Green Transport Strategy for South Africa: (2018-2050)

transport

Department:
Transport
REPUBLIC OF SOUTH AFRICA

2030 NDP

DECADE OF ACTION FOR ROAD SAFETY 2011-2020

SOUTH AFRICA
MOVING SUSTAINABLY

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CONTENTS

LIST OF ACRONYMS

ACSA	Airports Company of South Africa
ADR	Formally, the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)*
ASBU	Aviation System Block Upgrades
ATNS	Air Traffic and Navigation Services Company
BRT	Bus Rapid Transit System
C-BRTA	Cross-Border Road Transport Agency
CBG	Compressed Biogas
CF2	Cleaner Fuels Programme II
CO2	Carbon dioxide
CH4	Methane
CNG	Compressed Natural Gas
COP	Congress of Parties
CORSIA	Carbon Off-setting and Reduction Scheme for International Aviation
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
DST	Department of Science and Technology
DTI	Department of Trade and Industry
EDD	Economic Development Department
EEZ	Exclusive Economic Zone
EVs	Electric Vehicles
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GHGI	Greenhouse Gas Inventory
GIS	Geographic Information Systems
INDC	Intended Nationally Determined Contribution
GTS	Green Transport Strategy
ICAO	International Civil Aviation Organisation
ICT	Information and Communication Technologies
IDC	Industrial Development Cooperation
ICE	Internal Combustion Engines
IMO	International Maritime Organisation
IoT	Internet of Things
IPAP	Industrial Policy Action Plan
ITP	Integrated Transport Plan
IPTN	Integrated Public Transport Network
IPPC	Intergovernmental Panel on Climate Change
LNG	Liquefied Natural Gas
ktCO2e	kilo tons of Carbon Dioxide equivalent
LPG	Liquefied Petroleum Gas
MARPOL	International Protocol for the Prevention of Pollution from Ships
MRV	Measurable Reportable Verification
NAAMSA	National Association of Automobile Manufacturers of South Africa
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
NMT	Non-Motorised Transport
NT	National Treasury
OEMS	Original Equipment Manufacturers
PBN	Performance-based Navigation
PHEV	Plug-In Hybrid Electric Vehicles
PICC	Presidential Infrastructure Coordinating Commission
PRASA	Passenger Rail of South Africa
RAF	Road Accident Fund
RTIA	Road Traffic Infringement Agency
RTMC	Road Traffic Management Corporation
SAA	South African Airways
SACU	South African Customs Union
SADC	Southern African Development Community
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
SARPs	Standards and Recommended Practices
SOEs	State Owned Enterprises
STP	Sustainable Transport Progamme
SUT	Sustainable Urban Transport
TSU	Technical Support Unit
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
USTDA	United Nations Trade and Development Agenc

*ADRis a 1957 United Nations treaty that governs transnational transport of hazardous materials. ADR is derived from the French name for the treaty, *Accord européen relatif au transport international des marchandises Dangereuses par Route.*

LIST OF TABLES AND FIGURES

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

Emissions 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). Should these trends continue in the absence of policies and measures, the transport sector is projected to emit a total of 136 Gg CO□ 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 Chapter 2 (S24) of the Constitution of South Africa is 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.

This target is very ambitious and requires bold steps to be taken. These steps will include shifting passengers from private transport to public transport and freight 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.

Dr Bonginkosi Blade Nzimande

MINISTER OF TRANSPORT, MP


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1. EXECUTIVE SUMMARY

The movement of goods and services in time and space defines and influences economic activity. Demand for transport shapes the urban landscape and influences our peoples' spatial choices in relation to schooling, places of work, religious services; economic services such as banking, shopping and basic lifestyle requirements. Businesses, in similar ways, choose to establish themselves based on market proximity and size, and ease of transport supporting labour, goods and services. These choices contribute in ways that are either favourable or extremely compromising to the well-being of individuals, households and businesses. (National Household Travel Survey, 2013:1).

Emissions from the transport sector in South Africa account for 10.8% of the country's total Greenhouse Gas (GHG) Emissions. In addition to these direct emissions arising from the combustion of fuels, there are indirect emissions from the production, refining and transportation of fuels.

Continued growth within the transport sector, is likely to have an increasing impact on land resources, water quality, air quality and biodiversity. In urban centres transport is a major contributor to air pollution and emissions include nitrous oxides and particulates, which contribute to the brown haze we see over many of South Africa's main cities. These pollutants have a significant impact on human health, increasing risks of respiratory diseases, heart disease, lung cancer, and low birth weight (among others) – with children and the elderly particularly vulnerable. This places an even greater burden on the healthcare system with substantial medical costs.

Planes, trains and automobiles, carriages, carts and coaches from history's earliest to modern man's most sophisticated, modes of transport have changed through the ages with little attention paid to man's first step in mobility: walking. In South Africa walking is one of the most utilised forms of getting people from one place to another, but at enormous cost: financially, emotionally, morally and physically.

It is the responsibility of the DoT to contribute significantly to national economic development through a people-centred approach that creates opportunity and stimulates growth. Thus, it is the intention of the Department of Transport (DoT) to drive the goals of the National Transport Master Plan 2050 as South Africa confronts its crossroad to bring safe, efficient, reliable, affordable transport to all its people.

That makes the need for real change within the transport sector urgent and imperative.

The Department of Transport is therefore committed to making a significant impact in reducing GHG emissions. To address the significant contribution of transport to national GHG emissions, government through the Department of Transport has developed a Green Transport Strategy (GTS), which aims to minimise the adverse impact of transport on the environment, while addressing current and future transport demands. This is underpinned by sustainable development principles. The strategy will promote green mobility to ensure that the transport sector supports the achievement of green economic growth targets and the protection of 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 sustainable socio-economic development;

2. Promoting behavioral changes towards sustainable mobility alternatives through information, education and awareness raising;

3. Engaging the low carbon transition of the sector, to assist with the aligning and developing of policies which promote energy efficiency and emission control measures in all transport modes;

4. Minimizing the adverse effects of transport activities on the environment, and

5. Facilitating the sector's just transition to climate resilient transport system and infrastructure

Road transport has been identified as the primary source of transport-related CO□ emissions in South Africa, contributing 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 effect a significant reduction of emissions in the transport sector as a whole. Therefore, one of the main drives of the implementation of the GTS will be to initiate immediate interventions in this sector to directly combat the emissions. (GHG Inventory, 2014).

This renaissance trajectory will require commitment to resources: significant long-term finance and investment, as well as supplementary work to prepare detailed business plans for finance and investment in transport-related mitigation (INDC, 2015). There are broad-scale economic opportunities for growth in the public and private sector. Some of the benefits include access to employment opportunities for poor communities such as an efficiently run public transport system, access to clinics and other healthcare services and less polluted air. Similarly, improvements in transport efficiency will have positive knock-on effects for all economic sectors that make use of transport.

The main difficulty is effective implementation and sufficient funding. The challenge of developing transport policies for sustainable development is to illustrate the trade-off but emphasise the benefits and the critical urgency. We are acutely aware that environmental, social and economic costs have to be integrated responsibly to achieve this balance. (Sustainable Transport policies, 2001:17). Many of the measures required to achieve this balance are not new.

To achieve sustainable development, we need to:

- develop regulatory instruments (particularly for vehicle emissions);

- restructure taxes and provide incentives to reduce costs where possible;

- prioritise infrastructure development; and,

- educate and stimulate awareness to accelerate behavioural change

The quality of transport is our guiding principle, with a particular focus on rail services ensuring reliability across the supply chain and promotion of inter-modal services to achieve an integrated transit system.

Long-term investment is essential for the success of the Green Transport Strategy. Innovative industries or sectors within and outside of transport parameters are at the forefront of bringing about low carbon intensive initiatives. 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 enables various drivers and initiatives, while largely reducing barriers as perceived by the private sector. In practice, green transport is integral to society, the economy and the environment.

In terms of the social impact, we need to address the increase of sustainable mobility and counter the spatial disconnect from business centres, trade markets and job opportunities for less privileged groups as a national priority. When it comes to the environment, reducing air pollution, particularly in an urban context, is a direct short-term need, in addition to combating climate change in the long run. Lastly, and even more importantly, in the context of a developing economy, the economic proposition of green sustainable transport is a central factor to making green options “the spring of hope” in a commercially brimming future.

South Africa has committed to the core principles of international conventions, such as the United Nations Framework Convention on Climate Change (UNFCCC), and other conventions especially the Chicago Convention for Aviation, and the International Maritime Organisation (IMO) Convention for Maritime Transport.

The Paris Agreement outlines the following principles to 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, recognising 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 financial support 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 has been identified for implementation within the transport sector to reduce emissions and contribute towards South Africa’s GHG reduction targets by 2050.

The list of mitigation opportunities was categorised as follows:

- mplementation of the “modal shift” notion;
- Demand reduction measures;
- More efficient vehicle technologies;
- 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 resilient climate change initiatives for the sector that include joint ventures with other spheres of government and the private sector.

Transport remains a key sector to ensuring economic transformation through innovation. We must not only be responsible but responsive to the real challenges: to adjust by learning, moving forward with time and delivering sustainable solutions for a liveable future for all South Africa's people.

2. PROBLEM STATEMENT

Decarbonising transport is a significant challenge, as it is one of the major sectors where emissions are well above their 1990 levels, and have continued to increase at about 33% over the same period. They have however started to fall recently due to high oil prices and improved vehicle efficiency. More than two thirds of transport-related Greenhouse Gas (GHG) emissions are from road transport. Emissions from the transport sector in South Africa account for 10.8% of the country's total 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 consisting 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 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 are mostly 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 rai nfall 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 a vital 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 a critical factor in urban spatial planning. The historical focus on providing and maintaining 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 (NMT).

As a result, scarce urban space is allocated inefficiently. The sector has also had to confront the legacy of apartheid spatial planning which has resulted in fragmented, unequal and inefficient transport systems that require the poor to commute long distances to reach their places of work. These travel patterns impact substantially on air quality and climate change. Interventions to transform the transport sector should therefore include lessening the movement of goods and people; shifting to low carbon modes of transport and improving energy and fuel efficiency.

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

Transport systems form the backbone of South Africa's socio-economic activities through enabling the movement of people and products.

Apartheid planning and marginalisation 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 urbanisation, which is intensifying the need for access to reliable transport systems.

Demand for transport is derived from other economic activities and is directly related to social levels of wealth within a country's 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 the acquisition of more cars.

Streets become congested, especially in the cities, and more so during peak hours. Traffic congestion restricts the 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 congestion.

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 greater the number of 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 are overloaded. Overloaded trucks are also associated with safety concerns and increased 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. 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.

Figure 1 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.

