptance in international fuel markets. These are biodiesel from vegetable oils and bioethanol fuels. Currently, biodiesel can be produced more economically than bioethanol fuels, provides more energy, is a cleaner burning fuel and is compatible with existing engines and commercial fuel distribution systems. Given the potential long-term benefits of biodiesel, a favourable fuel tax treatment was announced in the 2002 budget in an attempt to reduce the cost disadvantages that biodiesel currently faces with respect to fossil fuels. The intention is to give a similar fuel tax dispensation for bioethanol in the future.

The environmental effects of existing environmentally-related taxes and charges needs to be better understood and quantified where possible. In some instances this will prove difficult since many of these instruments have been in place for some time. A study of the impact of current environmentally-related taxes may therefore depend on the development of scenarios to illustrate what the situation would have been in the absence of these taxes.

Given the likely potential to improve the environmental effectiveness of existing environmentally-related taxes and charges, such opportunities need to be identified and assessed. This important step will help to identify priority areas for future environmental fiscal reforms. In addition, potentially new environmental tax instruments need to be identified and their appropriateness evaluated.

In terms of fiscal objectives, one area that has received a great deal of attention over recent years is the idea of using the revenues from environmentally-related taxes as part of a tax shifting exercise. The idea of taxing *bads* (such as environmental pollution) and reducing taxes on *goods* (such as labour) has been termed the *double-dividend hypothesis*. This hypothesis asserts that a win-win situation could be achieved in that not only is an improvement in environmental quality secured (the first dividend), but gains in economic efficiency and employment could also be realised (the second dividend). Such a policy approach is of particular relevance to South Africa since it offers the potential to better align the achievement of environmental goals with other social and economic objectives.

Table 2 highlights the fuel taxes that are currently applied on petrol, diesel and biodiesel. Currently, diesel is taxed at a lower rate than petrol and no fuel tax differential currently exists between leaded and unleaded petrol.

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Table 2: Highlights the fuel taxes that are currently applied on petrol, diesel and biodiesel

Theme	Instrument	Incentive Mechanism	Shortcomings and key technical considerations
Transport (National Government)	General Fuel levy	<ul style="list-style-type: none"> Increases the price of transport fuels, thereby suppressing demand Discourage vehicle use Encourage the use of public transport/ vehicle sharing Encourage the development of fuel efficient technologies; and Could encourage the use of certain fuels over others 	<ul style="list-style-type: none"> Not differentiable for the time and location of infrastructure use; Relatively far removed from the main source of environmental externality Complementary policies required to increase its effectiveness such as information campaign Potentially regressive
	Vehicle custom and excise duties	<ul style="list-style-type: none"> Increase the price of certain vehicles (building on the idea of a luxury tax thereby suppressing demand for passenger and light commercial vehicle Encourage the use of public transport/ vehicle sharing Could encourage the use of selected types of vehicles/ technologies through differential taxation 	<ul style="list-style-type: none"> High information requirement on vehicle types and technologies Difficult to link tax to time and frequency of infrastructure use (if desirable).
Transport (Provincial Government)	Vehicle licensing fees	<ul style="list-style-type: none"> Increase vehicle ownership cost and therefore suppress vehicle demand By altering the fee structure to include, environmental criteria, appropriate incentives could be offered to vehicle users Could be used to increase scrapping rate of older vehicles (i.e. differentiate fees according to the age of the vehicles 	<ul style="list-style-type: none"> The environmental incentive is likely to be small Must avoid over-complication of the fee structure; and Potentially regressive

(Source: EFR Policy, National Treasury, 2010)

From an environmental perspective, there is little merit in promoting diesel use over petrol. Whilst diesel engines are more efficient and have advantages in terms of greenhouse gas emissions, petrol engines can have air quality advantages and lower particulate emissions using basic abatement technologies. Since the diesel fuel tax concession addresses concerns over diesel input costs for off-road primary users, the proposed fuel tax framework aims to better reflect the environmental costs associated with diesel in comparison to petrol. The framework could be further refined to reflect other environmental externalities and objectives. Although the general fuel levy could be reformed to better contribute to air quality objectives, the limitations of this instrument must be recognised. In particular, it

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is difficult to create more targeted incentives beyond those outlined above. Supplementary reforms in vehicle taxation could be used to this end and could help to incentivise the introduction of vehicles that produce fewer emissions and with increased fuel efficiency.

At the national level, reforms to existing vehicle excise duties could play an important role. Currently, new passenger and light commercial vehicles (both domestically produced and imported) are subject to an *ad valorem* customs and excise duty based on their value. The tax structure as it stands is a *luxury tax* based on price in the sense that the more expensive the vehicle, the higher the tax burden (up to a ceiling of 20 per cent). To the extent that more expensive vehicles use better technologies to reduce emissions into the atmosphere, the current imposts are not supportive of environmental objectives.

In taking environmental considerations into account, it would be appropriate to distinguish between the environmental costs imposed by different vehicles. This could be done according to a range of different criteria including vehicle type, fuel type, and / or emissions. In doing so, care must be taken not to adversely impact on the rate of renewal of the vehicle stock or the level of tax revenue. Treasury announced reforms to the motor vehicle *ad valorem* excise duty in 2009 to include a carbon emissions component, based on DoE and NAAMSA vehicle carbon emission labelling, for implementation. In Budget 2010, the levy was adjusted to a flat rate tax on new passenger vehicle emissions at the rate of R75 gCO₂/km for emissions exceeding 120gCO₂/km effective from 1 September 2010. Since the external environmental costs resulting from the use of medium and heavy commercial vehicles are likely to be much higher than for passenger or light commercial vehicles, consideration could also be given to include these categories of vehicles in the excise duty net.

2.3.1 Transport (Provincial Government)

Provinces have exclusive responsibility under the Constitution for provincial road management and traffic control. The Constitution, however, provides for concurrent responsibility for public transport, road traffic regulation and vehicle licensing. Motor vehicle registration and licensing, roadworthy testing, the issuing of learner's and driver's licenses, and other traffic-related activities are covered in the Road Traffic Act (Act 93 of 1996).

Fees (and levies) collected under the National Road Traffic Act remain the largest source of provincial own revenue, contributing just over R3.4b in 2005/06. There are significant variations in levels of revenues collected between provinces. This results primarily from differences in vehicle license fee structures and the regularity of their revision, vehicle population and composition, commission structure and pay-over rates of agents.

Despite the upward trend in revenue collection over recent years, annual vehicle license fees in South Africa are very low in comparison to other countries⁵³. There appears to be significant scope to simultaneously increase the revenues generated whilst at the same time creating better environmental incentives. Currently, vehicle licensing fees are based on tare (or net weight of the vehicle). There have

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been suggestions that license fees should instead be based on gross rather than net weight to better reflect the road damage caused by heavy and medium sized commercial vehicles.

There are a number of options to include environmental criteria in the license fee structure and to complement efforts undertaken at the national level. One possibility would be to include fuel consumption criteria with the less fuel efficient vehicles being required to pay higher licensing fees. Another (possibly complementary) option could be to differentiate fees according to different technologies such that vehicles without catalytic converters are charged at a higher rate. However, given that licensing fees constitute such a small part of overall vehicle operating costs, the environmental benefits are likely to be small unless the fees are increased significantly. Moreover, because vehicle license fees are a cost of ownership and not on use, they are likely to have a limited impact on the actual use of the vehicle, and consequently its environmental impact, once a decision to purchase the vehicle has been made. Ensuring that information about license fees is linked to vehicle purchasing decisions is likely to be an important consideration for realising changes in environmental behaviour. In exploring these options, care must be taken not to over complicate administrative systems since this could have implications for cost effectiveness and the levels of revenue collected. In addition, distributional implications also need to be carefully analysed.

3. SITUATIONAL ANALYSIS

3.1 Overview of the transport sector

Transport systems form the backbone of South Africa's socio-economic activities through enabling the movement of people and products, the demand for transport is thus derived from other economic activities and is directly related to social levels of wealth within a countries population. Wealth indicates the propensity of households to acquire food, household goods, and services. Research shows that a steady increase in household incomes directly translates into increased consumption and increased demand for transport.

As people (especially in South Africa) earn more, they end up buying more cars. However, there are externalities associated with acquisition of more cars. Streets become congested, especially in the cities, and more so during peak hours. Traffic congestion restricts mobility of workers, raw materials, and finished goods (Takyi et al., 2013). Supply interruptions are costly to the economy. Overall productivity tends to be negatively affected by traffic congestions.

The developing nature of the South African economy is also reflected in the energy environment. The energy mix in South Africa is still dominated by fossil-fuels such as oil and coal, with oil being responsible

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for 66% of the total energy mix. While efforts are being made to increase the share of renewable energy in the total energy mix, much of the discourse on energy in South Africa is still dominated by fossil-fuels.

The Integrated Resource Plan (IRP) (2013) provided the framework for macro-economic features impacting transport related greenhouse gas emissions. The macro-economic feature looked at in this study is the trajectory of the carbon intensity of the energy resources available in South Africa up to 2050.

The carbon intensity of the energy mix is determined by the composition of the different energy sources that together make up the total energy-mix, i.e. the fraction coal-based-, gas-based-, nuclear-, solar-, hydro-, and wind-energy. The IRP, has been used as a base case energy-mix for the fuel supply with high carbon intensity.

The IRP indicates that there is a revised economic and electricity sector outlook from what was previously expected in 2010. Based on this new outlook the demand in 2030 is now projected to be in the range of 345- 416 TWh as opposed to 454 TWh expected in the policy-adjusted IRP. As per the updated IRP this implies a reduction from 67800 MW to 61200 MW (on the upper end of the range), with the consequence that at least 6600 MW less capacity is required (in terms of reliable generating capacity) from a peak demand perspective.

The above-mentioned outlook is based on the ambitious economic growth as discussed in the NDP of 5,4% per annum until 2030. This growth path is aligned to moving away from energy intensive industries so as to attain the required economic growth rate without severely straining electricity capacity to 2030 and beyond. The IRP does however question this growth path, cautioning against oversupply of generation capacity.

In addition to apparent uncertainty around future demand, there are a number of additional variables in the energy sector that must be taken into consideration from an economy-wide perspective including:

- The potential for shale gas;
- The extent of other gas developments in the region;
- The global agenda to combat climate change and the resulting mitigation requirements pertaining to South Africa; and
- The uncertainty related to the cost of nuclear capacity and future fuel costs (specifically coal and gas), including fuel availability.

Based on the above the IRP suggests that an alternative to a fixed capacity plan would require a more adaptable approach. Such an approach should take into account the different outcomes based on changing assumptions (and scenarios) and looking at the determinants required in making key investment decisions.

The IRP considers a number of aspects related to developments in the energy sector and the change in demand. From an economy-wide perspective the suggested lowering in demand will align to the practical impact of energy and energy availability, considering such a transition will have a definite

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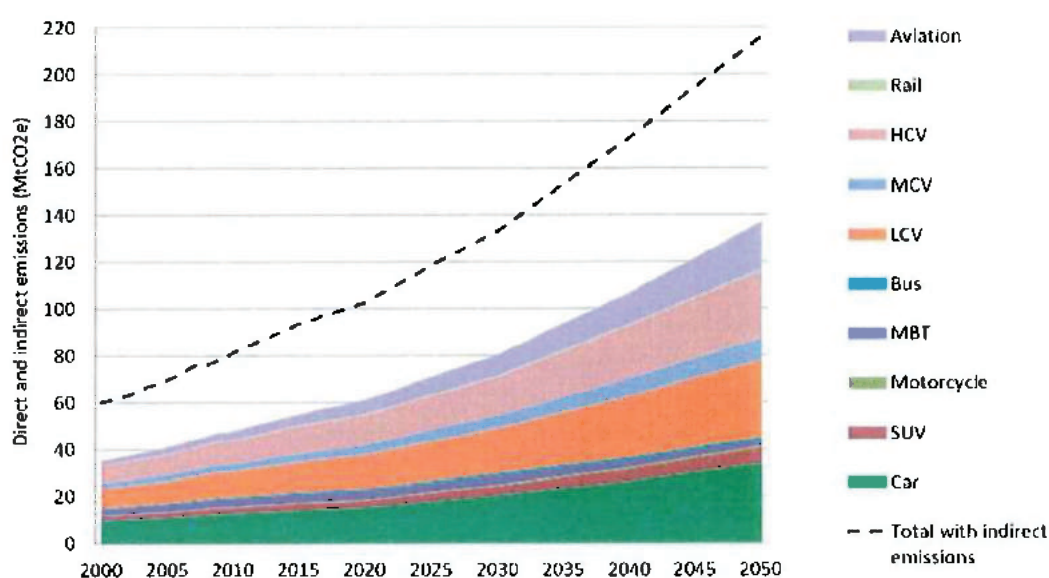
bearing on the transportation sector. It is imperative that South Africa takes a long term view (both strategically and sustainably) about how to move goods and people within the context of a changing energy sector.

Apartheid planning and marginalization of some communities has left a legacy of transport networks that are poorly integrated, resulting in the majority of citizens living far from work, and with inadequate transport infrastructure. Many people do not have access to convenient, safe and affordable transport. Furthermore, South Africa is a developing country experiencing rapid urbanization, which is intensifying the need for access to reliable transport systems.

Similarly, rising GDP drives the demand for freight transport (heavy vehicles). The number of heavy vehicles using a road is the main cause of road deterioration (CSIR, 1994:4). In South Africa, the number of heavy vehicles increased considerably as a result of the shift of cargo from rail to road due to deregulation and the subsequent underutilisation of rail. The more the heavy vehicles on SA's roads, the greater the deterioration of the country's roads, and increased maintenance costs. The outcome is worsened if the heavy vehicles happen to be overloaded. Overloaded trucks are also associated with safety concerns, and increase in carbon dioxide emissions.

Careful long-term planning is thus required to ensure that there is sufficient infrastructure to support the efficient functioning and growth of the transport sector in the future, while minimising the externalities referred to above. Notwithstanding growing demand for transport, the sector has a critical role to play in achieving South Africa's GHG reduction targets and the DoT will need to focus all resources available to meet these ambitious targets.

The figure 2: Below illustrates GHG emissions from the transport sector between 2000 and 2050 taking into account existing and currently planned policies. On the basis of this projection, it is apparent that a radical shift within the transport sector is required.



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Figure 2: GHG emissions from the transport sector with existing measures (Source: South Africa's GHG Mitigation potential Analysis, DEA)

Table 3 also represents a projection of GHG emissions taking into account existing and planned policies. It is clear from this table the expected increase in GHG emissions from 2000 to 2050 (GHG Mitigation Report, 2014).

Table 3: Projection for the transport sector: total of all GHG's with existing and planned measures

CO2 (Gg/yr) equivalents	2000	2010	2020	2030	2040	2050
Road Transport	33	44	54	71	92	116
Rail	0	0	0	1	1	1
Aviation *	2	4	5	7	8	9
Total	35	48	60	78	101	126
Indirect emissions (all modes)	25	33	42	55	71	90

* as described in Table 3 the emissions projection for the aviation sector assumes only the partial implementation of the target implied by the voluntary sectoral agreement to reduce net CO₂ emissions from the aviation sector. Source: GIZ mitigation potential analysis

3.1.1 Road Transport

The road sub-sector in South Africa contributes 91,2% of the transport sector's total emissions. It is therefore evident that this sub-sector can offer the highest mitigation potential benefits.