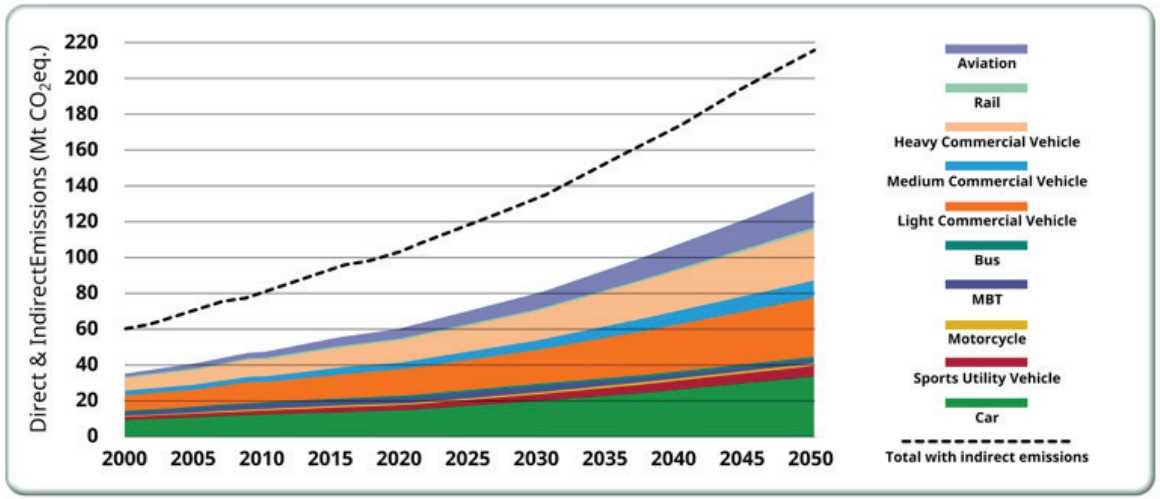

Figure 1. GHG emissions from the transport sector with existing measures (Source: South Africa's GHG Mitigation potential Analysis, DEA)

4. POLICY AND LEGISLATIVE MANDATE

According to United Nations Environment Programme (UNEP) (2011), Green transport is defined as support for 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 engenders a sustainable competitive economy, as well as balanced regional development and the creation of decent jobs) and social (e.g. allowing basic access and the 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) .

Government is developing an implementation plan (the Green Transport Strategy) that will ensure that the South African transport sector initiates 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 eliminate or minimise the use of fossil-energy over time.

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.

- Maximise 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 10 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."

4.1 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 taking 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 NDC commits the country to limiting its GHG emissions to peak at a range between 398 and 614 Mt CO2eq for 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.

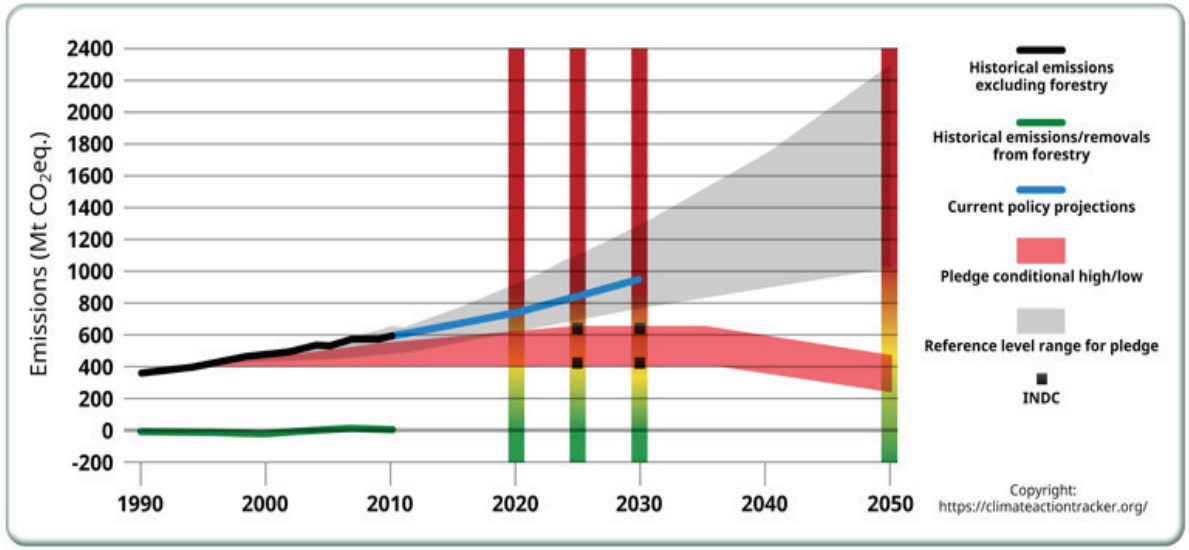

Figure 2: Analysis of South Africa's pledge to emission reduction targets based on the Department of Environmental Affairs figures for historical and projected GHG emissions

The graph illustrates that the projections for GHG emissions based on existing measures. To curb GHG emissions in South Africa will be required to significantly exceed the emissions targets outlined in our NDC.

South Africa's Nationally Determined Contributions also include 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; and
- Investment in public transport infrastructure.

4.2 Overview of National Policies

The overview of national policies focuses on outlining the current policy and regulatory framework that forms 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 that 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 marginalised service providers and cargo owners, while applying downward pressure on prices and transit times.

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

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, 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 that underpin spatial planning decisions by local and provincial authorities.

NATIONAL DEVELOPMENT PLAN VISION 2030

The National Development Plan emphasises that by 2030 investments in the transport sector will ensure that it serves as a key driver to empower South Africa and its people. These investments will enable and improve access to economic opportunities, social spaces and services, by overcoming the challenges of geographic distances in an affordable, reliable and safe manner.

PETROLEUM PIPELINES ACT

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 licences allocated. The Act prohibits manufacturers and wholesalers from holding a retail licence except for training purposes. Also, it aims to facilitate transformation of South Africa's petroleum and liquid fuels industry; ensures a system for allocation of licences, prescribes offences and penalties, and provides for appeal and arbitration platforms. It is an annexure to 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

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 as per a certain predetermined format (DTI, 2016).

PROCUREMENT RULES FOR LOCAL CONTENT IN THE BUS SECTOR

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

TRANSPORT OF DANGEROUS GOODS

The transport of dangerous goods is regulated by the South African 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 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 gazette, 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 EVs, subsequently increasing by 5%,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 lifestyle, provides safe and accessible mobility options, 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 Chapter 9 of the NATMAP Report.

NATMAP Objectives: Environmental

1. Reduce greenhouse gases and other emissions;

2. Minimise transport's impact on the environment;

3. Reduce traffic congestion; and

4. Minimise environmental impact by promoting public passenger transport, choosing optimal transport modes, using low carbon-emitting energy and renewable energy resources.

THE INDUSTRIAL POLICY ACTION PLAN (IPAP)

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.

4.3 Approach

The approach used to develop the Green Transport Strategy included both primary and secondary research. Primary research included gathering and collating information and inputs from an expert reference group, as well as inter-Governmental stakeholder and implementation workshops. Secondary research consisted of desktop research involving both national and international literature reviews, as well as extensive stakeholder consultations.

The overarching approach has been to identify a short-term draft of GHG mitigation interventions which 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 (DEA). 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 within a specified time frame.

The GTS's Approach has been informed by:

The pre-requisite 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 and innovative change

5. 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. They 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 used to compensate victims of motor vehicle accidents (NT, 2017). The Equalisation Fund levy is used as a mechanism to smooth retail fuel prices to offset 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).

5.1 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 are collected in terms of an agreement by the 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).

5.2 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). It also provides an incentive for consumers and businesses to adjust their behaviour, resulting in a reduction in 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 GHG emissions, while minimising any potential adverse impacts on low income households and industrial competitiveness. The provision of tax-free emissions thresholds and allowances ranging from 60% to 95% will result in a relatively modest carbon tax rate ranging from R6 to R48/ton CO2eq 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 under development.

It is proposed that domestic aviation will be subject to the domestic carbon-related fuel taxation, taking into account climate policies proposed under the International Civil Aviation Organisation (ICAO).

South Africa has a number of environmentally-related taxes already in place (see Table 1). Together, these tax instruments account for approximately 2% of GDP and just under 10% of total tax revenue. Environmentally-related tax revenue trends are heavily influenced by the general fuel levy, which accounts for more than 70% 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	322 cents per litre 161 cents per litre 337 cents per litre
	Road Accident Fund Levy	National	Petrol, Diesel, Biodiesel	193 cents per litre
	Equalisation Fund Levy	National	Petrol, Diesel, Biodiesel	Currently zero
	Customs and Excise Levy	National	Petrol, Diesel, Biodiesel	4 cents per litre
Vehicle taxation	Ad Valorem Customs & Excise Duty	National	All passenger light and commercial vehicles	Graduated rate based on the vehicle price with an upper ceiling of 20%
	CO_2 Emissions of new Passenger Motor Vehicles	National	All new passenger vehicles	R110/g CO_2/ km for emissions exceeding 120 g CO_2/ km
	CO_2 Emissions of new Passenger double cabs			R150/ g CO_2/ km for emissions exceeding 175 g CO_2/ km
	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	15.5 cents per litre on all fuel sales excluding foreign operators
	Airport charges	National	Landing, parking and passenger service charge	13 cents per litre Charges imposed to fund the operation of the South African Civil Aviation Authority (SACAA)
	Air Passenger Departure Tax	National	International air travel from SA	R190 per passenger R100 per passenger to 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, the potential exists 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.

5.3 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. Provinces have exclusive responsibility under the Constitution for provincial road management and traffic control. The Road Traffic Act of 1996 with its relevant regulations empowers provincial governments to impose certain road traffic fees. The Road Traffic Act fees are divided into the following categories: motor vehicle licences that include all categories of vehicles; operator licences that include setting the level of these fees and appoint registered agents to collect the fees on their behalf. Provinces also charge fees for road traffic regulation services hose 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.

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 - something which is very unlikely to substantially change within the next five years.

The environmental effects of existing environmentally-related taxes and charges need 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 current fuel taxes 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.

Table 2: Highlights of the fuel taxes on petrol, diesel and biodiesel

Theme	Instrument	Incentive Mechanism	Shortcomings and key technical considerations
Transport (National Government)	**General fuel levy**	• Increase 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	• 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 campaignS • Potentially regressive
	Vehicle custom and excise duties	• Increase the price of certain vehicles (building on the idea of a luxury tax thereby suppressing demand for passenger and light commercial vehicles • Encourage the use of public transport/vehicle sharing • Could encourage the use of selected types of vehicles/ technologies through differential taxation	• 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**	• 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	• The environmental incentive is likely to be small • Must avoid over-complication of the fee structure • Potentially regressive

(Source: EFR Policy, National Treasury, 2010)

From an environmental perspective, there is little merit in promoting diesel use over petrol. While diesel engines are more efficient than petrol engines in terms of energy production per litre, their main disadvantage is that they produce more carbon emissions than petrol engines. Hence petrol engines have air quality advantages and lower particulate emissions using basic abatement technologies. Diesel engines can have air quality advantages and lower particulate emissions using basic abatement technologies.

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 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.

In taking environmental considerations into account, it is appropriate to distinguish between the environmental costs imposed by different vehicles. This could be done according to a range of 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 the National Association of Automobile Manufacturers of South Africa (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.

6. OVERVIEW OF THE TRANSPORT SECTOR

When conducting an overview of the transport sector, it becomes imperative to compare the full life-cycle of 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 depend 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 transport systems in South Africa.

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

CO_2 (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 CO emissions from the aviation sector. Source: GIZ mitigation potential analysis*

6.1 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 offers the highest mitigation potential benefits.

Table 3 above indicates that road contributes the most significant amount to total GHG emissions from the transport sector in South Africa. 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 minibus taxis as their prime mode of transport.

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, it has started engaging with the taxi industry about introducing green initiatives into the minibus taxi industry by promoting the use and the uptake of cleaner fuels as a transport fuel for the taxi industry.

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 Green Transport Strategy will align to the following desired outcomes pertaining to 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 infrastructure , 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.

[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)

- 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 CO□ 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.