Table 1 above indicates that road contributes the most significant amount to total GHG emissions from the transport sector in South Africa and the road sector will therefore be the focus of the Green Transport Strategy as this allows the greatest opportunity for reductions. The modal shifts from private car usage to public transport (particularly rail) and non-motorised transport have been identified as essential actions to reduce energy consumption and GHG emissions.

The Public Transport Strategy also plans to integrate rail, taxi and bus services in co-operation with private operators, both operationally and through ownership. Johannesburg's successes with the Bus Rapid Transport System (BRT) has led to it being adapted and implemented in other South African cities, including Cape Town, Nelson Mandela Bay, Rustenburg, Ekurhuleni, Johannesburg and Tshwane. Tshwane is the first African city to operate a fleet of clean fuel BRT buses (operating on CNG) in Africa. Approximately 67% of the South African population use mini bus taxis as their prime mode of transportation.

The South African government has introduced compulsory safety standards and a taxi recapitalisation programme which aims to replace old and unsafe taxis with newer, more efficient taxi vehicles. In addition, the government has started engaging with the taxi industry on introducing green initiatives into the minibus taxi industry by promoting the use and the uptake of cleaner fuels as a transportation fuel for the taxi industry.

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The road infrastructure in South Africa is also a cause for concern as it is generally poorly maintained with 78% of the national road network thought to be older than its original design life, while 30% of the infrastructure is rated as being in either 'poor' or 'very poor' condition. Of particular concern is the state of provincial gravel roads, 50% of which are rated as being 'poor' or 'very poor' and particular municipalities, some of which contain settlements in which virtually all roads are either in a 'poor' or 'very poor' condition.

The following desired outcomes have been identified to which the Green Transport Strategy will align especially with the proposed norms and standards for "Green Roads":

- A well-resourced road network that provides sustainable employment opportunities for the maintenance and expansion of paved and unpaved road infrastructure nationally.
- The minimisation of waste, water, heat and energy requirements and the sourcing of materials, resources and labour locally to reduce costs and life cycle emissions in the construction and maintenance of road infrastructure.
- The utilisation of recycled construction materials to minimise usage of virgin resources wherever possible.
- The construction of low-carbon climate resilient (LCR) road infrastructure¹, including bus lanes, railways and non-motorised transport infrastructure.
- The careful consideration of road network expansion so as to conserve and promote natural habitats, ecological corridors and water systems, and prevent erosion and flooding.
- Substantial investments in renewable, sustainable fuel and power sources for private vehicles (e.g. electricity, biogas).
- Promotion of motor vehicle manufacturing and assembly in South Africa to mitigate life cycle CO₂ emissions of imported vehicles.
- Promotion of non-motorised transport infrastructure to promote sustainable, carbon neutral modes of transport (e.g. cycling, walking).
- Legislative frameworks and smart incentives to promote uptake of sustainable transport modes and infrastructure.

¹ Low-carbon resilient infrastructure refers to infrastructure required to tackle climate change, both in terms of meeting greenhouse gas (GHG) emission targets and in terms of adapting to inevitable consequences of increasing temperatures (Global Green Growth Institute, 2015)

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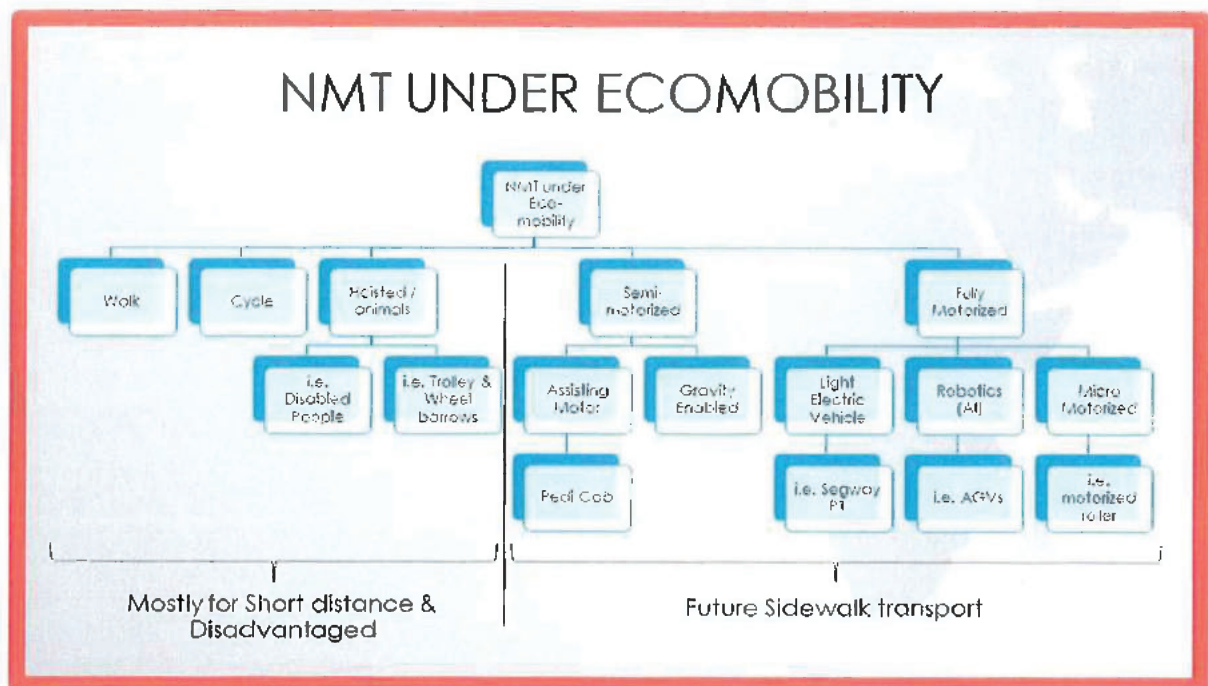


Figure 3: Showing different modes of Eco-mobility including Non-Motorised Transport

3.1.2 Rail Transport

The events that have marked South Africa's history have impacted significantly on the development of the rail sector and, together with other external factors have resulted in a railway industry that now faces several major challenges. Current challenges include the aging, deteriorating or obsolete state of much of the rail infrastructure and rolling stock, a capital investment backlog and a need for investment funds, and a preference by logistic transport service providers to transport freight by road rather than rail. There also exists the preference by long distance passengers to travel by road rather by train, poor rail security for both passenger and freight, inefficient rail operations and a shortage of technical skills and experience within the rail sector (National Rail Policy, 2015).

After many years of overloading and under-maintaining rail infrastructure, the condition of the heritage commuter rolling stock had deteriorated to crisis levels, and was unable to satisfy passenger demands. Similarly, the network infrastructure was not able to meet the demands of a rapidly changing society. To consolidate passenger rail, that is Metrorail and Shosholozza Meyl, the Passenger Rail Agency of South Africa (PRASA) was established in 2009.

Regarding freight rail, most branch line traffic was lost to predatory competition from road haulers during the 1980s. Deregulation of road freight in 1988 resulted in substantial volumes of high-value low-density freight on the core network shifting from rail to road during the 1990s. During the 2000's, continued lack of competitiveness and investment by Transnet Freight Rail (TFR) resulted in road haulers deploying side tipper interlinks to encroach on the last bastion of freight rail, long distance haulage of heavy bulk commodities such as coal, grain, and ore. Overall, railways in South Africa had deteriorated

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to a stage where the need to adapt to rail's global renaissance had become patently obvious to most stakeholders (National Rail Policy, 2015). However, since 2012 TRANSNET has invested R108.6 billion in rail infrastructure and new locomotives.

By contrast, two important positive steps were the establishment of the Railway Safety Regulator by Act of Parliament in 2002, and the development of the Gautrain Rapid Rail Link as a public private partnership in terms of a concession agreement between the Gauteng Provincial Government and the Bombela Concession Company. Gautrain opened for service in May 2010, in time for the FIFA Soccer World Cup.

The South African National Infrastructure Plan, which includes both economic and social infrastructure, is coordinated by the Presidential Infrastructure Coordinating Commission (PICC). The PICC is mandated to oversee the implementation of eighteen Strategic Infrastructure Projects (SIP's) that will stimulate social and economic growth. The SIPs are aimed at addressing South Africa's infrastructure deficit to boost economic growth and create much needed jobs. These include, among others, the construction of roads, power stations, pipelines and, in the present context, rail. Six of the SIPs address rail issues such as branch lines, capacity, corridors, densification, infrastructure, investment, logistics, road-to-rail-shift, and upgrading.

Improving the country's 20 247km rail network is a top government priority, with projects aiming to address maintenance backlogs, to increase freight rail volumes, increase market share of container traffic, and to procure new fleet for both the passenger and freight sectors.

The Department of Transport is responsible for the passenger rail system which is being overhauled with a 20-year fleet renewal programme in place to procure more than 7 200 new trains. The passenger rail network is managed and implemented by the Passenger Rail Agency of South Africa (PRASA), which focuses on revitalising the local industry through the local manufacturing of components. The existing rail network for both passenger and rail is being upgraded to take advantage of the new technological features and modernizing rolling stock.

Around 2.2-million people travel by train every day in South Africa, and the Metrorail commuter services can be found in Cape Town, the Eastern Cape Province, Durban, and greater Johannesburg and Pretoria. The intention is to expand the rail services and their accessibility to the bigger emergent middle class, who are showing more aptitude and appetite to use an integrated but safe network.

Government's National Climate Change Response White Paper, 2011 identifies a modal shift from road-to-rail as a key activity under the Transport Flagship Programme for South Africa. As the owner and operator of the country's rail freight network, Transnet has undertaken to increase its rail market share to 35% by 2018/19. According to the Transnet 30-Year Long-term Planning Framework, Transnet is planning to expand and modernise infrastructure so as to encourage the switch of freight from road to rail. Transnet is modernising operations and investing in infrastructure to encourage a modal shift from road to rail in rail transportable cargo. Transnet aims to capture 80% market share of long haul (rail friendly) transportation. Transnet is in its fourth year of implementing the Market Demand Strategy (MDS). R124 billion has been invested since 2012 and the commitment is to invest R340-R380 billion in

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railway, port and pipeline freight capacity in the next 10 years. This will increase rail volumes and lower carbon emissions in the transport sector.

3.1.3 Aviation Transport

Currently aviation has a small contribution to GHG emissions at only 8% of the total GHG emissions of the transport sector (GHG Mitigation Report, 2014)

South African Airlines currently sit with an aging fleet and lack funds for retrofitting their current fleet or for renewal. There is some work being done around investigating the switch to biofuels, for example, a project in Limpopo, Solaris, being done by South African Airways (SAA), American aeroplane maker, Boeing and in partnership with SkyNRG and Sunchem SA, is looking at using a high energy tobacco hybrid for biofuel production for aviation.

Recently Airports Company South Africa (ACSA) launched its first 200 square meter solar power plant at George Airport demonstrating its commitment to clean energy generation and sustainability. George airport is South Africa's first and currently the only regional airport to be powered through solar energy. ACSA is planning on introducing an energy mix into all its airports and over the next 18 months they are rolling out similar plants at all their smaller airports – Kimberley, Upington, Port Elizabeth, East London and Bloemfontein.

3.1.4 Maritime Transport

Maritime transport is a very small contributor to transport sector emissions in South Africa, being less than 1% (GHG Mitigation Analysis Report, 2014). This is due to maritime transport operating mainly beyond South African boundaries. The international nature of maritime emissions is being discussed under the relevant United Nations agency responsible for maritime safety and the prevention of pollution from shipping, the International Maritime Organization (IMO). South Africa is a signatory to a number of multilateral conventions relating to climate change for which the IMO is also responsible to implement measures to reduce emissions from maritime transportation, and must ensure that it continue and expand its engagement with these multilateral processes which are responsible for setting important norms of standards for the sector, many of which relate to the environment.

Marine Fishing may be considered under Maritime Transport but because fishing is mainly within South African waters (EEZ), the sector is not directly subject to rules and regulations of the IMO. The Department of Environmental Affairs (DEA) published an inventory of GHG emissions between 2000 and 2010 but this did not include South Africa's marine fisheries. However CO₂ emissions per landed tonnes of fish per year, inferred from a desktop exercise, was roughly estimated as 1.5 million tonnes of CO₂ per year for the entire fishing sector, in the year 2000 (DAFF, 2016). Given the estimated total emissions by the country for that year was 461 million tonnes CO₂, fisheries sector accounted for only 0.35% of CO₂ (DAFF, 2016)

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Currently, this subsector offers a relatively small opportunity for significant actions of change and GHG emission reductions compared to the reductions and impacts that can be made within the road sub-sector.

It is worth noting that South Africa exports commercial fish products to remote destinations in Europe, the USA and Far East. This could add significantly to the carbon footprint of the relevant fishing sectors. Even though, as stated above, maritime contribution to GHG emissions is only 1% of the total GHG emissions of the transport sector (GHG Mitigation Report, 2014), it is still prudent that effort be applied in more accurately estimating the carbon footprint of South Africa's fish trading activities coupled with regular monitoring (DAFF, 2016).

Conclusions

The Situational Analysis demonstrates that while a strong and extensive legislative framework to guide the transport sector is in place, there has been a lack of focussed strategy and policy in relation to cleaner mobility and green transportation to guide regulation of the transport sector. For implementation numbers of measures have been outlined to be carried at provincial and local level, unfortunately there is lack of framework to guide the implementation of measures at national, provincial and local level. The GTS development provides opportunities for the DoT to develop norms and standards to ensure that there is consistency in the way climate change responses are implemented across different jurisdiction (national, provincial and local level)

Since the transport sector has been identified as one of the major contributors to total GHG emissions in South Africa, the Green Transport Strategy (GTS) needs to make a significant contribution to South Africa's governance of low carbon mobility transport choices in the future, across all modes.

4. STRATEGIC FOCUS

4.1 Purpose of the Green Transport Strategy

The GTS will be the cornerstone of policy development within the transport sector regarding the lowering of GHG emissions, the contribution of transport into the green economy, the promotion of green sustainable mobility and the uptake of cleaner and more efficient technologies.

The Green Transport Strategy (GTS) serves as a guide to the DoT to implement a "basket of measures" that will significantly:

- Reduce Green House Gas (GHG) emissions produced by the transport sector,
- Reduce the environmental and human health impacts associated with the transport sector, and result in a more resilient sector,

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- Reducing transport GHG emissions to contribute significantly to the national effort to decrease emissions as agreed to by the South African government at COP21 in Paris through the Nationally Determined Contribution (NDC).