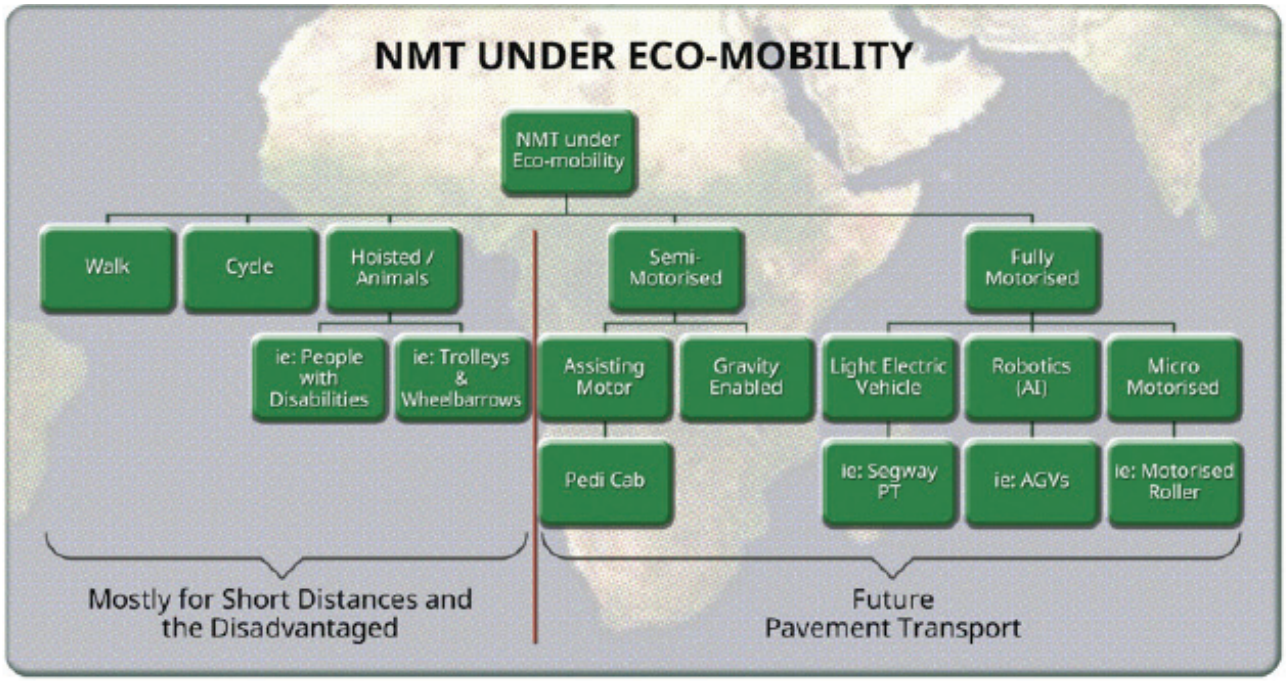

Figure 3: Showing different modes of eco-mobility including non-motorised transport

6.2 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 Shosholoza 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 2000s, a 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 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 18 Strategic Infrastructure Projects (SIPs) 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, increase freight rail volumes, grow market share of container traffic, and procure new fleets 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 modernising 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.

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6.3. Aviation Transport

Currently aviation contributes only 5% of the transport sector's GHG emissions (GHG Mitigation Report, 2014).

South African airlines currently have aging fleets and lack funds for retrofitting their current fleets 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 - in partnership with SkyNRG and Sunchem SA, is looking at using a high-energy tobacco hybrid for biofuel production for aviation. We already have a success story. The South African Airways group in 2015 operated Africa's first sustainable biofuel flight. Mango flew Boeing 737-800s between Johannesburg and Cape Town, making history as the first flights of their kind on the African continent. The flights used home-grown feedstock from the Marble Hall area in the Limpopo region. In addition to supporting the historic flight, the farming project brought job creation and economic growth to the area. South Africa is enormously proud of this bio jet fuel supply chain.

Recently Airports Company South Africa (ACSA) launched its first 200m2 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 of its airports. Over the next 18 months they are rolling out similar plants at all of their smaller airports – Kimberley, Upington, Port Elizabeth, East London and Bloemfontein.

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. These could include 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. This is also in line with reaching the Carbon Neutral Growth by 2020 from the aviation Industry as per ICAO principles.

6.4 Maritime Transport

Maritime transport is a very small contributor to transport sector emissions in South Africa: less than 2.2% (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 Organisation (IMO). South Africa is a signatory to a number of multilateral conventions relating to climate change. The IMO is also responsible for implementing measures to reduce emissions from maritime transport. It must also ensure that it continues and expands its engagement with these multilateral processes which are responsible for setting important norms or 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 - Exclusive Economic Zone), the sector is not directly subjected to the rules and regulations of the IMO. The Department of Environmental Affairs (DEA) published an inventory of GHG emissions, but this did not include South Africa's marine fisheries. However, CO2 emissions per landed tons of fish per year, inferred from a desktop exercise, was roughly estimated as 1.5 million tons of CO2 per year for the entire fishing sector, in the year 2000 (DAFF, 2016). Given that the estimated total emissions by the country for that year was 461 million tons CO2, the fisheries sector accounted for only 0.35% of CO2 (DAFF, 2016).

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's contribution to GHG emissions is only 1% of the total GHG emissions of the transport sector (GHG Mitigation Report, 2014), we still recommend that more accurate estimates of the carbon footprint of South Africa's fish trading activities be obtained. We should also monitor this. (DAFF, 2016).

In conclusion, 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 focused strategy and policy in relation to cleaner mobility and green transport to guide regulating the transport sector. We have outlined a number of measures to be carried at provincial and local level. Unfortunately, there is no framework to guide the implementation of measures at national, provincial and local levels. 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 jurisdictions (national, provincial and local).

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

Measures that have been undertaken through the International Maritime Organisation include the adoption of a marine sulphur cap of 0.5%, as provided for in the MARPOL Annex VI, as from January 2020. 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.

7. STRATEGIC FOCUS

7.1 Vision

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

7.2 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.

7.3 Values

In order to meet the county's GHG emissions reduction targets within the relatively short time horizon, the transport sector needs to implement radical changes. 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 poor people from economic opportunity
- reduce the cost and improve the convenience and safety of transport, ie. providing guidelines for favourable cost-effective future green energy technologies

7.4 Objectives of the Green Transport Strategy

- 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 sustainable socio-economic development;
- Promoting behavioral changes towards sustainable mobility alternatives through information, education and awareness raising;
- Engaging the low carbon transition of the sector, to assist with the aligning and developing of policies which promote energy efficiency and emission control measures in all transport modes;
- Minimizing the adverse effects of transport activities on the environment, and
- Facilitating the sector's just transition to climate resilient transport system and infrastructure

7.5 Purpose of the Green Transport Strategy

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

The Green Transport Strategy serves as a guide for the DoT to implement a basket of measures that will significantly:

- reduce GHG emissions produced by the transport sector;
- reduce the environmental and human health impacts associated with the transport sector, resulting in a more resilient sector; and
- reduce transport GHG emissions to contribute significantly to national efforts aimed at decrease emissions as agreed to by the South African Government at COP 21 in Paris through the NDC.

Research undertaken by 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 by the transport sector, shifting passenger choices 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 the modal shift from road to rail, private to public transport, and promotes cleaner vehicle technologies. It is also important to promote non-motorised transport and develop the associated infrastructure to support this.

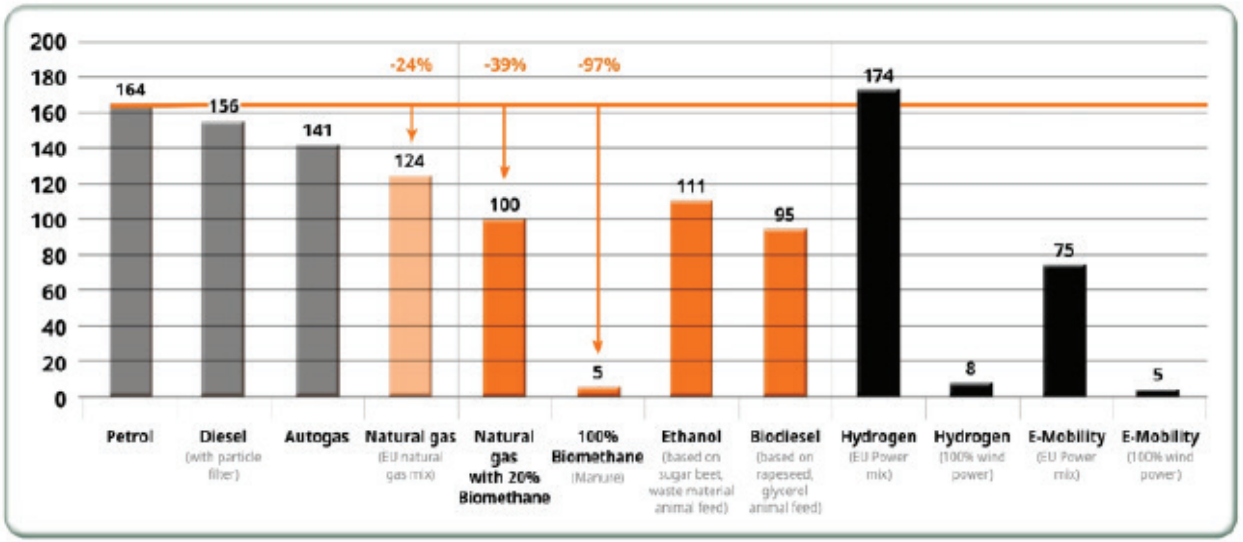


Figure 4: Comparison of GHG emissions from different transport fuels and technologies (Source: SANEDI, 2015)

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 in all spheres of Government.

7.6 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 dependent on ecosystems.

- Basic human needs must be met to ensure that the resources 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;

- reduce the impact of transport infrastructure on the environment;

- ensure integrated transport systems provide equitable access to economic opportunities for all South Africans and support economic growth and development; and,

- ensure that the provision of transport services and infrastructure includes using resources sustainably.

LONG-TERM VISION: THE USE OF RESOURCES AND SUPPORTING THE ECO-SYSTEM

- nstituting “no-car zones”, within most of the central business districts being closed off for car use, and emphasising eco-mobility 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 National Freight Logistics Strategy, will be restricted to rail, with the 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 from domestic, commercial and agricultural waste

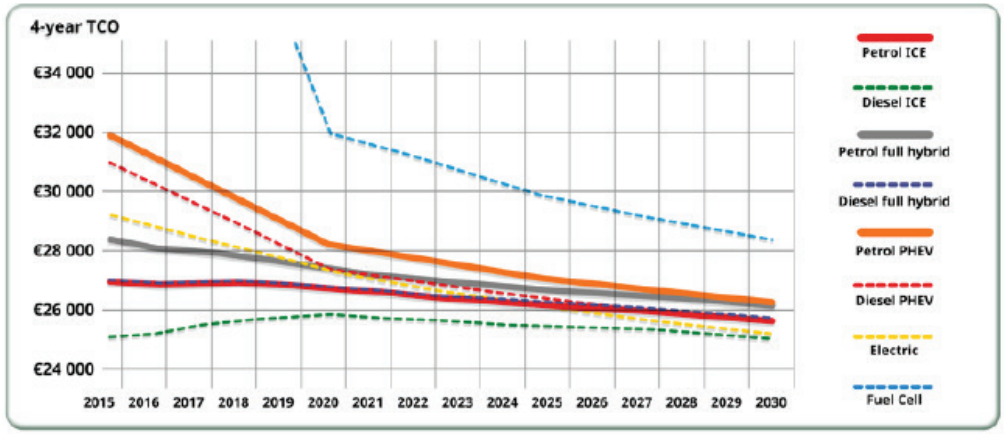


Figure 5: Showing change in cost of different fuel types (cost to improve the convenience and safety of transport)

7.7 Strategic Pillars and Implementation Themes

The Green Transport Strategy is based on:

- 5 implementation themes and
- 10 strategic pillars.