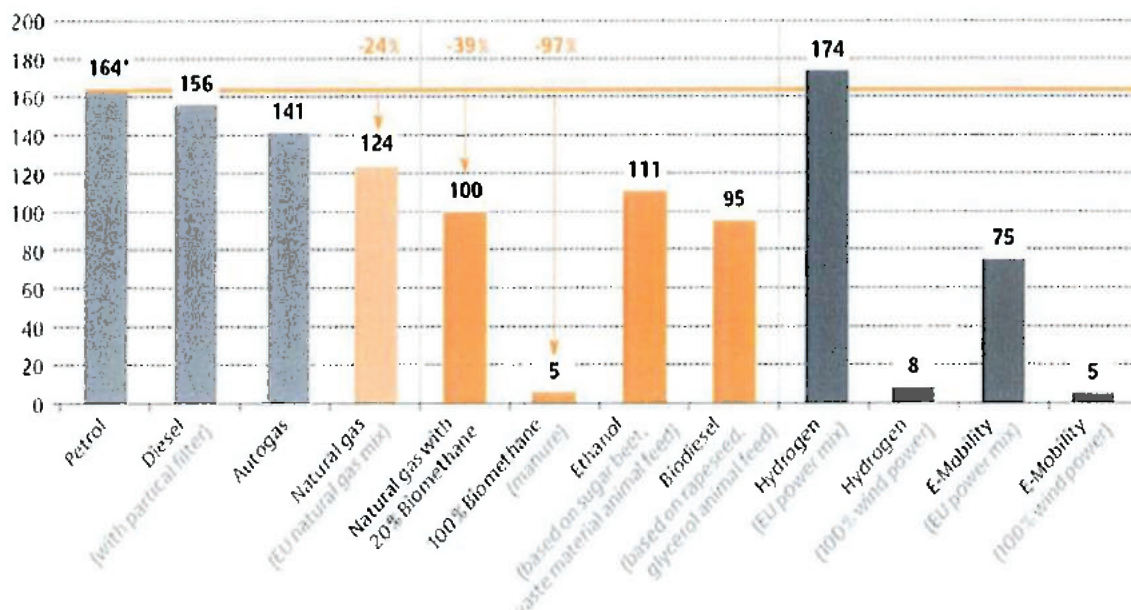
Research undertaken by GIZ, SANEDI and a host of other research organisations on behalf of the South African government clearly indicates the following core conclusions:

- Implementing measures that will reduce the need to travel and avoid unnecessary trips through walkable communities, integrated land use planning or “transit oriented development” and improving vehicle occupancy rates.
- Given that the road transport sub-sector is responsible for 91.2% of direct emissions from transport, shifting of passengers to public transport and freight to rail is a necessity.
- Biogas and solar powered electric mobility surpasses any other cleaner fossil fuel in terms of GHG reductions.

The GTS identifies and proposes key measures to facilitate modal shift from road to freight, private to public transport, and promoting cleaner vehicle technologies. There also exists an important need to promote non-motorised transport and develop the associated infrastructure to support this.

Analysis of the mitigation potential of available fuels and technologies suggests that South Africa should be focusing on adopting biogas (biomethane) as a transport fuel and electric vehicles (e-Mobility) as a technology, this should not preclude a determined effort to reduce the carbon profile of vehicles powered by fossil fuels since they represent the vast majority of vehicles on our roads and this is very unlikely to substantially change within the next five years.

Figure 3: below graphically compares full life-cycle GHG emissions (including the extraction and production of transport fuels and energy carriers) of a wide range of transport fuels, hydrogen fuel cell and electric vehicle technologies. Emissions of electric vehicles and hydrogen fuel cell vehicles are dependent on the emissions factors of the electricity source. The European Union power mix is used as reference point in illustrating the potential for an adaptive, cleaner and efficient “Fuel Mix” for transportation systems in South Africa.



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Figure 4: Comparison of GHG emissions from different transport fuels and technologies (Source: SANEDI, 2015)

While vehicle efficiency and low carbon fuels have an important role to play in reducing transport emissions, building a resilient low carbon transport system requires systemic changes in order to shift from the current situation of low density human settlements in which the private car is the primary form of transport. Integrated transport planning that actively addresses the spatial planning implications of land use decisions is best achieved through cooperation between all affected departments at all spheres of government.

4.2 Guiding Principles

The GTS is informed by the fundamental and substantive principles of sustainable development articulated in the National Strategy for Sustainable Development as approved by the Cabinet in 2011 (DEA, 2011):

The substantive principles are based on the following sustainable development principles that are already enshrined in South African law and that underscore a systems approach to achieving sustainable development:

- *Natural resources must be used sustainably.*
- *Socio-economic systems are embedded in and are dependent on ecosystems.*
- *Basic human needs must be met to ensure that the resources that are necessary for long-term survival are not destroyed for short-term gain.*

The fundamental principles of Sustainable Development can also be related to the following fundamental human rights that are guaranteed in the Constitution of the Republic of South Africa:

- *Human dignity and social equity*
- *Justice and fairness*
- *Democratic governance*
- *A healthy and safe environment*

In the context of the GTS, this creates the following imperatives:

- To reduce environmentally harmful emissions from the transport sector.
- To reduce the impact of transport infrastructure on the environment.

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- To ensure integrated transport systems provide equitable access to economic opportunities for all South Africans and support economic growth and development.
- To ensure that the provision of transport services and infrastructure involve use of resources sustainably.

4.3 Mission

The GTS will support the contribution of the transport sector to the social and economic development of the country while incrementally initiating innovative green alternative transformations in the sector to assist with the reduction of harmful emissions and negative environmental impacts associated with transport systems.

4.4 Vision

The vision of the GTS is to substantially reduce the GHG emissions and other environmental impacts from the transport sector by 5% by 2050.

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- Instituting “no-car zones”, within most of the central business districts being closed off for car use, and emphasizing ecomobility mode of transport like walking and cycling as the preferred mode of transport, allowing significant areas of urban real estate currently used for parking to be repurposed for use in affordable inner-city housing and businesses.
- An extensive network of cycle lanes and pedestrian walkways to re-orient South Africa’s towns and cities away from cars towards people. The investment in non-motorised transport infrastructure will yield a double dividend in terms of human health by both reducing harmful air pollution and promoting healthy exercise.
- Long distance freight, identified by the Freight Logistics Strategy, will be restricted to rail, with the eminent development of “Green Corridors” in the road network to promote the use of cleaner efficient technologies in our Freight industry. Together with intensified modal shifts in passenger transport this will greatly reduce road traffic and the costs of maintaining urban and national roads, allowing resources to be redirected to environmentally sensitive upgrades of rural road infrastructure.
- The replacement of fossil fuels by vehicle technologies with low or zero tailpipe emissions, such as electric and fuel cell vehicles, will be far advanced and, coupled with a significantly lower national electricity grid emissions factor due to a large scale switch to renewable energy improvements this will lead to a dramatic reduction in the carbon intensity of motorised transport.
- All waste collection vehicles and a portion of municipal buses not already replaced by electric vehicles will be retrofitted to enable propulsion with a combination of biogas and biofuels produced

4.5 Values

In order to meet the county’s GHG emissions reduction targets within the relatively short time horizon, radical changes are required in the transport sector. At the same time, these changes should not undermine transport’s contribution to meeting economic and social needs for connection and mobility. In particular, the GTS seeks to:

- Contribute to the prosperous functioning of a modern economy and cater for the transport needs of expanding human settlements
- Provide for a healthy environment and supportive ecosystem services while dismantling apartheid’s structural disconnection of poorer people from economic opportunity.
- Reduce the cost and improve the convenience and safety of transport i.e. providing guidelines to favorable cost effective future green energy technologies

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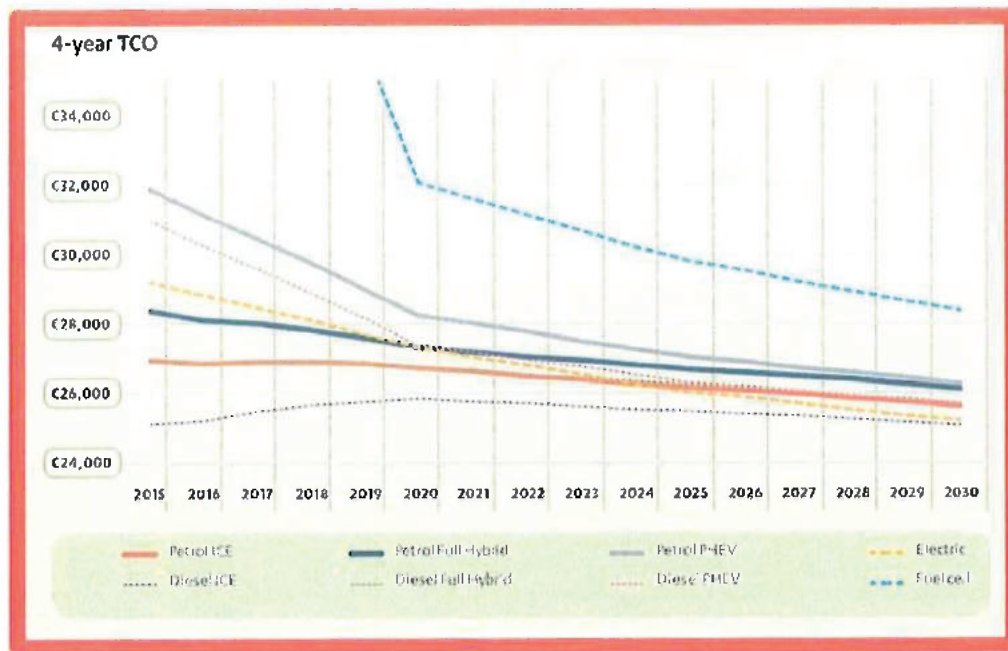


Figure 5: Showing change in cost of different fuel types (cost to improve the convenience and safety of transport)

4.6 Strategic Objectives

The Green Transport Strategy is based on the foundation of:

- Five (5) Implementation Themes and
- Nine (10) Strategic Pillars.

Table 4: Strategic pillars of the Green Transport strategy

IMPLEMENTATION THEMES	STRATEGIC PILLARS
Climate Change response norms and standards	1. Develop norms and standards for climate change response at National, Provincial and Local level to ensure that there is consistency in the way climate change responses are implemented across different jurisdiction
Green Roads	2. Shift car users from private passenger cars to public transport, including rail
	3. Shift freight transport from road to rail
	4. Provide infrastructure to promote ecomobility transport
	5. Provide transport infrastructure in a manner supportive of the eco-system, while not dearly compromising generations to come.
Green Rail	6. Extend the rail network to provide reliable, safe and affordable high-speed transport while switching to renewable energy trains
Green transport technologies	7. Reduce the carbon footprint of petroleum based fuels, by

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			decarbonizing the transport sector.
			8. Promote alternative fuels such as Compressed Natural Gas (CNG) or biogas, Liquefied Natural Gas (LNG), and liquid biofuels as transport fuels
			9. Promote electric and hybrid-electric vehicles
Green Standards	Fuel Economy		10. Provide norms, standards and regulations that promote green fuel economy in vehicles and improve emission standards of fuel in South Africa

The short-term strategic targets expanded below form part of the “quick wins” for the strategy as they will essentially form part of the first phase of the Implementation Plan: (5-7 years)

1. To promote strategies and standards for **delivering transport infrastructure and integrated transit planning and systems that build climate resilience** in urban and rural communities and **minimize the environmental impact** of transport infrastructure.
2. To convert 5% of the public and national sector fleet in the first 5 years of the implementation of this strategy and an annual increase of 2% thereafter, to **cleaner alternative fuel and efficient technologies vehicles (ideally powered through renewable energy) and environmentally sustainable low carbon fuels by 2022**, including the use of CNG, biogas and biofuels and the use of renewable energy to provide electricity for transport.
3. To reduce fossil-fuel related emissions in the transport sector by promoting norms and standards for fuel economy and putting in place regulations that promote **improved efficiency in fossil-fuel powered vehicles and improved environmental performance of fossil fuels**.
4. To achieve **modal shifts** in the transport sector that reduce GHG emissions and other harmful emissions, reduce transport congestion and improve temporal, spatial and economic efficiency in the transport sector. In particular, achieve a 30% shift of freight transport from road to rail by 2022, and a 20% shift of passenger transport from private cars to public transport and eco-mobility transport in the same year.
5. The DoT also needs to develop best practice guidelines to ensure that integrated, climate friendly transport options are incorporated into land use and spatial planning at a national, provincial and local level.
6. Invest in sources of green energy’s infrastructure, like biogas filling stations, electric car charging points, GIS integrator ICT technology platform for locating stations, regulating future pricing and providing statistics.

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5. STRATEGIC INITIATIVES

The GTS focuses on key/priority measures that will contribute most to a radical shift in South Africa's transport emissions profile. The corollary effects of full implementation will be safer, more reliable and cheaper transport options for the majority of South Africans. It is a recommendation of this strategy that, "all future investments in the transport sector should be informed by the vision, guiding principles, and strategic objectives of the GTS". Strategically involve youth in the planning and design of future models, through institutions and engagement.

5.1 Integrated Transit Systems

Fundamental to the greening of the transport sector is the seamlessly integrated functioning of the transport system. These integration policies and strategies have been defined in all transport sector planning, policy and strategy documents. Integration is the key principle on which all transport strategy rests for successful execution and functioning.

In terms of the GTS, the modal shifts to rail and away from private vehicle use are premised on integrated transit and feeder systems that make far greater use of public transport and non-motorised transport.

The interaction of transport infrastructure with the property market can lead to outcomes that are neither socially nor environmentally desirable. For instance, the provision of transport infrastructure such as railway stations or bus terminals tends to result in an increase in the market value of nearby property, which can have unintended local consequences in terms of converting residential property to commercial property and reducing the availability of land for mixed and low cost housing. The DoT needs to develop best practice guidelines to ensure that integrated, climate friendly transport options are incorporated into land use and spatial planning at a national, provincial and local levels. One option is for the Minister to prepare such guidelines in terms of the provisions of the Spatial Planning and Land-Use Management Act in order for them to inform planning decisions.

In addition, Intelligent Transport Systems have the potential to reduce GHG emissions and can be used through transport planning processes to provide advanced data & digital connectivity such as signal timing, real time traveler information, incident management, etc. Transport planning and investment decisions can improve the operational efficiency of multi-modal transportation networks and integrated transportation and land use planning to reduce travel time. The DoT in consultation with National Treasury will provide a national team of experts to consult to all spheres of government as infrastructure is expanded. The team of green transport integration experts will also consult to the Strategic Integrated Projects (SIPs) throughout their planning and execution.

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5.2 Road Transport Initiatives

The road transport sector contributes approximately 91% of total transport GHG emission (GHGI, 2015). **Therefore, the emphasis of the GTS must be on drastically reducing emissions from the road sector.**

One of the primary intervention mechanisms to achieve this, is through freight achieving modal shifts in the transport of freight from road to rail, and from private vehicle use to public transport and eco-mobility transport for passenger transport.

Modal shift, which is generally an aggregate analysis phenomenon, takes place after a choice of travel mode, at an individual-user level, is made. One of the reasons for modal shifts from road to rail is deterioration of transport assets, and thus contributing to increasing operating costs and reducing efficiency and industrial competitiveness.

There is frequent comment on the dominance of road freight transport and the need to move freight from road to rail (DOT, 2005). Road transport services for bulk and semi bulk commodities are often a more expensive second best option, which is used by industry and logistics providers as the default option in the absence of available railway services. Road transport is the primary source of transport related CO₂ emissions in South Africa. Road freight transport has continued to increase with heavy goods vehicles making up 34% traffic on the N3; and HGV accidents on that route at the same level as light vehicles. There is deteriorating infrastructure in all modes and restricted capacity to fund maintenance, upgrading and modernization of the infrastructure. There is a frequently stated policy objective to transfer road freight to rail, for the purpose of reducing road freight traffic and the usage of the roads (DOT, 2005).

According to Page et al, (2001), the reasons for public transport users changing to private cars is affordability, availability and safety. Based on the 2003 national household travel survey, it is clear that, across the board, unavailability of services is the main reason for not using public transport. Therefore in order to influence mode shift from private to public transport, it is important that efforts needs to be made in expanding the public transport network, whilst making the public transport available, affordable, convenient and accessible. Modal shift from private passenger cars to public transport have the potential to significantly reduce emissions from the road sub-sector, by emphasizing the use of and expansion of BRT services thus encouraging a modal shift from private use to public transport use.

The DEA's 2014 Mitigation Report, provides estimates of the potential CO₂ emissions reductions that can be achieved through modal shifts in the transport sector (in Table 4), and the estimated costs of achieving these reductions per ton of avoided CO₂ emissions. While the initial capital costs are high, by 2050 modal shifts in passenger transport represent a saving to the economy.

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Table 5: Estimated mitigation potential and cost (which are likely to be borne by the public and private sector, as well as consumers) of modal shifts in the transport sector

Modal shift	2020		2030		2050	
	ktCO ₂	R/tCO ₂	ktCO ₂	R/tCO ₂	ktCO ₂	R/tCO ₂
Road – passengers, pvt vehicle to public transport	820	3,105	3,087	729	9,396	-1,128
Road – freight, road to rail	1,840	1,375	2,729	2,085	2,997	1,497

Source: GIZ mitigation potential analysis on behalf of DEA 2014.

ktCO ₂ - Kilotonne of Carbon dioxide	R/tCO ₂ - Rand per tonne of Carbon dioxide
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Added tax to new fuel car buyers, use that money to contribute to the cost of buying green vehicles to bring the price down. Relax taxes associated with green vehicles to further reduce the price to below the petrol or diesel cars. Taxes to the manufactures of diesel and petrol, bring that fund across into emobility development in the country.

5.2.1 Road Passenger Transport

The GTS aims to provide the policy, regulatory norms and standards, fiscal instrument and recommendations essential to achieve a modal shift of passengers from private vehicle use to public transport, and particularly from road to rail.

In order to achieve these modal shifts significant investment needs to take place.

- **Bus rapid transit (BRT)** systems need to be significantly expanded throughout the large cities and the security, reliability and frequency of BRT systems improved.
- Infrastructure must be innovatively upgraded to allow the minibus taxi industry (or high occupancy vehicles such as carpooling initiatives) to utilize the BRT-only lanes. Cities will be engaged to allow this access.
- The **taxi industry**, a major component of the transport industry, needs to be engaged to develop their role as important **feeders to the public transport system**.
- An **intelligent transport system** must be developed where all public transport and the minibus industry can be monitored by metropolitan control centers through GPS, GIS and IoT connectivity. The intelligent transport system will provide information to the public in terms of congestion, stations available transport options and arrival/departure times throughout South Africa's large urban cities.
- A **single ticketing system** will be developed where the public can utilize a smart tag as the payment mechanism. The smart tag will be swiped on entry and exit of the public transport system. The smart tag may also be used in the minibus taxi industry. The smart tag will be loaded with funds at the same distribution points used to buy mobile air time. Innovatively through various available forms of digital technology, such as those of banks and pay point systems.

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- **Non-motorised transport infrastructure**, namely the building of cycle lanes along key transport routes and improved pavements and sidewalks must be included in the maintenance mandates of SANRAL and local government where appropriate. These facilities require urgent expansion to provide for the majority of South Africans who utilize NMT as their primary mode of transport and to capitalize on the growing public desire for non-motorised 'green' transport.
- The **planning and design of transport infrastructure expansion must consider future eco-mobility developments**.
- The government will work with the private sector to expand on the current number of **electric charging stations powered by renewable energy sources**. These stations will also be accessible to the general public.
- **Vehicle energy efficiency programme** – the government will set an example for procuring energy efficient vehicles by instituting "Procurement Guidelines" for the government vehicle fleet. DoT will engage with National Treasury and relevant national departments, as well as provincial and local government to set appropriate targets for the procurement of **alternative fuels and efficient technologies vehicles**. In addition, the government will only procure the most fuel efficient vehicle makes and models.
- A baseline analysis of the government fleet will be undertaken to use as data for the public communication of fleet emissions improvements. Data collection will continue in order to measure and enhance continuous improvement. The analysis will include the following as a minimum:
 - basic specifications – engine size, curb weight, footprint etc.,
 - utility – power, maximum speed
 - fuel consumption, CO₂ emissions
 - technology adoption – fuel type, transmission, air intake
- DoT will engage with DTI to provide manufacturing incentives to vehicle manufacturers who supply the government fleet with high energy efficient vehicles and EV's, to consider options of manufacturing these vehicles within the country.
- The Department of Agriculture, Forestry and Fisheries (DAFF) and DoT, will conjunctly develop a "rehabilitation plan" focusing on a tree planting initiative within and around major cities, with emphasis of replanting trees especially after the construction of transport infrastructure.
- DoT will develop a national green transport awareness campaign to be rolled out nationally. The awareness campaign will include behavior change initiatives such as eco-driving.
- DoT in partnership with Department of Basic Education will include in the lower education curriculum, a module, under life science subject about green transport and innovation.

5.2.2 Road Freight Transport

Road infrastructure is affected by several factors, but most importantly environmental factors, the volume of vehicles and the weight of the vehicles on the road. All roads are built with a design life and with the addition to the impact of the traffic load, the environment (heat, cold, rainfall etc.) also causes deterioration.

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Commodity Characteristics	Commodities	Annual Tons mtpa	Typical origins	Typical destinations	Modal Usage %		Primary reason for modal choice	Rail mtpa	Road mtpa	
					Rail	Road				
Bulk - Coallink Bulk - Orex Bulk - GFB	export coal	76.3	Mines	Ports	100	0	Full rail facilities	76.3	0.0	
	export iron ore	59.7	Mines	Ports	100	0	Full rail facilities	59.7	0.0	
	local coal	24.6	Mines	Powerstations	85	15	Some rail facilities	21.0	3.6	
	local iron ore	12.0	Mines	Foundries	100	0	Some rail facilities	12.0	0.0	
	local coal	9.5	Mines	Factories/ports	74	26	Few rail facilities	7.0	2.5	
	other minerals	8.5	Mines	Foundries/ports	72	28	Some rail facilities	6.1	2.4	
	Clinker	5.8	Quarries	Factories	86	14	Some rail facilities	5.0	0.8	
	fuel/chemicals	3.9	Plants	Ports	90	10	Some rail facilities	3.5	0.4	
	Grain	10.0	Silos/ports	millers	40	60	Some rail facilities	4.0	6.0	
	steel	2.1	Foundries	Ports	53	47	Some rail facilities	1.1	1.0	
	timber	8.0	Forest	mills /ports	75	25	Some rail facilities	6.0	2.0	
	Paper and pulp	1.5	Port/plants	ports/plants	67	33	Some rail facilities	1.0	0.5	
	Other bulk	4.0	Mines/agric	Plants/ports	100	0	Some rail facilities	4.0	0.0	
	TOTAL BULK		234.5			91	9		213.7	20.8
	Break bulk	steel	1.0	Foundries	Wholesaler	1	99	No rail facilities	0.0	1.0
cars		1.0	Ports/Plants	Ports/ Plants	40	60	Few rail facilities	0.4	0.6	
cars		1.0	Ports/Plants	Retailers	20	80	Few rail facilities	0.2	0.8	
containers		6.0	Ports/Terminals	Plants	30	70	Few rail facilities	1.8	4.2	
containers		14.0	Ports/Terminals	Ports/terminals	36	64.3	Few rail facilities	5.0	9.0	
chemicals		20.0	Factories	Users	0	100	No rail facilities	0.0	20.0	
fuel		30.0	Plant	Retailers	0	100	No rail facilities	0.0	30.0	
Mixed	agric prods	111.0	Farms,silos	Farms / Mills	5	95.5	Few rail facilities	5.0	106.0	
	industrial goods	550.0	Ports/factories	User industries	0	100	No rail facilities	0.0	550.0	
	FMCG	500.0	Processors	Wholesale/retail	0	100	No rail facilities	0.0	500.0	
	beverages	90.0	Plants	Wholesale/retail	0	100	No rail facilities	0.0	90.0	
	packaging	40.0	Plants	factories/processors	0	100	No rail facilities	0.0	40.0	
Casual	Construction	40.0	Suppliers	Sites	0	100	No rail facilities	0.0	40.0	
	Building	20.0	Suppliers	Sites	0	100	No rail facilities	0.0	20.0	
	Retail	20.0	distribution	stores	0	100	No rail facilities	0.0	20.0	
TOTAL BREAK BULK		1444			1	99.1		12	1432	
TOTAL LAND FREIGHT		1679	Million tons p.a.		13	86.5		226	1452	

Table 6: Indicative Total Tonnage of Rail and Road Freight in South Africa by category and current modal usage (NFLS: 2015)

The growing use of the road network for freight is causing a further increase in maintenance requirements and costs for the road network, adding to congestion and the growth in emissions and particulate matter in the air. Strategic action, including possible regulatory or fiscal measures is needed to encourage freight to be transported via the rail network. The increased use of rail will ease the environmental, health and congestion burdens, and as seen in Table 6, above the need for modal shift of some commodities is a necessity to improve the efficiencies of both modes, and also manage negative externalities as much as possible.

Rail transportable freight that has been identified as per Table 7 below, should ideally not be transported via the road network. Historically, rail was the preferred method of moving freight in South Africa, but following deregulation of the transport sector, the rail market share, and consequently also investment in rail transport infrastructure, has progressively decreased. There is a modal imbalance between road and rail movements, which leads to an unsustainable use of road infrastructure (Havenga & Pienaar 2012). This has led to strain being put on the national fiscus due to increased capital and

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maintenance costs of road infrastructure, as well as strain on the private sector the cost of road transport has increased (Freight shift from road to Rail Report, DEA, 2014).

Table 7: Showing the tonnage of freight moved by train (Source: Freight Train / NP&A)

Commodities	Estimated Tons p.a.
Steel	1,000,000
Oil and Fuels	2,500,000
Domestic Coal	3,500,000
Export (Sized) Coal	1,500,000
Manganese	800,000
Grain	6,000,000
Timber	2,000,000
Pulp and Paper	500,000
Minerals	2,000,000
Total	19,800,000

South African roads are also placed under further pressure by increased freight and passenger transport within the SADC region. South Africa has the largest ports and provides important transit corridors to the SADC region. This is also compounded by the large movement of people coming to South Africa in search of employment and better opportunities.

Recommended road regulatory actions

DoT will prepare the following regulatory actions targeted at encouraging the modal shift from road to rail and from private vehicle use to public transport:

- In consultation with the cities (local government), DoT will develop a regulatory and policy framework for levying a **congestion charge** on vehicles that enter central business hubs. International best practice with regard to congestion zone taxing will be taken into account.
- **Congestion zone taxing** will require supporting infrastructure – park and rides, **integrated ecomobility transport facilities, bike and car share scheme development.**
- In consultation with stakeholders and the National Treasury, **review the current levels of the environmental levy on new motor vehicle CO₂ emissions and expand the tax to include commercial vehicles** in order to more effectively influence energy efficiency and the environmental performance of the country's vehicle fleet.
- Develop a regulatory regime in consultation with National Treasury for the **annual taxing of vehicles based on their emissions** through the annual car licensing renewal system.
- Added tax to new fuel car buyers, use that money to contribute to the cost of buying green vehicles to bring the price down. Relax taxes associated with green vehicles to further reduce the price to

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below the petrol or diesel cars. Taxes to the manufactures of diesel and petrol, bring that fund across into emobility development in the country.

- Enhance the regulatory regime to include a **3 yearly test** on vehicles that covers roadworthiness and exhaust emissions. The test certificate with need to be produced every 3 years of car licensing renewal and the test scores will be used to adjudicate a price relative to safety and emissions performance.
- The use of **vehicle fuel economy norms and standards to label vehicles** in terms of their fuel efficiency and emission standards will continue, and baseline studies on the **implementation of more stringent fuel economy standards** (such as Euro V) should lead to the adoption of appropriate greener standards.
- Introduce a **car life cycle limits** on the road, i.e. a car with an engine more than 400 000km must be burned from the road.
- In consultation with cities, DoT will develop regulations to ensure that **freight vehicles may only enter urban hubs during off peak hours**.
- Research will be conducted into the **staggering of school and work start times** to relieve congestion in cities.
- **Road freight permits** will be re-introduced into South Africa with permit pricing reflecting the emissions for tonne cargo of freight vehicles, as well as road-use charges to internalize the externalities of possible overloading from freight haulers. Also increase taxes on road cargo to fund rail development.
- The DoT will develop Green Standards and Guidelines for road construction, maintenance and upgrades. This will include standards and guidelines on climate change resilient materials.

5.3 Rail Transport Strategic Initiatives

Rail provides the most immediate relief required to meet emission reduction targets in the limited time frame available. The GTS supports the determination of the NATMAP 2050 vision to establish targeted high speed intercity networks, heavy haul, tram rail, cable cars, double stacking and contemporary urban rail options, which could lead to the revitalizing of rail in South Africa through investment in a small high performance new network that can set extra-urban railways on a renaissance trajectory and expanding funding sources through private sector participation. Rail is far superior from a direct emission mitigation perspective than road transportation.

Direct emission from the rail sector contribute only 1% of all transport emissions (GHGI, DEA, 2015) however, this figure excludes emissions from electricity consumption. In order to achieve the successful development and integration of the rail sector in South Africa, and to support the measures proposed in the Green Transport Strategy. There are accordingly significant investment costs required to actualize the modal shift required for achieving the sectors reduction figures. These costs can be covered by extracting by the use of taxes and penalties from the emitters of GHG and reinvested these funds to modal shift initiatives.

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5.3.1 Passenger Rail Transport

The DoT, through the GTS, supports the following rail policy directives and additional proposed regulatory frameworks:

- Drawing on the lessons learned and experience of the Gautrain model, expand and upgrade rail networks into all urban areas.
- Invest in the improvement and development of PRASA (passenger rail) infrastructure and services.
- Increase frequency, digital information connectivity (IoT), reliability and safety levels for passengers.
- Restore the rural branchline network.
- Secure local and global private sector participation in high speed networks.
- Conduct research to appropriately tax the road transportation sector to reflect the maintenance cost of road.
- Develop tax incentives related to corporate and private spend on rail transportation.
- Encourage PRASA to move towards fuel-cell and solar powered locomotives in a shift to using low carbon energy sources.

Note fuel cell future estimated cost compared to other energy technologies as researched by Pforzheim University of Applied Sciences.