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 jurisdictions
Green Roads	2. Shift car users from INDIVIDUAL private passenger cars to public transport, including rail
	3. Provide infrastructure to promote NMT and eco-mobility transport
	4. Provide transport infrastructure in a manner supportive of the eco-system, while not dearly compromising generations to come
Green Rail	5. Extend the rail network to provide reliable, safe and affordable high-speed transport while switching to renewable energy trains
Green transport technologies	6. Reduce the carbon footprint and over-reliance of petroleum based fuels, by decarbonising the transport sector
	7. Promote alternative fuels such as Compressed Natural Gas (CNG) or biogas, and liquid biofuels as transport fuels
	8. Promote electric and hybrid-electric vehicles
Green Fuel Economy Standards	9. Develop **"Green Procurement Guidelines"** to promote efficient, and low carbon vehicle technologies
	10. Provide norms, standards and regulations that promote green fuel economy in vehicles and improve emission standards of fuel in South Africa

Table 4: Strategic pillars of the Green Transport Strategy

The short-term strategic targets listed below form part of the "quick wins" for the strategy. They will essentially form part of the first phase of the Implementation Plan: 5 to 7 years.

1. 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 a 20% shift of passenger transport from private cars to public transport and eco-mobility transport.

2. To convert 5% of the public and national sector fleet in the first seven years of the implementation of this strategy and an annual increase of 2% thereafter, to **cleaner alternative fuel and efficient technology vehicles (ideally powered through renewable energy) and environmentally sustainable low carbon fuels by 2025**, 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 promote strategies and standards for **delivering transport infrastructure, integrated transit planning and systems that build climate resilience** in urban and rural communities, whilst minimising **the environmental impact** of transport infrastructure.

5. To develop best practice guidelines to ensure that integrated, climate- friendly transport options are incorporated into land use and spatial planning at national, provincial and local levels.

6. Invest in sources of green energy's infrastructure, such as biogas filling stations, electric car charging points, GIS integrator ICT technology platforms for locating stations, regulating future pricing and providing statistics.

8 STRATEGIC INITIATIVES

The GTS focuses on 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", while strategically involving youth in the planning and design of future models, through institutions of learning and regular engagements.

The IUDF and NSDF present the spatial development vision for the country, thus giving direction as to where development and infrastructure investment is/ and or will be concentrated. The IUDF emphasizes the importance of urbanization and space, therefor the IUDF seeks to unlock the potential of urban areas by implementing interventions that augment the spatial transformative, economic growth, poverty alleviation and inclusive impacts of urbanization. In order to help achieve this, the GTS has created a platform to incorporate and unpack the following policy levers of the IUDF, such as:

a. integrated urban planning and management,

b. integrated transportation and mobility,

c. integrated and sustainable human settlements,

d. integrated urban infrastructure, and

e. efficient land governance and management systems.

The GTS must also locate and relate initiatives in Municipal Spatial Development Frameworks required interns of the Spatial Planning and Land Use Management Act, Act 16 of 2013. Currently the GTS ought to cite the BRT systems as not only a means to achieve modal shifts, but also to realise spatial transformation and economic growth. Here the bottom up and top down processes that ensures mutual reinforcement of local and national policies will be critical. The roles of provinces and municipalities in ensuring that the GTS is incorporated into spatial plans, land use schemes and related policies must be emphasised and vice versa. This is also in line with the Sustainable Urban Agenda which aims to:

- support better coordination between transport and urban and territorial planning departments in mutual understanding and policy frameworks ant the national, subnational and local levels, including through sustainable urban and metropolitan transport and mobility plans,

- strengthening sustainable transport and mobility by ensuring connectivity between cities and their surroundings,

- generating and using renewable and affordable energy and sustainable and efficient transport infrastructure and services,

- renewable energy costs give cities and human settlements an effective tool to lower energy costs

- adopting a "smart" approach that makes use of opportunities from digitilisation, clean energy and technologies, as well as innovative transport technologies

- improving road safety and integrating it into sustainable mobility and transport infrastructure planning design,

- promoting access for all to safe, age- and gender- responsive, affordable, accessible and sustainable urban mobility and land and sea transport systems, enabling meaningful participation in social and economic activities in cities and human settlements, by integrating transport and mobility plans into overall urban and territorial plans and promoting wide range of transport and mobility options, and

- establishing urban and territorial transport infrastructure and service funds at the national level based on a variety of funding sources ranging from public grants to contributions from other public entities and the private sector, enduring coordination among actors and interventions as well as accountability.

Through the execution of the GTS, and its initiatives it's important to be non-prescriptive with the outcomes/principles of technology within transport, as this will allow for innovation in pursuit of an emission lowering outcome for the transportation sector.

8.1 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. This 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 - nationally, provincially and locally. One option is for the Minister to prepare such guidelines in terms of the provisions of the Spatial Planning and Land-Use Management Act 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 via 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 transport networks and integrated transport 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 expands. The team of green transport integration experts will also consult to the Strategic Integrated Projects throughout their planning and execution.

8.2 Road Transport Initiatives

The road transport sector contributes approximately 91.2% 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 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 deteriorating transport assets, resulting in increased 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 freight transport has continued to increase with heavy goods vehicles (HGV) making up 34% of traffic on the N3. HGV accident levels on the route are the same as light vehicles. There is deteriorating infrastructure in all modes and restricted capacity to fund maintenance, upgrading and modernisation 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 over-usage of the road infrastructure (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 are made to expand the public transport network, while making public transport available, affordable, convenient and easily accessible. Modal shift from private passenger cars to public transport has the potential to significantly reduce emissions from the road sub-sector, by emphasising the use of and expansion of services such as the BRT services, and passenger rail systems, 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 (Table 4), as well as 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

Source: GIZ mitigation potential analysis on behalf of DEA 2014

	2020		2030		2050	
Modal shift	$ktCO_2$	R/tCO_2	$ktCO_2$	R/tCO_2	$ktCO_2$	R/tCO_2
Road – passengers, private 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

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

The proposed tax on new vehicle sales (fuel-based) will be used to contribute to the cost of procuring green vehicles to ultimately bringing the price down.

The relaxing of taxes associated with green vehicles to further reduce the price to below the petrol or diesel vehicles is also another suggestion, Taxing diesel and petrol manufacturers is another possible way to fund e-mobility development in the country.

8.2.1 Road Passenger Transport

The GTS aims to assist with developing policy, regulatory norms and standards, fiscal instruments and recommendations essential for achieving 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 is required.

- **Bus rapid transit** systems need to be significantly expanded throughout the large cities. Security, reliability and frequency of BRT systems also need to be improved.
- The taxi industry, a major component of the transport sector, 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 including the minibus industry can be monitored by metropolitan control centres through GPS, GIS and IoT connectivity. The intelligent transport system will provide information to the public about congestion, stations available, transport options, as well as arrival/departure times throughout South Africa's large urban cities.
- **A single ticketing system** should be developed, where the public can use smart tags as the payment mechanism. The smart tag will be swiped on entry and exit of the public transport system. It could 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. Non-motorised transport infrastructure, namely the building of cycle lanes along key transport routes and improved pavements walkways 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 use non-motorised transport as their primary mode of transport and to capitalise on the growing public desire for non-motorised 'green' transport.
- The **planning and design of transport infrastructure expansion must consider future eco-mobility developments.**
- Government will work with the private sector to expand 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:** 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, 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, CO emissions
  - technology adoption – fuel type, transmission, air intake

Commodity Characteristics	Commodities	Annual Tons	Typical origins	Typical destinations	Modal Usage %		Primary reason for modal choice	Rail	Road
		mtpa			Rail	Road		mtpa	mtpa
Bulk - Coallink	export coal	76.3	Mines	Ports	100	0	Full rail facilities	76.3	0.0
Bulk - Orex	export iron ore	59.7	Mines	Ports	100	0	Full rail facilities	59.7	0.0
Bulk - GFB	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
	other minerals	8.6	Quarries	Smelters	81	19	Some rail facilities	7.0	1.6
	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

- The Department of Agriculture, Forestry and Fisheries and DoT, will jointly develop a rehabilitation plan focusing on a tree-planting initiative within and around major cities, focusing on 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 behaviour change initiatives such as eco-driving.

8.2.2 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 an intended life cycle, but with the impact of the traffic load, as well as the environment (heat, cold, rainfall etc.) the deterioration rate is accelerated.

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. More importantly as seen in Table 6, the need for modal shift of some commodities is a necessity for improving the efficiencies of both modes, and also for managing 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 a strain on the national fiscus due to increased capital and maintenance costs of road infrastructure, as well as demands on the private sector, as the cost of road transport has been increased (Freight shift from road to Rail Report, DEA, 2014)

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

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

South African roads are under more pressure from increased freight and passenger transport within the Southern African Development Community (SADC) region. South Africa has the largest ports and provides important transit corridors to the SADC region. The pressure 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 assist with the development of regulatory and policy frameworks for levying a congestion charge on vehicles entering central business hubs. International best practice with regard to congestion zone taxing will be taken into account. Congestion zone taxing, however, will require supporting infrastructure – park and rides, integrated eco-mobility transport facilities, as well as 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 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.
- Enhance the regulatory regime to include a three-yearly test on vehicles that covers roadworthiness and exhaust emissions. The test certificate will need to be produced every three years of car licensing renewal. 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. Baseline studies on the implementation of more stringent fuel economy standards (such as Euro V) should lead to the adoption of appropriate greener standards.
- ntroduce car life cycle limits on the road, i.e. a car with an engine more than 400 000km must be banned from the road, or scrapped (e.g. propose a similar program such as the taxi recap).
- In consultation with cities, DoT will assist with the development of regulations to ensure that freight vehicles may only enter urban hubs during off peak hour

- Research will also be conducted into the viability of re-introducing “Road freight permits” in South Africa with permit pricing reflecting the emissions for tonne cargo of freight vehicles, as well as road-use charges to internalise the externalities of possible overloading from freight haulers.

- 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.

8.3 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. This vision could revitalise rail in South Africa through investment in a small high-performance new network that can set extra-urban railways on a renaissance trajectory and expand funding sources through private sector participation. Rail is far superior from a direct emission mitigation perspective than road transport.

Direct emissions from the rail sector contribute only 1.6 % of all transport emissions (GHGI, DEA, 2015). However, this figure excludes emissions from electricity consumption. There are accordingly significant investment costs required to actualise the modal shift required for achieving the sector’s reduction figures. These costs can be covered by extracting taxes and penalties from the emitters of GHG and reinvesting these funds into modal shift initiatives.

8.3.1 Passenger Rail Transport

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

- Invest in the improvement and development of PRASA’s (passenger rail) infrastructure and services.

- Restore and revitalise the rural branch line network.

- Drawing from the Gautrain model, expand and upgrade rail networks into all urban areas.

- Increase frequency, digital information connectivity (IoT), and reliability and safety levels for passengers.

- Secure local and global private sector participation in high-speed networks.

- Conduct research to appropriately tax the road transport sector for road maintenance.

- Develop a system to incentivise corporates and private sector spend on rail transport.

- Encourage PRASA to investigate a move towards fuel-cell and solar powered locomotives in a shift to using low carbon energy sources.

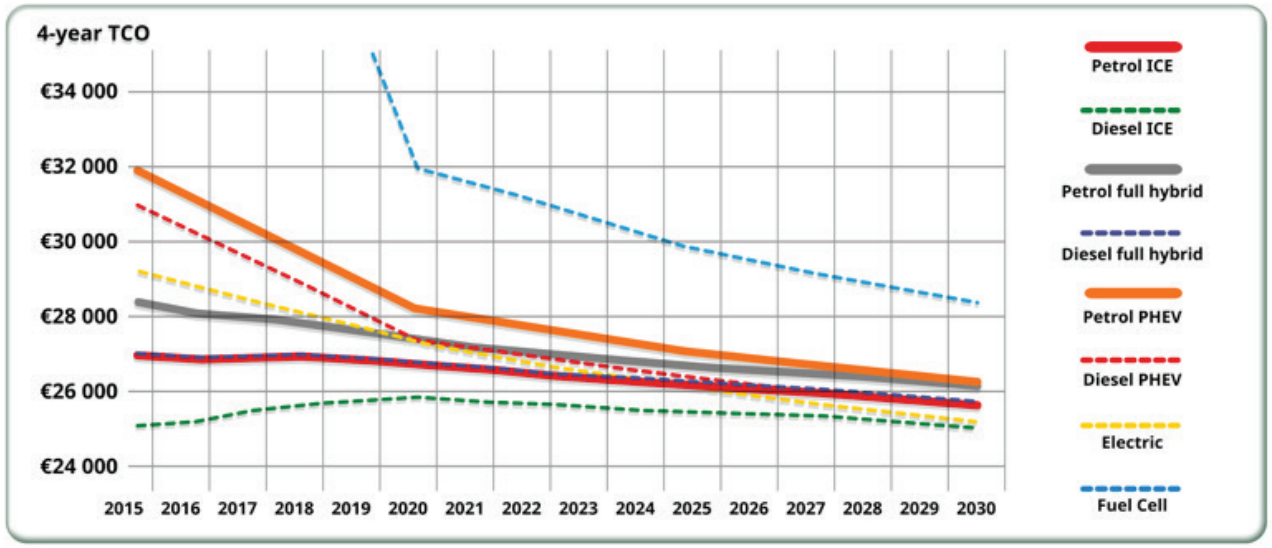


Figure 6: Showing Fuel Cell future estimated cost compared to other technologies

• 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.

8.3.2 Freight Rail Transport

• Increase frequency, digital information connectivity (IoT), reliability and safety levels for freight.

• Design a pricing system that is competitive with road transport.

• Develop tax incentives related to corporate and private spend on rail transport.

• 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.

8.4 Aviation Transport Strategic Initiatives

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 estimation of baseline fuel consumption and CO2 emissions for international aviation within South Africa 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 CO2 emissions. In order to contribute towards the global ICAO goal of Carbon Neutral Growth (CNG) 2020, South Africa selected measures to begin the implementation process. 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).

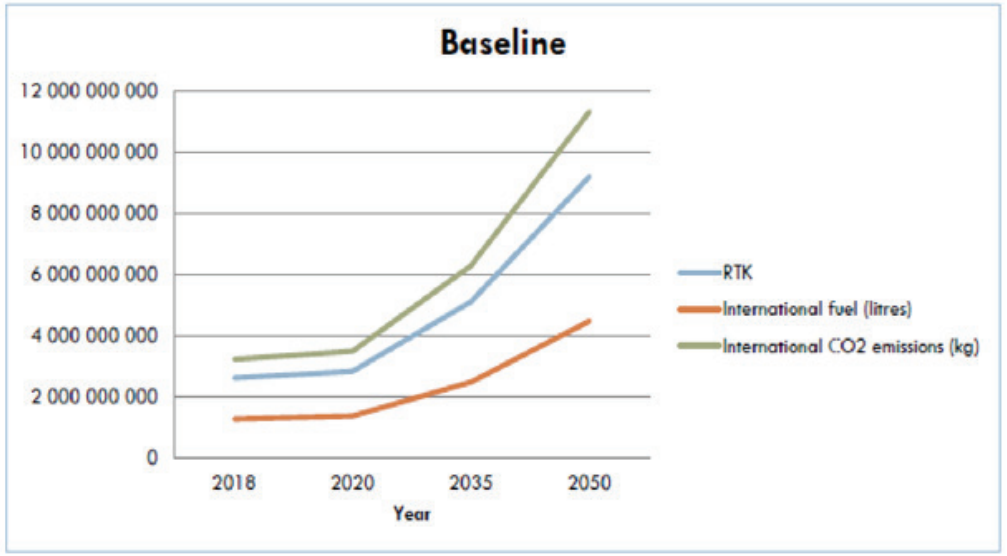


Figure 7: Absence of measure baseline in Aviation for S.A (Source: DOT State Action Plan: 2016)

The International Civil Aviation Organisation (ICAO) is a UN specialist 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 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. The plan is at an advanced stage of implementation due to the country's Performance-based Navigation 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; this reduces fuel burn, emissions and words 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.

Collaborative initiatives such as the United Nations Trade and Development Agency (USTDA) airside capacity study; facilitate 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.

Airports Company South Africa 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 programme 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 recognised among some of the most 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, making history as the first sustainable biofuel flights to have taken place in Africa. South Africa 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. We need assistance in various research areas that have a role to play in ensuring CNG 2020. Heavy involvement of youth in innovation is critical to designing a suitable future for them.

- Education

Training on collection, monitoring, reporting and verification of data is required, in addition to filtering through to lower levels of 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 upscaling 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 experts - both locally, as well as some through the German government SES programme - http://lang.ses-bonn.de/en/.0

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.

8.4.1 Carbon Off-setting and Reduction Scheme for International Aviation (CORSIA)

ICAO's CORSIA aims to achieve Carbon Neutral Growth by mitigating aviation emissions above 2020 levels, through the purchase of carbon offsets. Starting in 2021, the system will be implemented in three phases: voluntary pilot and first phases from 2021 to 2026, and then a mandatory second phase for states accounting for approximately 75% of traffic growth from 2027 to 2035. The mandatory phase is implemented through a dynamic approach, in which the offsetting requirement for a given carrier transitions from the industry average to the growth rate of that airline. The original measure, developed during the 38th Assembly, proposed a mandatory phase starting in 2021. To address concerns from less developed countries, the finalised measure pushed the mandatory second phase to 2027, adding two voluntary phases: a pilot phase from 2021–2023, and Phase 1 from 2024–2026. **As of January 30, 2017, 66 member states, representing about 64% of global traffic as covered by CORSIA, have pledged their participation in the pilot phase.** Countries choosing to opt-in later may still do so, and any countries participating in the voluntary phases can later choose to opt out with six months' notice to ICAO. (ICCT, 2017)

The mandatory phase, starting in 2027, will apply to all member countries, with exceptions for developing countries and small markets. Small Island Developing States (SIDS), Least Developed Countries (LDCs), and Landlocked Developing Countries (LLDCs) will be exempt from the measure - unless they choose to opt in. The same will hold true for countries whose 2018 global aviation activity market share is less than 0.5% of the global total or is not within the 90% cumulative share, from largest to smallest, of all international aviation activity in the form of RTKs.

The offsetting obligation will begin based on the sectoral growth rate, in which all air carriers purchase offsets for emissions that are consistent with the average emissions growth rate of the entire sector since 2020. Starting in 2030, the offsetting obligation will transition to an individual approach, where unique air carriers offset some portion of their own individual growth since 2020. Starting in 2022, ICAO plans to review the measure every three years to adjust as necessary. A final review will take place in 2032, when ICAO will decide whether to extend CORSIA beyond 2035.

CORSIA establishes a framework under which airlines will purchase carbon credits from other sectors to offset most emissions above 2020 levels. Thus, the impact of the system on both net (in-sector emissions minus offsets) and absolute in-sector aviation emissions will depend on the criteria used to determine offsets eligible for use under the system and, correspondingly, the cost of those offsets. Because those criteria are still under development, it is difficult to definitively assess the impact of this system on absolute emissions until the criteria are finalised.

The CORSIA approach could impact absolute aviation emissions if the direct offsetting costs are high enough to promote further fuel efficiency improvements or to raise ticket prices enough to reduce demand. One approach to estimating the effect of CORSIA on efficiency is to compare the direct costs imposed by CORSIA to the underlying cost of fuel. The cost of the offsetting required by CORSIA depends on the price of offsets, the year of implementation, the growth rate of a given airline, and the fraction of the offsetting obligations based on the individual airline's growth, as opposed to the sectoral growth.

Within ICAO's approach to reduce CO2 emissions from international aviation, which includes promoting operational efficiency improvements, more efficient aircraft and engine design, and low carbon fuels, CORSIA is meant to act as the final "gap filler" to offset any remaining post-2020 emissions growth (ICCT, 2017). With current exemptions, however, CORSIA will cover, at most, 75% of traffic growth not reduced by the other measures. Because the coverage gap resulting from these exemptions will not be redistributed to participating carriers, the CNG 2020 goal is not expected to be met, regardless of low carbon fuel use or operational and design improvements. CORSIA applies to CO2 emissions growth from international aviation only. It does not apply to domestic aviation, which was responsible for 30% of aviation traffic in 2014. CORSIA also does not address the non-CO2 climate impacts of aviation, notably methane, nitrous oxides, black carbon, and the precursors of AIC.

8.5 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.

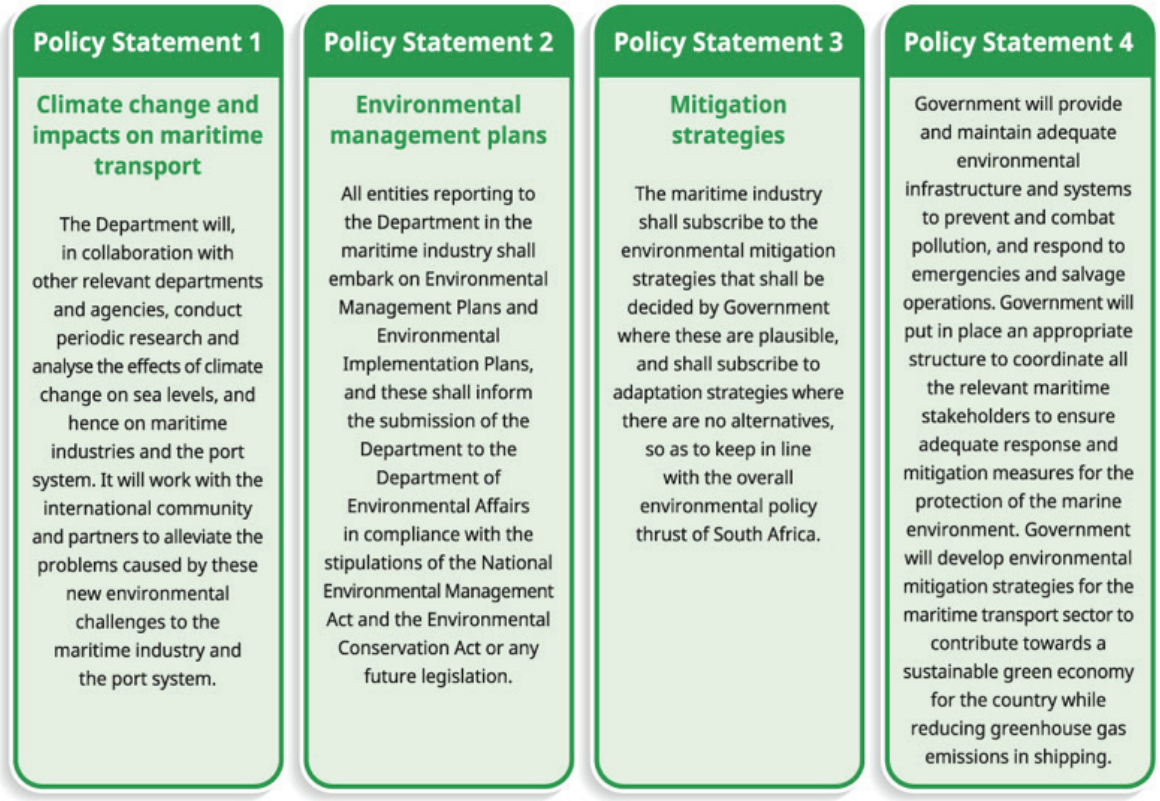
The protection of the environment and ecosystems on which our livelihoods depend has emerged as one of the most pressing issues in the past few decades. Concerned with the implications of unsustainable consumption of finite natural resources, governments decided to launch, working through the United 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 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 programmes 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. It is in the interests 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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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.