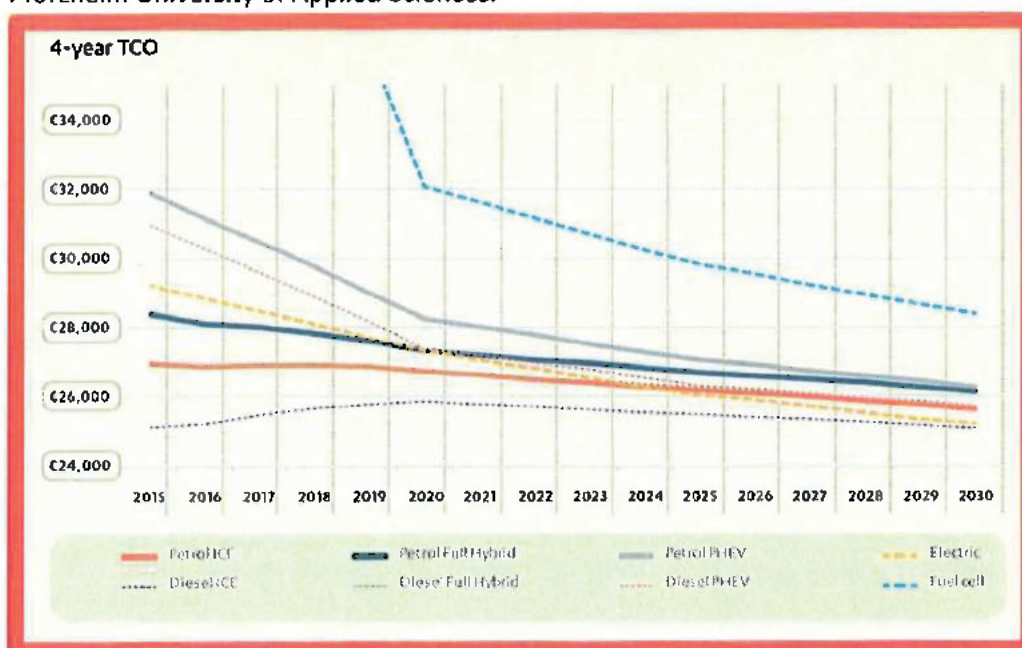


Figure 6: Showing Fuel Cell future estimated cost compared to other technologies

- The DoT together with industry will also initiate the development of Green Standards and Guidelines for rail infrastructure and construction, maintenance and upgrades. This will include standards and guidelines on climate change resilient materials.

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5.3.2 Freight Rail Transport

- Increase frequency, digital information connectivity (IoT), reliability and safety levels for freight.
- Design a pricing system that is competitive with road transportation.
- Develop tax incentives related to corporate and private spend on rail transportation.
- Encourage TRANSNET to move towards fuel-cell and solar powered locomotives in a shift to using low carbon energy sources (figure above)
- The DoT will develop Green Standards and Guidelines for rail infrastructure construction, maintenance and upgrades. This will include standards and guidelines on climate change resilient materials.

5.4 Aviation Transport Strategic Initiatives

The overall strategic approach for the RSA's climate change response is guided by the National Development Plan (NDP) (Vision 2030). The NDP proposes movement towards a low carbon economy. Different sectors of society have roles to play to fulfil Vision 2030. The DOT's objective to support the transition to a low carbon economy is to 'increase the contribution of transport to environmental protection' (State Action Plan, DOT: 2016). Historic data was obtained from ICAO, thus the methodology used for differentiating between international aviation and domestic emissions is the ICAO methodology (State of Registration).

The estimation of baseline fuel consumption and CO₂ emissions for international aviation within RSA was done with assistance from ICAO statistics. The baseline was projected from 2016 until 2050. Figure 1 shows that in the absence of any measures- 'do nothing approach'- there will be a gradual increase in the CO₂ emissions. In order to contribute towards the global ICAO goal of Carbon Neutral Growth (CNG) 2020, measures were selected by the South Africa to begin the implementation process.

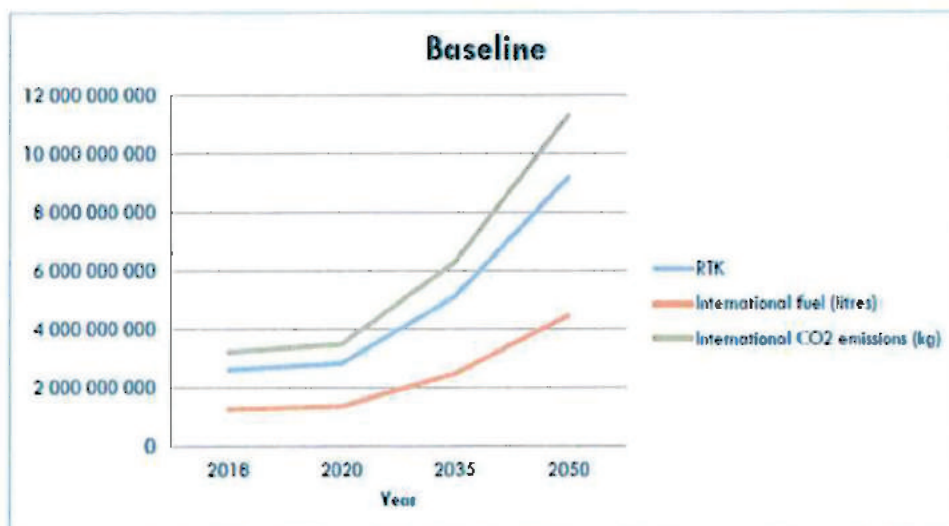


Figure 7: Absence of measure baseline in Aviation for S.A (Source: DOT State Action Plan: 2016)

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Although emissions from domestic aviation have more than doubled since 2010, (State Action Plan, DOT,2015) reflecting the large growth in passenger demand over this period, aviation still only contributed less than 8% to total transport GHG emissions, in South Africa. However, this figure is likely to grow given the growth in passenger demand for air travel (GHGI: DEA: 2014).

The International Civil Aviation Organization (ICAO) is a UN specialized agency, established by States in 1944 to manage the administration and governance of the Convention on International Civil Aviation. As a member state of ICAO, South Africa has consented to the implementation of "International Civil Aviation Standards and Recommended Practices" (SARPs) and policies in support of a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector.

ICAO's basket of measures to reduce CO₂ emissions from international aviation include the following:

- Aircraft-related technology development;
- Aircraft based emission testing with penalties,
- Alternative fuels;
- Improved Air Traffic Management (ATM) and infrastructure use;
- Market-based measures;
- Airport improvements; and
- Regulatory measures.

As per the State Action Plan, 2016, South Africa has committed to only focus on the improved ATM measures as this is at an advanced stage of implementation due to the country's Performance-based Navigation (PBN) Implementation Plan.

The Air Traffic and Navigation Services (ATNS) Company is the home of expert Air Traffic Control and Management solutions for South Africa as well as 10% of the global airspace. South Africa has embarked on a project to align the South African fixed route structure to support PBN implementation. The project is aimed at reducing track miles for aircraft operating in the en-route environment, **which reduces fuel burn, emissions and works towards environmental sustainability.**

The important ICAO initiative of Aviation System Block Upgrades (ASBU) in facilitating a seamless global air navigation system has been collectively embraced by the RSA. In support of the ASBU initiative, RSA, through the aviation industry-sanctioned ATM roadmap (led by ATNS), rolled out several ongoing initiatives to facilitate compliance with Block 0 as detailed in the ASBU framework.

Declaration through collaborative initiatives such as the USTDA airside capacity study; facilitation of the flexible use of airspace; and air traffic flow management. A further initiative in line with the ASBU Block 0 upgrade is the implementation of PBN. Envisaged milestones in achieving the PBN initiative include revised terminal area procedures for several airports such as Lanseria, George, East London and Port Elizabeth. These revisions are aimed at enhancing the flexibility and efficiency of both departure and descent profiles for airspace users, thus addressing several PIAs, including the environmental- (greener airports) and efficiency- (flexible flights) related parameters associated with air travel.

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The Airports Company of South Africa (ACSA) has and continues to invest in infrastructural and operational upgrades. In addition, George Airport is the first airport in South Africa to install extensive solar technology. ACSA also intended to participate in the Airports Council International's (ACI) Airport Carbon Accreditation program in 2016. Reduced energy demand projects include the installation of building management systems which reduce electrical demand, and the installation of cleaner alternative sources of power generation such as the installation of photovoltaic panels which generate a portion of the airports' electrical demand. Projects for the installation of photovoltaic panels have already been completed at three ACSA airports.

SAA has a progressive environmental strategy with the overall and firm objective of being recognized amongst the environmentally sustainable airlines in the world. The first African sustainable biofuel flight was done by SAA on 15 July 2016. SAA and Mango flights on Boeing 737-800s operated between Johannesburg and Cape Town, made history as the first sustainable biofuel flights to have taken place on the African continent.

RSA is currently implementing one of the seven measures highlighted by ICAO. However CO₂ emissions are slowly being reduced. Therefore, for the country to reduce more CO₂ emissions, some of the other measures listed below need to be fully implemented.

The following assistance will be needed to enable the implementation of other measures:

- **Research and innovation**

The RSA intends to implement some of the seven measures recommended by ICAO. Assistance is required in various research areas that can have a role in ensuring CNG 2020. Heavy involvement of youth in innovation is critical to designing a suitable future they will live in.

- **Education**

Training on collection, monitoring, reporting and verification of data is required, in addition spreading down to lower education.

- **Finance**

The process of taking the Alternative fuels measure from a conceptually small scale project to a large industrially viable stage will require massive scaling up to produce enough sustainable feedstock. A refinery will need to be established to process the oil that is produced. Penalties from single aircraft testing can be used. The competition commission has good models that could be adopted.

- **Technical support**

For the Alternative fuels project, knowledge of agronomical and mechanical best practices is needed to optimise the supply chain. This can be achieved through bringing in retired expert from locally as well as some through the German government SES programme - <http://lang.ses-bonn.de/en/>.

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The financial pressures currently experienced by the industry in South Africa make it challenging to procure new, more efficient aircraft or invest in biofuel production. Hence efforts are concentrated on retrofitting technologies and improved operational efficiencies.

In addition to these user-charges and fees, national government imposes an air passenger departure tax, which is a departure tax on The South African Civil Aviation Authority (SACAA) regulates the air transport sector in South Africa. The following charges are imposed on the aviation industry:

- Aviation fuel levy - payable by wholesale distributors on the sale of all aviation fuel that is manufactured, distributed, imported or sold in South Africa; and
- Airport charges - payable by the operators of aircraft in South Africa and consists of a landing charge, parking charge, and passenger service charge.

International air travel from South Africa, the revenues from which flow into the national revenue account. However, upon imposition of the air passenger departure tax, additional funding has been made available for tourism promotion. Recognising the higher effective burden on international flights to neighbouring countries, a reduced rate applies to departures to Botswana, Lesotho, Namibia and Swaziland.

5.5 Maritime Transport Strategic Initiatives

Government's approach to protecting the marine environment from pollution is both proactive and reactive. The proactive component is the responsibility of South African Maritime Agency (SAMSA) – preventing pollution from ships. The reactive component is the mandate of the Department of Environmental Affairs (DEA) – mitigating and combating the effects of pollution from ships once it has occurred. Ports are required to provide adequate environmental infrastructure and systems, such as reception facilities. This helps to mitigate illegal dumping of ship-sourced pollutants at sea.

The protection of the environment and ecosystems on which our livelihoods depend has emerged as one of the most pressing issues in the past few decades. Concerned with the implications of unsustainable consumption of finite natural resources, governments decided to launch, working through the United Nations system, through multilateral environmental agreements. These agreements, while intended to address different environmental problems, and of differing proportions, share one commonality, namely the protection of the environment for the benefit of present and future generations.

Multilateral environmental agreements, by their very nature, are agreed at a global level, but implementation typically takes place at a national level. South Africa (through the Department of

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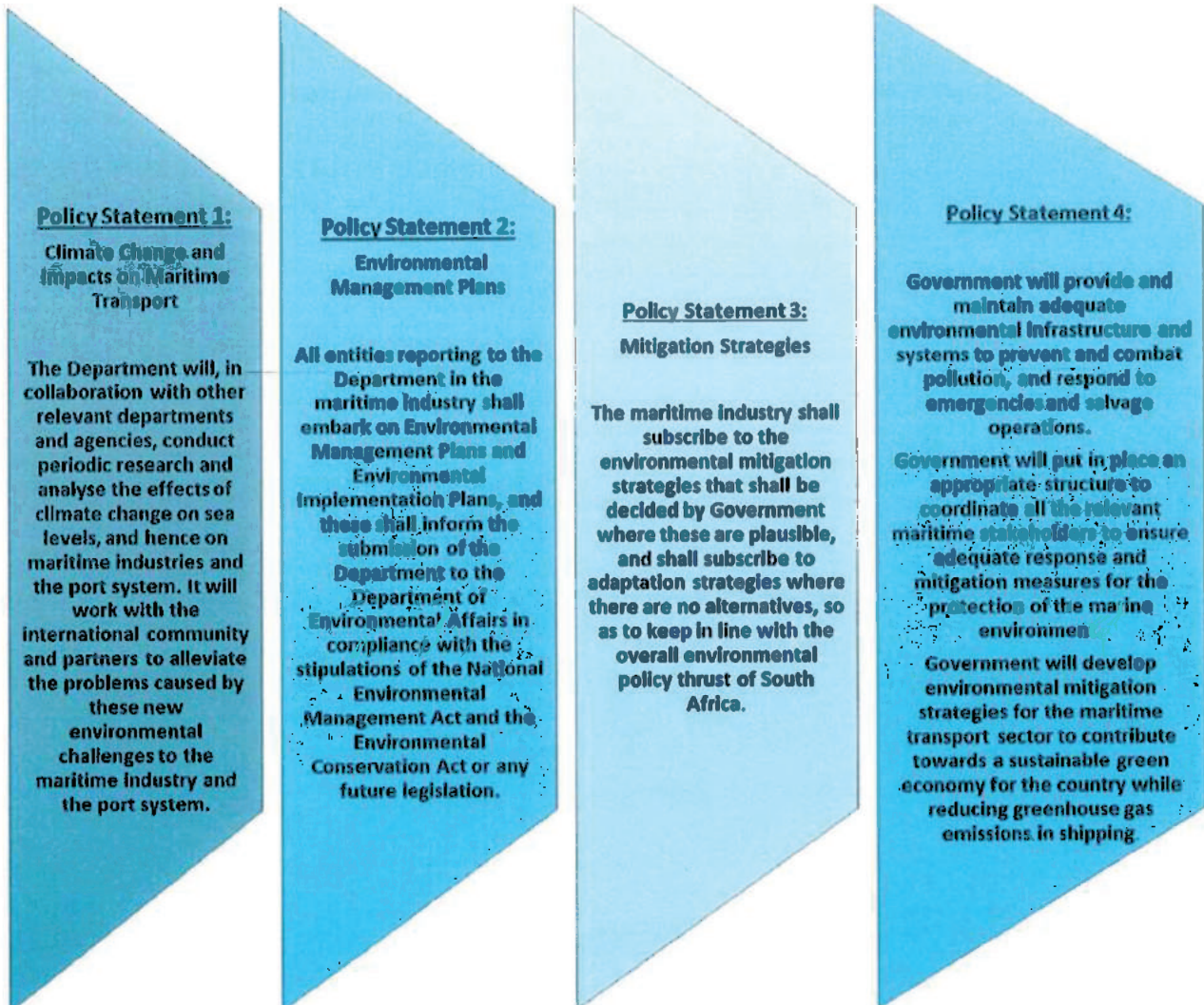
Transport) is a signatory to several of these agreements, with corresponding rights and obligations. The country needs to formulate and implement policies related to its multilateral obligations regarding the protection of its marine environment, while also giving effect to national environmental legislation.