Maritime transport is arguably the most ecologically-friendly 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, sewerage, as well as garbage from normal shipping operations. This includes air pollution, particularly the need to regulate and reduce GHG 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.

Another measure that has been undertaken through the IMO is the adoption of a marine sulphur cap of 0.5%, as provided for in the MARPOL Annex VI, effectiveJanuary 2020. As South Africa is party to the IMO, we will need to abide by this regulation, and initiate the necessary plans to ensure its successful implementation.

8.6 Pipeline Transport

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

8.7 Cleaner Fuels and Alternative Fuels

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, as well as 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 or incentive scheme 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 to develop LNG import facilities at the ports of Richards 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. Every effort therefore 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.

By adding strategic tax penalties for new fossil fuel vehicle buyers, that money could be used to contribute to the cost of buying green vehicles and bring the price down. By moderately reducing taxes associated with green vehicles, the intention is to further reduce the price to below that of petrol or diesel cars.

The two options listed above will enable the mobilisation 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 for the South African economy. The biofuels industry also has the potential to contribute significantly to job creation in South Africa.

8.7.1 Cleaner Fossil Fuels

Fossil fuels are the single largest contributor to GHG emissions in the transport sector (GHGI, DEA, 2014). In order to meet Government's global commitments low carbon intensive fuel

The Department of Energy is also engaged in the "Cleaner Fuels Program II" (CF2), which is essentially the planned upgrading of oil refineries in South Africa to produce Euro5-specific fuels. The CF2 regulations stipulate that sulfur levels in petrol and diesel must remain below 10 parts per million (ppm). This new national standard was supposed to have taken effect in July 2017, however the implementation of this regulation has not reached the level of uptake and support from the sector that it requires. The 10ppm fuel is currently only being produced and available at the pump by SASOL. The Department will also look into the IRP for references for this proposed lower carbon fuel transitioning that the GTS is proposing.

Cleaner Fossil Fuel Regulatory actions:

- As the mandated entity for drafting fuel regulations, the Department of Energy will be engaged in drafting regulations requiring refineries to produce fossil fuels that meet new standards and norms required for emissions profiles.

8.7.2 Compressed Natural Gas (CNG):

Natural Gas has begun to take a foothold in the South African 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 the current fossil fuels being used in the country. As such it could serve as a potential transition fuel to stimulate biogas production by developing a potential off-take market.

The DoT will capitalise 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.

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

Security of CNG supply 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 initiatives form the backbone of DoT's efforts to promote the use of Natural Gas:

- In conjunction with cities, DoT will assist with draft regulations requiring 10% of the Municipal fleets to be converted annually to energy efficient vehicles.
- 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 to foster a conducive environment for the conversions of public and quasi-public transport vehicles to be converted to dual-fuel vehicles within 10 years.

8.7.3 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 financially feasible. As with biogas, there is concern around the production of biomass for biofuel production regarding food security, water usage, and the hectares of land required. This also could have a negative impact on food prices. Biofuel needs to be regulated. 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 everyday access to biogas to use biogas as a fuel.
- in conjunction with National Treasury, draft tax incentive mechanisms 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 centralising animal manure collections at regional biogas plants to increase feedstock.

The Biofuels Industrial Strategy of South Africa followed by the Position Paper in terms of the National Energy Act34 of 2008, published by the DoE on 15th January 2014 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.

8.8 Electric Vehicles (EVs)

Currently the market share of EVs in South Africa is minimal (approximately 700 vehicles). 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 preferably 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).

Electric Vehicle Actions:

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

- offer producers of EV vehicle manufacturing incentives to both produce and sell affordable EVs in South Africa, for both 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 the Industrial Policy Action Plan (IPAP).
- introduce the conversion of old technology vehicles with higher emission factors to be retrofitted with EV technology.
- 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.

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.

8.9 Future Modes of Transport

With recent transport technologies evolving at such a rapid pace, the future modes of transport can be defined as those transport inventions that will be developed in the future or are currently under development such as these found below:

Types of future modes of transport	
Air Propelled Trains	Hyper-Loop
Space Elevator	The Jet-Pack
Dual Mode Transportation Systems	The Launch Loop
Spacecraft Propulsion or Space Transport	The Personal Air Vehicle
Flying Cars/Drones	Personal Rapid Transit
Walking Robots	Passenger Autonomous Vehicles

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These kinds of "newer" modes being introduced in the transport sector, will require operational regulations, as they will also need to be mandated to use clean, green, and safe energy sources; as alternatives to nuclear power. Self-driving cars could represent the next development and could well be the most disruptive innovation the transport sector has ever seen. Radical changes to transport services such as mobile application services like Uber and Ride-Share, indicate that the future spectrum of the transport sector will be extremely different from what it is today. It is vital that transport regulations be revised to accommodate technological innovations.

The Department of Trade and Industry (DTI), together with the Department of Science and Technology, have embarked on project to establish the enabling environment for implementing hydrogen fuel cell driven public transport, with the aim of promoting South Africa's OEM sector. The DTI has targeting South Africa's metropolitan municipalities as possible users of fuel cell technology in their bus fleets, while transporting the millions of commuters. This trial is still underway.

Hydrogen may be produced on a large scale using water coal, natural gas or plant matter. Thus, much as the final product involves lesser levels of pollution, the benefits are watered down if production uses fossil fuels.

Hydrogen fuel cell technology is advantageous in that it has a low carbon footprint - therefore contributing to cleaner air and better health for the South African citizenry. It also involves minimal noise when used in fuel cells. However, implementation from scratch, of production, distribution and retail outlets for hydrogen fuel cells is likely to be expensive. Each fuel cell vehicle would require $900 to $1000 to achieve the above listed chain of activities, according to 2013 International Energy Agency (IEA) estimations (Dti, 2017).

The Department of Science and Technology (DST) is facilitating the transition towards cleaner energy solutions and is supporting a number of research initiatives aimed at promoting the adoption of cleaner fuel cells for transport. The initiatives include the Biofuels research programme, Uyilo e-mobility Programme, energy storage focused on lithium ion batteries and the development of hydrogen and fuel cell technologies through the Hydrogen South Africa (HySA) Programme.

In the electric vehicle space, the Department is supporting research, development and innovation (RDI) initiatives focused on developing technologies that would enable the deployment of both hydrogen fuel cell and battery powered electric vehicles. Both battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs) will use an electric drivetrain, with the lithium ion battery and hydrogen used as the fuel sources respectively.

8.9.1 Biofuels Research Programme

The DST is supporting the development of cleaner fuels through its bio-fuels research programme, which has research chairs at the universities of Stellenbosch and North West. In addition, under the bio-fuels programme at Nelson Mandela University, the department is supporting the development of a blended bio-fuels mixing coal waste/discards with algae.

8.9.2 Uyilo e-mobility Programme

The DST in partnership with the Technology Innovation Agency (TIA) is supporting the development of electric vehicle components (motors, battery management systems) and research on the use as well as localisation of renewable energy based charging points. In addition, a battery testing facility has been established at Nelson Mandela University that will test and validate batteries for safety and compliance in collaboration with other institutions through the Energy Storage Programme.

8.9.3 Energy Storage Research Programme

As part of a broader Energy Storage research, development and Innovation (RDI) Programme, the department is supporting the development of the high energy density nickel manganese cobalt (NMC) precursor material for lithium ion batteries (LIBs) targeted at the electric vehicle market. The local development of precursors and value added components will support the deployment of electric vehicles in South Africa. LIBs, whose cathode materials use NMC precursors, appear to be the dominant battery technology for the electric vehicle market. Figure 8 gives an indication of the increase in revenue (starting from the manganese ore) that could accrue from the local production and export of precursor material. Development of precursor material for LIBs is being conducted at a pilot facility in Nelspruit while partnerships (both local and international) are being sought in order to take the technology to market. In addition, through the participating universities and science councils, other components of the LIBs such as electrolytes, cells and battery management systems are being developed. In this regard, a facility located at the University of the Western Cape (UWC) has demonstrated the production of lithium-ion battery cells at pilot scale.

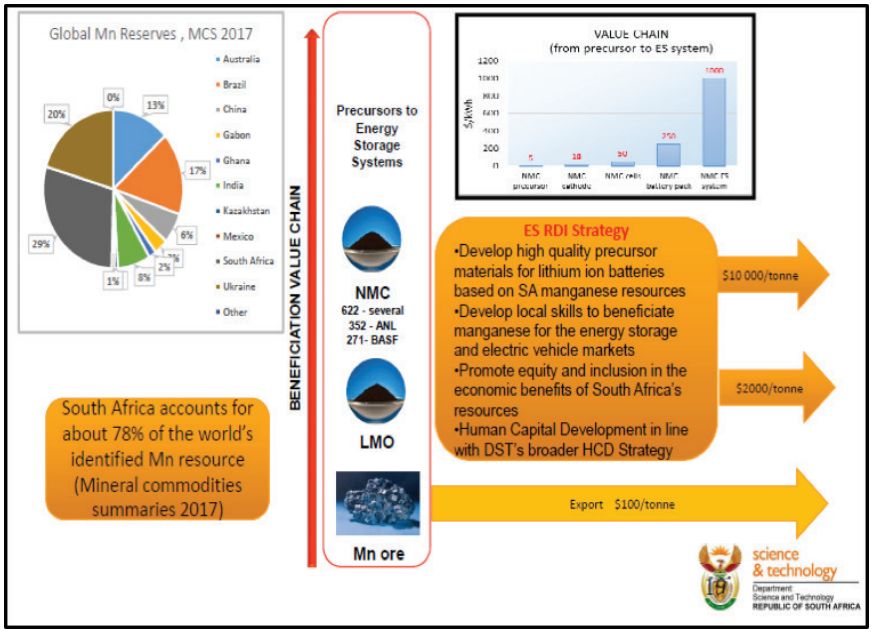

Figure 8: Value proposition for the development of manganese precursor materials

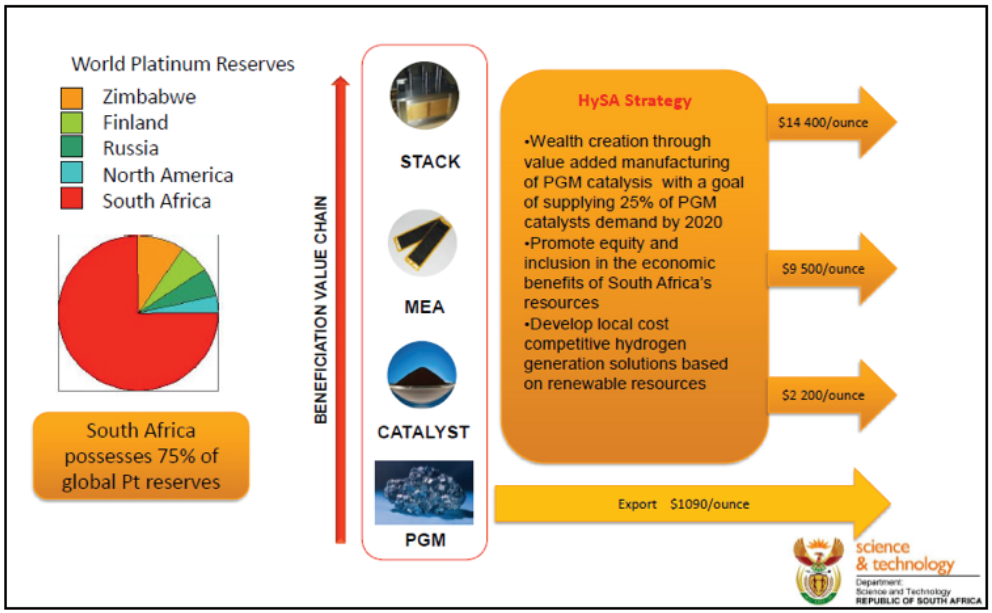

Figure 9: HySA value proposition (Note: Numbers given were calculated based on prevailing commodity prices at the time)

8.9.4 Hydrogen South Africa (HySA) Programme

Through the Cabinet approved Hydrogen South Africa (HySA) Programme, the DST is supporting renewable hydrogen production, storage and distribution in support of fuel cell powered transport. The three HySA Centres of Competence have made significant progress in the development of fuel cell technology that is already under demonstration in material handling equipment, golf carts and electric scooters. Further development work is targeted at components for fuel cell powered passenger vehicles including buses. The HySA Programme is therefore enabling the development of value added components (Figure 9) based on platinum group metals (PGM) beneficiation.

8.9.5 Technology Demonstrations

South Africa has embarked on a number of demonstration projects as part of implementing the various RDI initiatives, in order to show case how the technologies can make an impact in a number of sectors.

8.9.5.1 Fuel cell buses

The DST has earmarked funding for the first fuel cell bus demonstration project through a collaboration between HySA and Busmark (a local bus company based in Gauteng). The Department of Trade and Industry (the dti) has conducted a study on the viability of hydrogen fuel cell powered buses (fuel cell buses) in South Africa. The study indicates that there is potential for fuel cell bus adoption by the metros, given the predictability of the routes and the desire to go green. However, prior to the deployment of such buses, the technology must be proven under South African conditions through a demonstration (bus pilot) project.

8.9.5.2 Fuel cell Forklifts

Material handling vehicles offer another potential opportunity for the deployment of hydrogen fuel cells in on site transport. Fuel cell powered forklifts have the highest number of deployments globally, with the USA as the leading country. Studies conducted show that there is a good business case for fuel cell powered forklifts particularly in warehouses that operate for 24 hours. In this regard, the shorter refuelling times (5 -15 mins) make the fuel cell powered forklifts more attractive than the battery powered forklifts.

A fuel cell powered forklift has been in operation at Impala Platinum Refineries in Springs since October 2015. The project was a collaboration between Impala Platinum and HySA Systems hosted at University of the Western Cape (UWC). The Impala Platinum Refineries site has a direct pipeline of hydrogen, which makes it easier to refuel the fuel cell forklift using refuelling infrastructure developed and installed on site by the HySA team at UWC. To date, the demonstration has been able to show that there are indeed benefits such as an increase in productivity as well as a cleaner working environment due to reduced emissions through the use of the fuel cell powered forklift. As a result, further demonstration projects are being planned through collaboration involving the industrial development corporation (IDC), HySA and mining companies.

8.9.5.3 Electric scooters

Battery electric scooters tend to encounter challenges associated with range limitations, particularly in areas where the terrain is bad. In such instances, hydrogen fuel cells could be used to extend the range of these scooters and increase productivity. A project of this nature is currently underway through a collaboration between HySA and the South African Post Office (SAPO), with funding from the DST. At least three battery electric scooters will have their range extended using hydrogen fuel cells with the on-board hydrogen stored in containers using metal hydride hydrogen storage material developed through the HySA Programme. The first such scooter has been completed and is currently undergoing performance testing and validation.

8.9.6 Hydrogen production, storage and distribution

Hydrogen, usually in gaseous form, is the main fuel required for fuel cell operation. Hydrogen may be produced on a large scale using water electrolysis, coal, natural gas or plant matter. Thus, much as the final product involves lesser levels of pollution, the benefits are watered down if production uses fossil fuels. The production of hydrogen using renewable energy sources like solar photovoltaic (Solar PV) and wind powering electrolysers that break down water into hydrogen and oxygen has been demonstrated globally even at megawatt scale. HySA Infrastructure at North West University in Potchefstroom has a pilot facility producing renewable hydrogen from solar PV at 2.5kg per day.

The main challenge with hydrogen is its storage and distribution, given the size of its molecule. Significant quantities of hydrogen are transported only in the form of liquid hydrogen (at cryogenic temperatures) or using high pressure (350 -700 bar) cylinders as is the case in mobile applications. However, technologies such as metal hydride (solid state) hydrogen storage and liquid organic hydrogen carriers (LOHC) offer promise for on-site transport and underground mining equipment respectively.

Hydrogen fuel cell technology is advantageous in that it has a low carbon footprint - therefore contributing to cleaner air and better health for the South African citizenry. It also involves minimal noise when used in fuel cells. As an emerging technology, fuel cell technology, together with the associated production, distribution, storage and dispensing of hydrogen at retail outlets still comes at a high cost. Each fuel cell vehicle would require $900 to $1000 to achieve the above listed chain of activities, according to 2013 International Energy Agency (IEA) estimations (the dti, 2017).

8.9.7 BEVs versus FCEVs

Arguments have been put forward to present BEVs and FCEVs as competing technologies, yet they are actually complementary. According to a recent study by the Hydrogen Council , BEVs have a high well-to-wheel energy efficiency (60%) when powered by electricity from renewables, while batteries have a low energy density per weight (0.6 MJ per kg), which makes them suitable for lighter vehicles and shorter ranges. When stored aboard a vehicle, hydrogen has a much higher energy density per weight (2.3 MJ per kg) than batteries, which enables FCEVs to travel longer distances and performer better for heavy vehicles where batteries become impractical and inefficient (Figure 10). As the capacity increases, FCEVs will become cheaper, because adding hydrogen storage will be more cost effective than adding batteries in order to achieve the same performance.

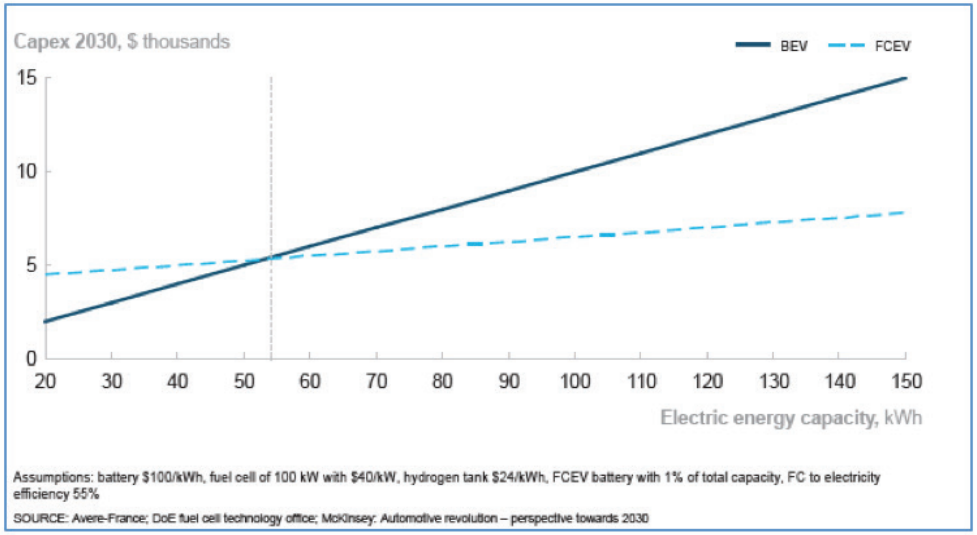

Figure 10: Comparison of BEVs and FCEVs.

The adoption of both BEVs and FCEVs has enormous benefits for South Africa and could launch the country on a route to energy independence, free from the unpredictable oil prices. The development of a local lithium ion battery industry will beneficiate the manganese resources that South Africa has as well as other minerals such as nickel, cobalt and lithium that are available in the Southern African Development Community (SADC) region. In addition, the carbon footprint of BEVs can be lowered further by using charging stations that are powered by Solar PV incorporating battery storage. FCEVs could use hydrogen generated from renewable energy resources such as solar PV and wind through water electrolysis. Large-scale generation of hydrogen from the solar PV plants for use as a transport fuel, storage for excess renewable energy and chemical commodity for other industrial sectors has the potential to put South Africa on a growth trajectory that is free from fossil fuels.

The Department of Trade and Industry (the dti), together with the DST, have embarked on a project to establish an enabling environment for implementing hydrogen fuel cell powered public transport, with the aim of promoting technologies developed through beneficiation of South Africa's mineral resources. The dti is targeting South Africa's metropolitan municipalities as possible users of fuel cell technology in their bus fleets, while transporting the millions of commuters. It is essential that both public and private sector partners come together to provide the necessary infrastructure required to scale up demonstration projects that will facilitate greater adoption of BEVs and FCEVs in South Africa. FCEVs in particular, have the potential to mitigate the potential decline in PGM demand used in internal combustion engines (ICEs) that is likely to result from the reduced use of ICEs due to emissions restrictions.

9. TRANSPORT ADAPTATION AND MITIGATION

The magnitude and rate of climate change depends partly on future global GHG emissions. Consequently, global mitigation action to reduce GHG emissions has been and continues to be a paramount strategy addressed through the United Nations Framework Convention on Climate Change (UNFCCC) and a range of related GHG mitigation policies. As transport is one of the main contributors to GHG emissions, mitigation actions have mainly been the focus of the sector in dealing with climate change. The overall strategic approach for the RSA's climate change response is guided by the National Development Plan (NDP) (Vision 2030). The NDP proposes moving towards a low carbon economy. Different sectors of society have roles to play in fulfilling Vision 2030. The DoT's objective in supporting the transition to a low carbon economy is to 'increase the contribution of transport to environmental protection' (State Action Plan, DoT: 2016).

Although usually seen as different strategies — mitigation dealing with the source of the problem and adaptation with unavoidable impacts — mitigation and adaptation are complementary actions.

The GTS addresses both mitigation and adaptation, and there should be an emphasis for future initiatives to be on climate-related projects and policies, including both mitigation and adaptation.

9.1 Transport Adaptation

It should be considered that even if global GHG emissions were to stop today, climate change would continue for many decades as a result of past emissions and the inertia of the climate system. Adaptation to already experienced changes in climate as well as to plausible future climate scenarios is therefore a necessity. For the GTS, 'adaptation' refers to actions responding to current and future climate change impacts and vulnerabilities (as well as to the climate variability that occurs in the absence of climate change) within ongoing and expected societal change. It means protecting against the negative impacts of climate change, but also building resilience and taking advantage of any benefits it may bring (EEA, 2014b).