Oceans and coasts are intrinsically linked with society and provide humankind with many environmental, economic and social benefits, from regulating the weather and climate to providing oxygen, food and livelihoods to the global population. However, overexploitation of our marine environment over the years and other human activities, such as the burning of fossil fuels, have had an adverse impact on the ocean; therefore, effective strategies that will help protect the marine environment for the benefit of present and future generations need to be explored.

To date, the country's maritime transport sector programs and other interventions have been skewed in favour of industrial development, and marine environmental protection has largely been ignored. The notion of sustainable development calls for the balancing of three pillars: social, economic and environmental. Government has a duty to protect the marine environment for the benefit of present and future generations.

Although the maritime industry has always been prone to environmental issues (such as oil pollution, ballast water issues and combating aquatic invasive species) and energy inefficiencies, these issues have taken on a new urgency in view of global warming and air pollution by ships. Hence, the Department will continue to be concerned with these issues. The protection and preservation of the environment is a pressing issue for developing nations, but the maritime industry knows no boundaries. Environmental compliance issues are now paramount in the international arena, and it is in the interest of the South African maritime industry to be kept abreast of international environmental compliance issues and to prepare for them. This way, when they are eventually extended to the South African industries, they will be implemented without hindrance.

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SECRET**5.5.1 Statutory Context for Maritime**

The mandate and obligations to develop policies and take corresponding measures for the protection of the marine environment stem from many international, continental and regional policy declarations. In addition, South Africa is party to many political declarations, including the Rio Declaration on Environment and Development and its Agenda 21, 1992, the Millennium Declaration and the Millennium Development Goals, 2000, as well as the Rio+20 Declaration. Furthermore, at national level, various pieces of environmental legislation and policies have a bearing on the maritime transport industry or policy, including the Constitution of the Republic of South Africa (Act No. 108 of 1996), the National Environmental Management Act, No. 107 of 1998, and the White Paper on National Climate Change Response, 2011.

5.5.2 Climate Change and Maritime Transport

Maritime transport is arguably the most ecological mode of transport and the most fuel-efficient way of carrying cargo. International shipping causes around 3% of the global carbon dioxide emissions from fuel combustion. The international regulatory framework under the Kyoto Protocol does not, however, cover bunker fuel emissions from international shipping.

Recent developments in global warming and climate change have sharpened the focus on the need to regulate issues such as pollution caused by the discharge of oil, liquid and other harmful substances, sewage and garbage from normal shipping operations. This includes air pollution, particularly the need to regulate and reduce greenhouse gas emissions from shipping. Nitrogen and sulphur dioxide are two of the major causes of environmental problems in the shipping industry.

The growth in international trade means that international shipping is expanding. Moreover, the globalisation of the shipping industry and economic activity promotes international shipping and consequently increases global emissions.

Other measures that have been undertaken through the IMO is the adoption of a marine sulphur cap of 0.5% S, as provided for in the MARPOL Annex VI, as from January 2020, and as South Africa is party to the IMO we will also need to abide by this regulation, and initiate the necessary plans to ensure its successful implementation.

5.6 Future modes of transport

Future modes of transport are those modes that will be developed in the future or currently under development such as walking robots like Atlas from Boston Dynamics <http://www.bostondynamics.com/> and Cassie from Agility Robotics <http://www.agilityrobotics.com>, passenger autonomous flying cars/drones such as the ehang184 <http://www.ehang.com/ehang184>, and SpaceXHyperloop <http://www.spacex.com/hyperloop>. These kinds of modes through they will require operational regulations, they will also need to be mandated to use clean, green, and safe energy sources; especially since nuclear power seem favorable to them.

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5.6 Pipeline Transportation

In the GHGI the transport sector is defined in terms of road transport, railways, civil aviation and water borne navigation categories. However, transportation of certain products (for example primary fuels) can also be accomplished using pipelines. Within the GHGI the emissions associated with energy used in pipeline transportation and particulates released are allocated to other sectors, and are therefore not relevant to discussion in the GTS. (Source: GIZ mitigation potential analysis)

5.7 Cleaner Fuels and Technologies

Clean fuels pose an interesting dichotomy. On the one hand local air quality will improve due to the use and combustion of clean fuels. However, on the other hand, as a result of the high energy demands associated with the production of these fuels, clean fuels will significantly increase national GHG emissions.

The upgrade to a Euro V-type specification level is being pursued under the so-called 'Clean Fuel 2' banner, with earlier cleaner fuels initiatives having raised fuel specifications levels to the Euro II-type level as from 2008. Should the automotive industry drive and support initiatives pertaining to clean fuels, as mentioned above, it will have a major impact on the transport sector. This support will not only pave the way for clean fuel uptake in the transport sector but pro-actively enable a regulatory context for large-scale transport sector interventions.

In terms of reducing the use of fossil fuels, the DoT needs to actively promote investment in the production of biogas, the use of CNG, LNG, fuel cell and solar powered EVs. In addition, there is currently no policy or regulatory framework that determines the requirements, norms and standards for cleaner fossil fuels in South Africa. There is also no policy that rewards users of cleaner fuels and cleaner fossil fuels. As mentioned below, the development of these regulatory and policy frameworks is an immediate priority.

Transnet is planning for the development of LNG import facilities at the Ports of Richard's Bay, Ngqura and Saldanha. This will facilitate downstream security of future supply of natural gas for CNG demand.

The production and burning of fossil fuels is the primary cause of global warming and therefore every effort needs to be made to reduce the impact of fossil fuels.

There are two options available:

1. Reduce the use of fossil fuels.
2. Produce cleaner fossil fuels.

Strategic adding tax penalties to new fossil fuel vehicle buyers, use that money to contribute to the cost of buying green vehicles to bring the price down. Relax taxes associated with green vehicles to further

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reduce the price to below the petrol or diesel cars. Taxes to the manufactures of diesel and petrol, bring that fund across into e-mobility development in the country.

The two options listed above will enable the mobilization of the sector towards moving into a low carbon intensive approach. The DoT also needs to promote the use of biofuels within South Africa as this renewable energy source presents the potential for numerous energy security and efficiency benefits to the South African economy. The biofuels industry also has the potential to contribute significantly to job creation in South Africa.

The *Biofuels Industrial Strategy of South Africa* followed by the *Position Paper in terms of the National Energy Act 34 of 2008*, published by the DoE on 15th January 2014 which provides for a 2% (or 400 million liters per annum) dispersion level of biofuels into the national liquid fuels supply. The deadline for the mandatory blending of biofuels with petroleum was set for the 1st October 2015, in an attempt to foster a regulatory environment to enable the production of biofuels through the full and proper implementation of the final Biofuels Strategy. The above timeframes for the implementation of the Biofuels strategy have not yet be achieved.

5.8 Biogas and Biofuels

The production of biogas through growing biomass material can have negative effects on food production and water usage as a result of the hectares and water needed to produce the biomass. It is therefore not ideal. However, the production of biogas using existing waste material – sewerage, animal manure, landfills - directly at the site of the waste storage or production is financial feasible. As with biogas, there is concern around the production of biomass for biofuel production regarding food security, water usage, and the hectares in land required. Also could have negative impact on food prices. Biofuel need proper regulations. For the stated purposes of food security and environmental concern, the *Final Biofuels Strategy* proposes the production of specific crops for the production of bioethanol and biodiesel (Department of Energy, Draft Position Paper, 2014).

The DoT and DoE will establish a team to examine the cost and benefits of building biogas plants at large urban landfill sites and sewerage plants. This research will be extended to compiling a cost/benefit analysis of constructing smaller biogas plants at the sites of large buildings that house considerable amounts of people and therefore produce larger quantities of waste.

Biogas Regulatory actions:

The team of experts will also investigate and draft regulations that:

- Compel government vehicles that are directly related to waste and have every day access to biogas to use biogas as a fuel.
- In conjunction with National Treasury, draft tax incentives for the use of biofuels in the private sector. Private sector tax incentives will encourage private sector investment in biogas production.
- Develop a system for centralizing animal manure collections at regional biogas plants

SECRET**5.8.1 Compressed and Liquid Natural Gas (CNG/LNG):**

Natural Gas has begun to take a foothold in the South Africa market in both the minibus taxi industry and in the cities' Metro bus systems. While not as GHG friendly as renewable energies or pure biogas, Natural Gas produces less emissions than fossil fuels, and serves as a potential transition fuel that could stimulate biogas production by developing a potential off take market.

Cities that have converted a portion of their Metrobus fleets to run on both Natural Gas and petrol/diesel have unfortunately found that the operators of buses are loathe to refuel using CNG. They have in fact gone as far as damaging the gas pumps at depots in order not to refuel with biogas. There is some evidence to suggest that operators are motivated to damage gas pumps because they reduce the potential to syphon traditional fuels for private sale. Slippage of diesel/petrol in Johannesburg's Metrobus fleet is approximately 12%. This compares unfavourably with slippage averaging 4% in private sector logistics companies. The solution is to accelerate the conversion of Metrobus fleets into gas-only vehicles.

The DoT will capitalizing on the private sector's initiative to grow the use of CNG in South Africa by working with the Development Bank of South Africa's (DBSA) Green Fund, Department of Trade and Industry (DTI) and the Industrial Development Corporation (IDC) to make development and project finance available at attractive rates. The private sector has concentrated on providing gas-fired boiler systems and converting minibus taxis into dual-fuel vehicles.

Key is the provision of attractive or concessionary finance rates to the private sector. The private sector should be encouraged to aggressively pursue this endeavor. Aggressive communication is required from DoT (and local and provincial entities responsible for transportation) to the minibus taxi industry to highlight the benefits and cost effectiveness of CNG relative to fossil fuels.

Security of supply of CNG is crucial. Currently South Africa has no CNG reserves available other than from Mozambique. In addition, the distribution network for gas is limited. The private sector is currently using road to transport gas the last mile from the large national and provincial pipelines. Additional domestic and regional supplies of CNG are currently being investigated, including off-shore natural gas reservoirs and "fracking".

CNG Regulatory Actions:

The following initiative form the backbone of DoT's efforts to promote the use of Natural Gas:

- In conjunction with cities, DoT will draft regulations requiring 10% of the Metrobus fleets to be converted to gas-only vehicles per year.
- DoT will lead the effort to provide available funding model options upon request for the conversion of minibus taxis to dual-fuel vehicles and retrofit filling stations.
- DoT will initiate discussions with the taxi industry to promote dual-fuel conversion
- DoT will draft regulations requiring all public and quasi-public transportation vehicles to be converted to dual-fuel vehicles within 10 years.

SECRET**5.8.1.1 Cleaner fossil fuels:**

Fossil fuels are the single largest contributor to GHG emissions in the transport sector. (GHGI, DEA, 2014) In order to meet the government's global commitments low carbon intensive fuel requirements will have to be imposed on the sector.

Cleaner Fossil Fuel Regulatory actions:

- As the mandated entity for drafting fuel regulations, the Department of Energy will be engaged regarding drafting regulations requiring refineries to produce fossil fuels that meet new standards and norms required with regard to emissions profiles. The methodology may be similar to the Air Quality Control Act.

5.8.1.2 Electric Vehicles (EVs)

Currently the market share of EVs in South Africa is minimal, however this number is expected to grow exponentially to make a meaningful contribution to reaching GHG reduction targets. Given the fossil fuels associated with electricity production and the pressures on South Africa's electrical power generation and distribution systems, EVs should be charged via renewable energy and in future may even assist as back-up power sources to households and grid feed through their batteries. Solar power is responsible for very low GHG emissions (primarily associated with the manufacture of photovoltaic cells).

In addition, according to research conducted by SANEDI (2014), despite the higher up front cost of an EV, the lifetime cost of the EV is below that of a conventional car as a result of the inexpensive electrical (solar) refueling. Secondly, with increased demand and production, and the advancement in battery technology, the high up-front costs are expected to decline.

Electric Vehicle Actions:

In order to radically grow the uptake of EVs in South Africa DoT, in conjunction with DTI and National Treasury, will:

- Consider removing or relaxing import duties on electric vehicles, particularly the classification of electric vehicles as luxury imports, in order to stimulate the experience and local capacity development in relation to these technologies.
- Offer producers of EV vehicle manufacturing incentives to both produce and sell affordable EVs in South Africa, for the local and export markets.
- Work with local research institutions to conduct research on EV batteries.
- Work with national, provincial and local government departments and authorities and the automobile industry to set annual targets for the uptake of electric vehicles and hybrid electric vehicles in the government vehicle fleet as well as monitoring the local content of the manufacturing of cars locally, in line with IPAP.
- Introducing the conversion of old technology vehicles, with higher emission factors to be retrofitted with EV technology.

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- Consider providing Incentives related to the beneficiation of using local resources in the manufacturing of key machineries and or components (e.g. fuel cell).
- Assist in establishing and developing local EV OEMs.

6. COMMUNICATIONS STRATEGY

Behavioral Change on the part of both consumers and service providers has a critical role to play in reducing the environmental impact of transport. Communication to support the GTS need to be based on evidence about consumer decision-making in relation to modal shifts in transport, promoting the uptake of eco-mobility and NMT, and introducing efficient vehicle technologies. For instance, consumers are more likely to investigate transport options when planning key life decisions around employment, education and moving home.

A further instance in which behavior change is important to both public and public transport is in relation to driver training. Appropriate driving techniques and vehicle maintenance can result in reduced transport emissions, and these need to be communicated to both service providers and consumers – for instance, through the system of licensing public and private drivers.

At the same time, consumers need to be well informed of the importance of transport in relation to the environment and made aware of the benefits of public transport, particularly as public transport infrastructure and services are improved and expanded. This needs to come as enforced compulsory educational modules at Lower to tertiary education as a fashionable and saving way of life. Parents tend to easily change rules when they favor and are driven by their children. Tertiary leavers have a huge uptake in buying new cars, if we change the mindset before acquisitions we are more likely to win vs. owners of vehicles, which would more likely comply to penalties than willingly contribute.

Strong public relations campaigns will need to be run in order to encourage the modal shift desired especially shifting the public to public transportation. Each regulatory action will also need to be fully communicated with stakeholders in order to drive buy-in and compliance. Banks are good drivers of campaigns as people spend time at banks and have enough chance to read about messages than on highway billboards or TV/Radio/Internet. It's similar to advertising on toilet seats as people don't pass a day without going there, which then transfer the message repeatedly.

7. THE SUSTAINABLE TRANSPORT PROGRAMME

The SUT Programme will be the implementing vehicle for the GTS. The programme envisions promoting the implementation of SUT measures (Avoid – Shift –Improve) at local level that align with national goals (e.g. National Climate Change Response White). The SUT programme will bridge the gap between the policy making at the national level and the implementation at the local level.

The implementation of the GTS is intended to be in a two phase cycle.

- The first phase is to establish a national programme (imbedded within the core elements of the GTS) and

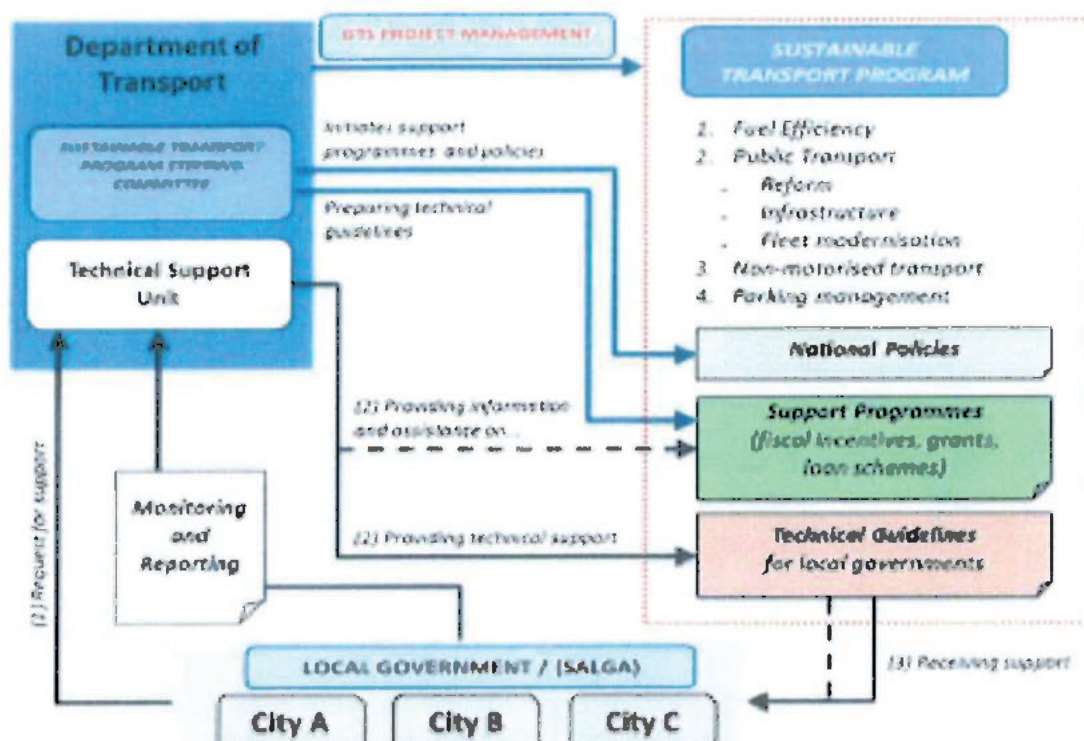
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- The second phase will then focus on the implementation of direct mitigation measures on the local level.

During **Phase 1** the following outputs are foreseen. These activities can be summarised as **supportive measures** to enable the implementation of mitigation actions in urban areas in South Africa.

1. Establishment of a Technical Support Unit (TSU) for SUT Programme;
2. Organizing a knowledge-sharing platform among all spheres of the Government on SUT & public;
3. Making improvement on the MRV capacity, aiming for a national harmonized approach;
4. Supporting Metropolitan municipalities and Cities during design and implementation of SUT measures;
5. Promoting the improvement of (national) legal framework in the context of SUT; and
6. Creating and coordinating access to financial resources to support implementation of SUT measures.

The national programme will support local governments in their actions towards an environmentally-friendly transport system. Therefore a comprehensive mechanism needs to be established to ensure successful implementation of the measures and the coordination among all stakeholders. One key intervention of the Sustainable Transport Programme of the DOT will be the coordination and distribution of lessons learnt and best practices among the cities/metros involved.



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7.1 NATIONALLY APPROPRIATE MITIGATION ACTIONS (NAMA's) PROGRAMME

As part of the mitigation efforts for the reduction of emissions, the concept of Nationally Appropriate Mitigation Actions (NAMAs) was introduced under the UNFCCC and is seen as a useful instrument for mitigation action in developing countries (GIZ, 2014). NAMAs are voluntary measures that are taken by developing countries and reported by national governments to the UNFCCC.

A NAMA is defined as "any action that reduces emissions in developing countries and is prepared under the umbrella of a national governmental initiative with the aim of achieving a reduction in emissions relative to 'business as usual' emissions by 2020 (GIZ, 2014).

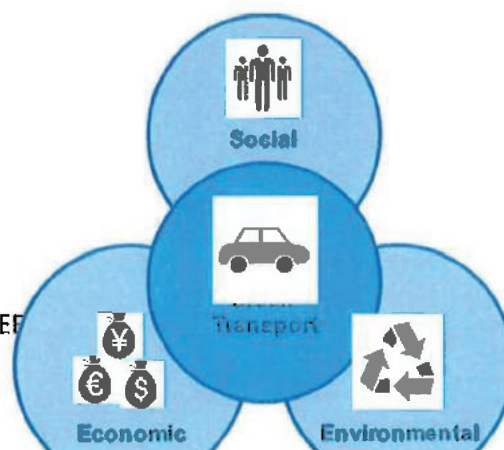
Table 8: Proposed NAMA's List for Transport (Source: DOT)

SHORT TERM NAMAS	MID TERM NAMAS	LONG TERM NAMAS
<ul style="list-style-type: none"> • Improved Bus Rapid Transit Systems in SA • Gautrain Expansion • Taxi Modernisation and Conversions • Uptake and Promotion of Eco Non & Motorised Transport 	<ul style="list-style-type: none"> • Fuel Economy Standards • Fuel Switch • Updated Fuel Regulations • Modal Shift form Road- to- Rail 	<ul style="list-style-type: none"> • Integrated Urban Planning • Integrated Public Transport Networks • Behavioral Change • Economic Incentives

The Department of Transport has committed to a NAMA's programme. The NAMA's in the table above are a representation of the 'scope of work' that has been identified and will be further elaborated on and finalised as a result of further work done by the DoT, GIZ project, CSP 3, and stakeholder engagement.

8. ENABLERS AND BARRIERS

Introducing change is often difficult, especially when it concerns innovative sectors where longer-term investments are made. For this reason, it is important to identify the factors that play a



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central role in facilitating or triggering change and those that can hinder successful implementation. While the government can set appropriate policies, it is ultimately up to the private & public sector to guarantee the large-scale uptake of green transport, hence, it is important to identify enablers, barriers and drivers as they are perceived by the market and society. Public policy can then be designed in such a way as to remove barriers and strengthen enablers and drivers.

On a high-level, green transport enablers, barriers and drivers are often placed in the context of their social, economic and environmental impact. In terms of social impact, one needs to take note especially of the need to increase mobility and counter the spatial disconnect from market and jobs for less privileged groups created during apartheid. When it comes to the environment, reducing air pollution, especially in an urban context, is a direct short term need in addition to contributing to the fight against climate change in the longer run.

8.1 Enablers and Barriers

Within an enabling environment a set of interrelated conditions such as the appropriate funding, and enabling regulatory environment are in place, which impact positively on the capacity of development actors. On the other hand, barriers might at the same time exist that negatively impact on this capacity. They hamper the development of the sector in an unnecessary or uncalled for manner. Enablers or barriers may exist in relation to the current policy framework that is in place, as mapped above, or they may exist in their own capacity.

When looking at the current enabling environment of the South African green transport sector, only a limited number of enabling conditions can be identified. For example:

- From an economic perspective, the recent discovery of shale gas in the Karoo has improved the capacity for actors to develop mid- and down-stream CNG infrastructure in that the initial supply side risk of CNG over the long terms has been reduced;
- *From a social perspective*, a number of industry associations covering several aspects of the green transport value chain with the aim to, among other things, increase the level of organisation within the sector and subsectors. A good example of this is the establishment of the National Biogas Platform during the 2013 National Biogas Conference. There is collaboration between the public and private sectors supported by the German government, in this regard. Also, with the support of entities such as the IDC, a number of CNG re-fuelling stations have been established. Although still at a pilot stage, some of these stations are equipped with training and information centres, provide valuable information to the different private actors within the value chain and the public at large.
- From an environmental perspective, the South African Automotive Industry in conjunction with the Department of Minerals and Energy is introducing a standardised fuel economy and CO₂

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emission testing and labelling system for application to new passenger cars at dealerships. Previous experiences show that this should significantly improve the decisions people make in terms of environmental impact and consciousness. Continuous digital data collection is required.

As with the enabling environment, several barriers can be identified that have impact on the capacity of development actors. For example:

- From an economic perspective, the private sector is currently held back in its long-term investment in CNG and CBG supply infrastructure due to regulatory uncertainty surrounding the continuance of relative tax benefit of these fuels, which are VAT-ed, and conventional fuels, which are subject to fuels taxes. A similar problem can be found with regard to the Biofuels Regulatory Framework. As long as the government does not set the operation date of the legislation, producers will not invest in the necessary projects to manufacture biofuels, as they are not guaranteed of adequate returns to make a viable financial proposition. High upfront investment costs for green technologies also provide an obstacle, as private-sector finance is difficult to obtain in practice;
- From a social perspective, the limited range of current EV technologies and long charging times create “range anxiety” for many people and present a barrier for people to use electric vehicles.
- Generally, vehicle owners travel relatively long distances in South Africa. As such, stakeholder consultations indicate that the lack of public charging infrastructure presents a significant hindrance to the development of the sector. For gas-powered vehicles, a same argument applies in that too few filling stations are in operation. Also, several stakeholders have indicated that general knowledge about CNG for transport is lacking, i.e. people are not aware of the possibilities for use in transport. Many people that are aware, perceive gas as something flammable and dangerous, not suited for transportation;
- From an environmental perspective, policy documents aimed at promoting green transport stand alone, hampering the overall effort of improving environmental outcomes in terms of (urban) air quality and mitigating climate change. There is no high-level, integrated plan that aligns policies and regulations. This may hinder the development of the green transport sector. There is also very limited data gathering on the topic to conduct research and inform policy.

In summary, one can conclude that there are a number of conditions that in combination provide an enabling environment for the green transport sector. However, it is important to note that most of the enabling conditions are still under development and early stage at best. It is also interesting to see that compared to the green transport sector, the enabling environment of the traditional petrol and diesel sector is much larger and more developed. Moreover, several barriers exist as perceived by the market and society. These should be addressed in the future to facilitate the uptake of green transport technologies.

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On a higher, more abstract level, drivers relate to people, knowledge, and conditions that initiate and support activities aimed at developing green transport technologies and tend to link quite direct to economic, social and environmental considerations.

8.2.1 Economic

Both businesses and consumers (end users) are generally hesitant to pay the investment premium for a greener option while being uncertain about the technical and financial performance. If the greener option, however, is cheaper over its overall lifetime of use, this can be an important driver for uptake. The latter tends to be the case for green alternatives where a higher investment cost is more than compensated by a lower cost of use. This is the case when investing in a taxi conversion to biogas and subsequently reaping the rewards of a lower fuel price. A prerequisite is, however, that users need to be well informed about the green alternative they are unfamiliar with.

Treasury can also benefit by using biogas or electricity as transport fuels, as these are locally produced, as opposed to petrol/diesel that are imported at the marginal level (or are made from imported crude oil, which represents about 90 % of their manufactured value). In other words, this would represent a significant increase in local economic activity, with associated forex (balance of payment) savings and the generation of more local taxes. A typical car uses about 2-3 more fuel than the cost of the vehicle (DTI, 2016), and for higher mileage vehicles, such as minibus taxis, the fuel (imported) cost can be more than 10 times the vehicle cost.

Furthermore, the creation of a substantial demand through green public procurement and the decision of fleet owners to switch to green alternatives, can take away the challenge of suppliers of green fuels and vehicles to secure economy of scale to justify investment. This can break through the classic 'chicken-and-egg' deadlock whereby suppliers are reluctant to invest in for example biogas production while users are reluctant to switch their vehicles to biogas as one has doubts about fuel availability and are not willing to take a risk.

8.2.2 Social

Green transport technologies do not per se contribute to the economic and social mobility of people as conventional transport technologies can, in principle, fulfil the same purpose. Nevertheless, job creation

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can be a driver for the introduction of green transport alternatives. (Green transport also involves lesser negative externalities being borne by society). Especially in respect of biofuels this is the case as it requires relatively labour intensive fuel production activities by farming energy crop and/or processing biodegradable waste and energy crop to fuel. In principle, however, all alternative green transport technologies have a job creation potential as new infrastructure has to be developed, but however on the downside there is also a potential of the green technologies leading to some job losses which in retrospect can be countered with the job creation that the industry will create.

Although on its own, environmental benefits do generally not constitute a decisive driver for businesses to act, it can if it comes together with envisaged future regulation making the continuation of conventional transport more difficult and/or costly. An example is the city of Paris which does not allow cars registered before 1 January 1997 in the city centre streets from Monday to Friday, from 8am to 8pm. Business stakeholders have indicated that from a strategic standpoint, long term protection of the 'license to operate' is a driver behind greening of transport particularly in case of urban transport and taxis. Global practice shows that only a small percentage of consumers will opt for the green choice on the merits of the contribution to improve the environment. (DTI, 2015)

9. GREEN TRANSPORT FUNDING/ FINANCING OPTIONS

9.1 Options for financing green transport and economic incentives

To support green transport, there is increased recognition of the need for reforms to current financing patterns and to consider financial options that help to bridge the financing gap between conventional and low, carbon green transport technologies. It is vitally important that transport investments are appropriately screened according to specific sustainability criteria to ensure that sufficient resources are channelled towards low carbon, green transport. This would ensure that:

- Adequate funding is made available for green transport technologies, capacity building, operations and infrastructure such that the additional costs of these investments can be recovered.
- Resources are shifted from supporting unsustainable forms of transport towards green transport, and that additional financial resources are mobilised and scaled up.
- Public funding at all levels including international, national and local funds are mobilised to support green transport. Decision making tools such as project appraisals and cost-benefit analysis should be reformed to ensure consistency with supporting green transport by efforts to monetise the non-market environmental costs and benefits of specific projects.
- Private finance is leveraged through appropriate design of markets and the creation of consistent, long term incentives to invest in green transport and the application of public-private sector models to directly invest in and operate green transport systems (such as the bus rapid transit systems).

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- Financing flows from various sources are designed to complement each other, rather than work towards different goals.

The Department of Transport in consultation with National Treasury, Department of Energy, and Department of Environmental Affairs shall consider and select the financing options that will have in increased benefits to the environment.

Table 9: An overarching policy framework to support low carbon, green transport

Policy Instrument	Strategy response			
	Avoid		Shift	Improve
Planning	High density mixed land-use developments Restrictive parking standards Car-free settlements	<i>Planning and regulatory cross-cutting instruments through planning legislation and infrastructure provision. Development of freight hubs/ consolidation points</i>	Integrated public transport High density mixed spatial planning. Investment in passenger transport through land use planning. Infrastructure for NMT Road freight to rail and sea Travel planning through planning process	n/a
Regulatory	Parking restrictions and availability Vehicle access		Traffic management measures including: parking restrictions, access restrictions on the type of vehicle that can be used Regulation of transport providers	Vehicle emission and fuel efficiency standards. Set and enforce speed limits Restrictions based upon emission e.g. low-emission zones
	<i>Parking restrictions can be used to avoid and shift</i>			
Economic	Fuel taxes, vehicle taxes Road user charges, parking charges, emission trading	Subsidies alternatives modes Fuel taxes, vehicle taxes, emissions trading, congestion charging Low emission zones		Use of pricing instruments to encourage investment in more carbon efficient energy and vehicles
	<i>Fuel pricing discourages travel, encourages modal shift and encourages improved fuel efficiency</i>			
Information	Promotion of alternative to travel	Travel awareness campaigns Personalised travel planning Public transport information Increase awareness of alternatives Mobility management and marketing Co-operative schemes Travel planning	Improve driver behaviour (eco-driving) Vehicle efficiency improvements Regenerative breaking biofuel Hybrid electric vehicles, plug-in hybrid electric vehicles, and	Public awareness campaigns aimed at informing consumers about vehicle efficiency
Technology	Enable virtual interactions: virtual-	Improvements in the efficiency and quality of passenger transport		

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conferencing, remote working Travel plans introduced through planning instruments include remote working and teleconferencing		electric vehicles. Hydrogen vehicles Rail electrification	
<i>Traffic management is both a shift and improve policy measure</i>			

Source: European Environment Agency (2010) "Towards a Resource Efficient Transport System: TERMS 2009: Indicators Tracking Transport and Environment in the European Union", Copenhagen.

Due to the costly nature of transport investments, public private partnerships are increasingly being used in developing countries, such as for the operation of bus rapid transit systems (BRTs). One of the options for mobilising private sector funding is through for example, Build-Operate-Transfer Schemes which have been used successfully for channelling private resources into large infrastructure projects. In addition, several specific climate financing mechanisms provide additional funding for green transport such as the Global Environment Facility and the Clean Technology Fund of the Climate Investment Funds.

In summary, several financial streams could be used to support green transport comprising both existing sources and dedicated, specifically designed funds and mechanisms for green transport. These options are listed in table below:

Table 10: Environmental funding and finance for the transport sector

Funding stream	Potential market based instruments and sources of funding
Transport oriented funding streams (focusing on public sector funding)	<ul style="list-style-type: none"> • Fuel tax • Vehicle taxes • Parking charges • Road pricing • Public transport subsidies • Grants, loans, transfers

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"Green Funding" Streams	
	<ul style="list-style-type: none"> • Clean development mechanism • Joint implementation • International emissions trading • Global environmental facility • Multilateral / bilateral funds • Green climate fund

The use of environmental funds has grown significantly over recent years. Examples include funds that have been developed at a global level (such as the Global Environment Facility (GEF) to deal with the provision of global public goods) and at national levels to address both acute and chronic environmental issues. In assessing the role of environmental funds, the arguments are fundamentally linked to broader debates around the relative advantages and disadvantages of earmarking. In general, environmental funds can be defined as financial mechanisms or tools set up to achieve certain environmental objectives. More specifically, environmental funds can be thought of as institutions designed to channel public revenues earmarked for environmental protection purposes. Proponents of environmental funds argue that, in most cases, the funds go beyond performing the sole function of a financial mechanism and if designed properly, they can serve as important institutions in themselves, bringing together different stakeholders in society to achieve certain environmental objectives. Proponents of environmental funds argue that, in most cases, the funds go beyond performing the sole function of a financial mechanism and if designed properly, they can serve as important institutions in, bringing together different stakeholders in society to achieve certain environmental objectives.

Instrument	Description	Related Environmental Programmes
Climate Change Levy	Per unit tax on energy use. Large energy user can apply for 80% tax rebate so long as they meet negotiated energy savings targets	<ul style="list-style-type: none"> - Revenues recycled through a 0.3% reduction in pay-roll taxes (National Insurance Contributions-NIC) - Introduction of enhanced capital allowances to assist key industries - Funding of carbon trust to provide advice to business concerning energy efficiency
Landfill tax	Tax on waste being disposed of to landfills (tax on landfill operators)	<ul style="list-style-type: none"> - Revenues recycled through a 0.2% reduction in pay-roll taxes - Landfill tax credits scheme to fund waste related programmes by registered bodies (less than 6% of landfill tax revenues)
Aggregate Levy	Tax on aggregate extractions to deal with noise, visual impacts, dust and biodiversity loss	<ul style="list-style-type: none"> - Revenues recycled through a 0.1% reduction in pay roll taxes

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		- Some revenues are channelled into a sustainability fund, which promotes the use of alternatives to virgin aggregates and funds projects to reduce the local impacts of aggregates extraction.
Fuel excise duties and differentials	Tax on aggregates extraction to reflect the environmental benefits associated with different fuel levy	- No revenue recycling but some related incentives are provided through the annual budget to facilitate improved responses to the tax differentials
Graduated company car tax and annual road tax	Reformed to encourage the uptake of more fuel efficient vehicle Annual road tax linked to CO ₂ emissions	- Emphasis on altering behaviour- no revenue recycling
Green technology challenge	Enhanced capital allowances to encourage investment in energy savings technologies and more recently in water efficiency technologies.	- Measures introduced to facilitate a response to other taxes

10. IMPLEMENTATION, MONITORING AND EVALUATION

Critical to the successful implementation of the GTS will be access to funding. This document outlines a number of regulatory action that will draw in funds. However, the quantum of funding required particularly for expansion and upgrading of public transportation and the rail network will require both international and private funding.

The DoT will facilitate the following actions:

- Engage its agencies, to conceptualize the implementation of this strategy and also align the underlying directive of this strategy within their Business Plans going forward.
- Arrange preferential funding through South Africa's development finance institutions for the local private sector to participate in:
 - The conversion of minibus taxis into dual-fuel vehicles and retrofit existing filling stations or new builds to provide CNG.
 - The building of high speed inter and intra-city rail networks.
 - The support of EV local development (OEMs, Chargers, & EV innovation), EV businesses including suppliers funding, and banks buy in on EVs by structuring vehicle finance for EVs.
- South Africa's commitment in terms of the NDC were made on the condition that South Africa receives global financial and technical support. Therefore, the DoT will compile documentation to support project specific funding requests to the Green Climate Fund, the World Bank and UNFCCC.
- DoT will develop an approach to engage other aid agencies, such as the USAID's Development Credit Agency who have committed to providing the IDC and South Africa's commercial banks with guarantee and insurance products for green projects.

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10.1 Implementation Plan

The following table indicates the specific action required, details thereof, the person responsible and the timeline. *To be completed following stakeholder engagements.*

All interventions or measures need to be SMART (Specific, Measurable, Achievable, Realistic, Timely).

The timeline referred to in the Implementation Plan follows the following outline:

- Short Term: (5- 7 years)
- Medium Term: (7-10 years)
- Long Term: (10-20years)

The GTS will also go through an internal review period, every three (3) years to ensure that the strategic interventions within the strategy are being implemented judiciously.

10.2 Monitoring and Evaluation

The DoT will make use of NT's project evaluation methodology in order to prioritise projects for funding and implementation.

Each project and the data produced needs to be measured, reported and verified in order to provide critical information for the future build out and expansion of projects. There is a need for advanced ICT development and implementation to analyses historical data vs. live data to decisively envision the future. Pulling of data must not take days, it should be instant - IoT. One consolidated datacenter for all needed parameters (congestions, GIS, GPS, buy in) – CSIR can do this.

Each project will require its own measuring, reporting and verification (MRV) framework which will be developed by the person and team responsible for implementing the project. This information is critical of securing both private sector and government or donor funding. DoT will work with DEA to implement DEA's GHG MRV framework.

Output Activity	Measures	Lead Department	Supporting Departments/institution	Timeframe
Integrated Transit Systems				
Taxi industry access	Upgrade BRT infrastructure to allow taxis access to BRT-only lanes	DOT	Taxi Industry, Municipalities	(SHORT TERM)
Intelligent Transport System	Develop an intelligent transport system for central control, monitoring and information provision. ICT National transport management System (integrated Transport Information),	DoT,	DPE, Public Transport Sector, all spheres of government	(SHORT TERM)

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Output Activity	Measures	Lead Department	Supporting Departments/Institution	Timeframe
Single ticketing system	Develop smart tag enabled single ticketing system for us in public transport and taxi industry	DoT,	DTI, DPE, Public Sector, Government, PRASA, Transnet, ReaVaya, Metrorail, Metros, All Taxis (mini bus and metered)	(SHORT TERM)
Revise ITP's	Revise minimum requirements in ITP's to facilitate integration between municipal transport systems, and also include sustainable transit plans for climate resilient cities	Provincial (enforcement) and Municipal (implementation)	DOT	(SHORT TERM AND LONG TERM)
National Green Transport Databank	Develop an online portal to aggregate transport data, including innovators (companies, individuals, institutions)	DOT		(SHORT TERM)
Emission standards	Develop regulatory regime with NT for annual taxing of vehicles based on their emission standards through car licensing renewal system and new car sales	DoT,	NT, DOE, Private Sector, Local Government	MEDIUM TERM)
Non-Motorised Transport Infrastructure	Develop regulations, standards and best practice guidelines Develop and expand NMT Infrastructure	DOT	LOCAL GOVERNMENT	SHORT TERM
Travel Demand Management	Develop a regulatory policy on congestion charges	Municipalities		MEDIUM TERM
Road freight permits	Re-introduce road freight permits reflecting load capacity of freight vehicles	DoT,	NT, Private Sector, SANRAL RTMC, CBRTA, RAF, RTIA, Provincial Government	(SHORT TERM)
Green Road Infrastructure Standards	Develop Green Standards and Guidelines for construction of low-carbon climate resilient road infrastructure, including bus lanes, EV Charger Points, Bio Gas/NCG/LNG stations.	DoT,	SANRAL, Provincial Government	(SHORT TERM)

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Output Activity	Measures	Lead Department	Supporting Departments/institution	Timeframe
Rail				
Passenger Rail	Invest in improvement of PRASA services and infrastructure. Market rail to attract users. (otherwise future services like Uber will always win)	PRASA	DOT	MEDIUM TERM
Expand branch network	Restore rural branch network	Transnet, Gautrain, NT, DoT, DPE, DTI		LONG TERM
Establish Rail Economic Regulator	Rail Economic regulator will regulate rail prices (passenger and freight) and ensure competitiveness to road	DoT,		MEDIUM TERM
Fiscal incentives for rail freight	Develop tax incentives related to corporate and private spend on rail transportation	NT	DOT (SHORT TERM)	MEDIUM TERM
Cleaner Technologies	Encourage PRASA and TRANSNET to invest in the use efficient and low carbon intensive technologies such as the use of fuel-cell or solar powered locomotives, and Hyperloop	DoT, DPE	PRASA, TRANSNET	MEDIUM TERM
Rail Infrastructure Standards	Develop Green Standards and Guidelines for rail infrastructure and construction, maintenance, upgrades and materials	DoT,	PRASA, Transnet, Metrorail, Gautrain, NT, DPE,	SHORT TERM
Maritime and Aviation				
Biofuels as alternative	Expand on existing pilots for the use of biofuels in aviation. Strengthen regulatory requirements for biofuels mix for aviation fuel. Research on Renewable Energy (There is no reason why planes can't carry solar panels since they fly above clouds the most)	DoT	SAA, ACSA (infrastructure)	SHORT TERM
		DOE		MEDIUM TERM
Operations and Procedures (Energy Efficiency)	Review and update existing procedures	DOT	ACSA, SAA SAMSA/DAFF	SHORT TERM
Infrastructure (Energy Efficiency and Renewable Energy)	Implement rooftop PV and EE retrofits of ports and airports	ACSA SAMSA/DAFF		SHORT-MEDIUM TERM

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Output Activity	Measures	Lead Department	Supporting Departments/institution	Timeframe
Carbon Offsets	Invest in the development of carbon offset programmes for transport consumers (business and private), and continuous testing of emissions per plane with limits and penalties to those planes above limited	DOE	SAMSA/DAFF	MEDIUM TERM.
Cleaner Fuels and Technology				
Biogas transport fuel regulations	Develop regulations that compel government fleet with access to biogas to use the biogas as an alternative fuel	DoT	NT, DOE, SANEDI, Provincial Government	SHORT TERM
Alternative fuels tax incentives Focus of the private sector needs to be balanced with the public sector.	Draft tax incentives for private sector use of alternative fuels, and penalties (carbon tax when buying new cars & end of life car engine limits)	NT	DoT, DOE,	SHORT TERM
Metro-bus fleets	Draft regulations requiring 10% of Metro-bus fleets converted to gas only vehicles per year.	DoT	Local Government	LONG TERM
Dual conversion	Secure attractive finance options or private sector conversion of taxis to dual vehicles to retrofitted by either EV technology or CNG technology and retrofitting of filling stations to provide "re-fuelling infrastructure" for both these technologies	DoT	IDC, DOE, DPE, DTI, Taxi Associations	LONG TERM
Dual-fuel regulations	Draft regulations requiring all public and quasi-public transportation to be converted to dual-fuel vehicles	DoT	IDC, DOE, DPE, Taxi Associations, SANEDI, CSIR	LONG TERM
CNG Supply	Engage DOE, Sasol and Mozambique government for increased supply of CNG to South Africa	DOE	DOT	MEDIUM TERM

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Output Activity	Measures	Lead Department	Supporting Departments/institution	Timeframe
Fossil fuels	Draft regulations requiring refineries to meet new standards and norms for clean fossil fuels, (penalize buyers of new fossil fuels vehicles to fund green vehicles buyers in order to reduce the cost below fossil fuels driven vehicles)	DOE	DOT	MEDIUM TERM
Fuel economy norms and standards	Develop vehicle fuel economy norms and standards used to label vehicles	DOE	DOT	SHORT TERM
Baseline analysis	Undertake baseline analysis of government fleet to determine specifications including CO ₂ emissions	DOT	DOE	SHORT TERM
Vehicle Energy Efficiency Programme	Government will procure EV's in incremental steps per annum	DOT	DTI,NT	LONG TERM
Government fleet Procurement Guidelines	Develop guidelines for government procurement to only procure efficient vehicles, using clean technologies.	DoT	NT,DTI	MEDIUM TERM
Vehicle manufacturers	Provide trade incentives to manufacturers who supply reduced cost, high energy efficient vehicles and EV's, support local innovation through funding and promotion	DTI	DoT, NT, DPE	SHORT TERM
Electric Vehicle Batteries	Finalise the feasibility of a local manufacturer of EV batteries at a reduced cost.	DTI	DOT,DST	SHORT TERM
Electric charging stations	Expand electric charging stations powered by photo-voltaic panels by 10 per annum: accessible to general public	DTI	IDC	SHORT-MEDIUM TERM
Funding				
Preferential funding	Arrange preferential funding through development finance institutions or private sector participation in dual-fuel conversions, EVs and high speed rail networks	All relevant stakeholders		SHORT, MEDIUM AND LONG TERM

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Output Activity	Measures	Lead Department	Supporting Departments/Institution	Timeframe
Global funding	Compile documentation for project specific funding requests to the green climate fund, world bank, UNFCCC, and USAID's Development Credit Agency	All relevant stakeholders		SHORT MEDIUM AND LONG TERM

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