In the context of the flagship initiative on a resource-efficient programme, in the transport sector, a shift towards a competitive and resource efficient transport system sets out how the transport sector can contribute by reducing its carbon emissions by 50% (EC, 2011b) from 1990 levels. Complementary to policies aimed at reducing GHG emissions, the adaptation to climate change (EC, 2013d) aims to

contribute to a more climate-resilient transport industry, by enhancing the preparedness and capacity to respond to the impacts of climate change at local, regional and national levels. It also refers explicitly to transport as a sector that needs to adapt. Furthermore, the transport sector supports moving to a competitive low carbon economy in 2050 that foresees a reduction of at least 80% of GHGs by 2050 compared to 1990.

The envisaged long-term GHG reductions in the roadmaps towards a competitive low carbon economy and resource-efficient transport require not only gradual improvements of current strategies but structural changes leading to a transition of society and as such of the transport sector. These structural long-term changes in the organisation of transport and mobility might also offer the potential to reduce vulnerabilities to climate change. Conversely, the magnitude of climate change might require major structural modifications to adapt and these efforts can support the transition towards a competitive low carbon economy too. For example, transforming transport behaviour and transport demand could achieve not only lower emissions but, at the same time, offer opportunities either to build a more resilient transport system and services under climate change, or to develop more flexible social and economic practices that could better accommodate eventual disruptions in the transport system.

Its objective is to contribute to a more resilient sector at national, regional and local levels, thereby focusing on enabling Member States and local governments to take action and to mainstream adaptation into different policy areas. The strategy considers that 'by prioritising coherent, flexible and participatory approaches, it is more affordable to take early, planned adaptation action than to pay the price of not adapting'.

Climate change adaptation is not yet broadly mainstreamed within transport planning and decision-making practices include specific mandates for the transport sector, such as the revision of technical standards in the rail sector, network vulnerability studies, the revision of guidelines on the hazards of forest fires on infrastructure, or the development of scenarios in order to consider adaptation within the Environmental Impact Assessment process.

9.2 Barriers to Adaptation in the Transport Sector

Adaptation in the transport sector still faces significant barriers both at political and technical levels. The adaptation of transport systems to climate change is generally associated with a need for additional resources, and particularly of financial ones; actual access to these financial resources was rated as very significant barrier. Lack of awareness, training and capacities are perceived as barriers with slightly lower importance and less consensus across the different spheres of government.

Barriers, such as uncertainty and the lack of political action also need to be addressed. This lack of action can be due to the fact that adaptation is seen as a long term issue. It does, not encourage urgent short-term action, because there is no political priority or because adaptation is perceived as a longer-term activity.

The development of adaptation strategies typically follows a cycle, moving from initial awareness raising among stakeholders and decision-makers to exploration of risks and vulnerability, identification of adaptation options, development of adaptation strategies or action plans, and monitoring of implementation and results. Information collected on past weather events and their impacts can be a valuable starting point for assessing vulnerabilities and developing strategies to adapt to climate change. However, obtaining data impacts, specifically on transport, available in the formats required to cross-check with weather information and with data from other stakeholders is difficult. Better, up-to-date tools for managing weather on an operational level serve to improve resilience on a day-to-day basis and provide practitioners with a better understanding of their baseline vulnerability. They can then extend this to consider the climate change timescale.

Transport Adaptation

- Transport systems are complex. They play a fundamental role in the economy and society, and are characterised by the long lifespan and high costs of their infrastructure. These characteristics all suggest the need for an adaptation approach with a long-term and systemic perspective, thus also preventing possible lock-ins into unsustainable development paths.

- Up until now, the dominant approach for reducing the vulnerability of transport systems has been to make incremental changes. While this approach works well for many cases, it can be insufficient to deal with disruptive or fundamental changes in climate, the society or the economy. When changes of this sort happen, transport systems will need to adopt a more fundamental and comprehensive change, involving both the use of new technology and the implementation of alternative approaches for managing transport demand and supply.

- A flexible transport structure - the ability to easily find another transport option in the event that one option becomes unusable - plays an important role in creating a resilient transport system. An approach, where incremental and fundamental changes are compatible depending on the specific situation to solve, will result in a more resilient transport system. In deciding when to act, it is better to anticipate this need for change and to act early rather than wait for events to force change. Forward-thinking will require a shift away from piecemeal action to more planned and integrated approaches, including early action whenever possible.

- Good adaptation requires information and knowledge. This information can be made available by a centrally managed database. Innovation and fundamental change often need research, often including a variety of measures to promote the implementation of adaptation measures in the transport sector. These measures include funding support, the provision of information, capacity building, and review of technical standards. The engagement of all the main stakeholders in the transport sector is of key importance from the perspective of both equity and efficiency, and policymakers and researchers should make an extra effort to engage stakeholders in their research and information-dissemination activities.

- Currently, greater attention is given to adapting transport infrastructure (rail tracks, ports, roads, etc.) than to adapting transport services (operation of infrastructure and equipment, use of staff, timetables and routing, contingency plans, communication of service options, etc.). More use could be made of this underused potential of transport service operators.

It is important that adaptation measures taken in the transport sector are monitored and analysed, as this will enable stakeholders to improve the effectiveness and efficiency of future policy. It will also help to stimulate a transparent public debate on what additional actions are needed. The next generation of transport policy will need to mainstream these transitional approaches to climate change adaptation and mitigation as two complementary strategies to cope with climate change, thereby facilitating the emergence of a resilient transport system.

9.3 Mitigation: The Sustainable Transport Programme

The response to Government's approach to mitigating climate change is reflected in the National Climate Change Response White Paper 2011, which stipulates that economic sectors such as transport need to develop "Mitigation Plans" in an effort to reduce emissions from different sectors.

The Sustainable Transport Programme (STP) will be the implementing vehicle for the GTS. The programme envisions promoting the implementation of STP measures (Avoid – Shift – Improve) at local level that align with national goals (e.g. National Climate Change Response White Paper). The STP programme and/ office will bridge the gap between the policy-making at national level and the implementation at 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
- 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. Establishing an independent Technical Support Unit (TSU) for STP;

2. Organising a knowledge-sharing platform among all spheres of the Government on STP & public;

3. Improving the capacity of MRV, aiming for a national harmonised approach;

4. Supporting municipalities during the design and implementation of sustainable mobility measures;

5. Promoting the improvement of the legal framework in the context of STP; and

6. Creating and coordinating access to financial resources to support the implementation of sustainable mobility measures.

The national programme will support local governments in their actions towards an environmentally-friendly transport system. An independent and comprehensive mechanism therefore needs to be established to ensure successful implementation of the measures and co-ordination of stakeholders. One key intervention of the Sustainable Transport Programme of the DoT will be the coordination and distribution of lessons learnt and best practices amongst municipalities.

9.4 Transport Flagships and Nationally Appropriate Mitigation Actions (NAMAs)

The GTS will also be used as a mechanism to implement the Transport Flagships as identified in the White Paper on National Climate Change Response 2011. As part of 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 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 9: Proposed NAMAs List for Transport (Source: DoT)

SHORT TERM NAMAs	MID TERM NAMAs	LONG TERM NAMAs
Improved Bus Rapid Transit Systems in SA	Fuel Economy Standards	Integrated Urban Planning
Gautrain Expansion	Fuel Switch	Integrated Public Transport Networks
Taxi Modernisation and Conversions	Updated Fuel Regulations	Behavioural Change
Uptake and Promotion of Eco Non & Motorised Transport	Modal Shift from Road to Rail	Economic Incentives

The Department of Transport has also committed to a NAMA programme. The NAMA 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.

10. ENABLERS AND BARRIERS FOR SUSTAINABLE MOBILITY

On 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 markets 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. Contributing to the fight against climate change in the longer run is also important.

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 central role in facilitating or triggering change and those that can hinder successful implementation. While Government can set appropriate policies, it is ultimately up to the private and 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.

10.1 Enablers and Barriers for Green Transport

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 exit 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, providing 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 emission testing and labelling system for application to new passenger cards 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 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 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 sector’s development. For gas-powered vehicles, the 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 who are aware, perceive gas as something flammable and dangerous, not suited for transport;

- 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. 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.

11. OPPORTUNITIES / CO-BENEFITS FOR GREEN TRANSPORT

On a higher, more abstract level, the opportunities / co-benefits relate to the enhanced access to employment opportunities for poor communities due to an improvements in public transport and public health benefits associated with improved air quality 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.

11.1 Economic

The context of a developing economy - even more importantly, the economic proposition of green sustainable transport - is a central factor in making green options commercially attractive in the future. The need to increase sustainable mobility and counter the spatial disconnect from market and jobs for less privileged groups is however especially urgent, but 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 benefits. 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 for 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 however, is that users need to be well-informed about the green alternative.

Treasury can also benefit by using biogas or electricity as transport fuels, as these are locally produced, as opposed to petrol/diesel, which 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 to 3 times 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 will encourage better choices. However suppliers might be reluctant to invest in, for example, biogas production, while users are reluctant to switch their vehicles to biogas doubting fuel availability and nervous to take a risk.

11.2 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 can be a driver for the introduction of green transport alternatives. Green transport also involves lesser negative externalities being borne by society. This is particularly the case with biofuels, as they require relatively labour-intensive fuel production. This requires the conversion of specially grown crops to a biodegradable waste and energy for fuel. In principle, however, all alternative green transport technologies have the potential to create jobs, as new infrastructure has to be developed. The downside however is that green technologies could result in job losses which could be countered with the job creation that the industry will create.

11.3 Environmental

When it comes to the environment, reducing air pollution, particularly in an urban context, is a direct short-term need, in addition to combating climate change in the long run. 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 ‘licence to operate’ is a driver behind the greening of transport, particularly for 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)

12 COST OF GTS AND FINANCING OPTIONS

12.1 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 channeled towards low carbon, green transport.

Access to funding is crucial to the successful implementation of the GTS. This document outlines a number of regulatory actions that will draw in funds. However, the quantum of funding required particularly for expansion and upgrading of public transport and the rail network will require both international and private funding.

This would ensure that:

- adequate funding is made available for green transport technologies, capacity building, operations and infrastructure to ensure 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).

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

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

Table 10: An overarching policy framework to support low carbon, green transport

Policy Instrument	Avoid		Shift	Improve
Planning	• High density mixed land-use developments • Restrictive parking standards • Car-free settlements	• *Planning and regulatory cross-cutting instruments through planning legislation and infrastructure provision* • *Development of freight hubs/consolidation points*	• 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
	Parking restrictions can be used to avoid and shift			
Economic	• Fuel taxes, vehicle taxes • Road user charges, parking charges, emission trading	• Subsidise 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
	Fuel pricing discourages travel, encourages modal shift and encourages improved fuel efficiency			
Information	• Promotion of travel alternatives	• 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 electric vehicles - Hydrogen vehicles - Rail electrification	• Public awareness campaigns aimed at informing consumers about vehicle efficiency
Technology	• Enable virtual interactions: virtual-conferencing, remote working • Travel plans introduced through planning instruments include remote working and teleconferencing	• Improvements in the efficiency and quality of passenger transport		
		Traffic management is both a shift and improved policy measure		

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

Table 11: 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)	• Fuel tax • Vehicle taxes • Parking charges • Road pricing • Public transport subsidies • Grants, loans, transfers
"Green Funding" Streams	• Clean development mechanism • Joint implementation • International emissions trading • Global environmental facility • Multilateral / bilateral funds • Green climate fund

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. These have been used successfully for channeling 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 above:

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, can serve as important institutions in themselves, bringing together different stakeholders in society to achieve certain environmental objectives.

13 IMPLEMENTATION, MONITORING AND EVALUATION

To ensure the successful implementation of the GTS, a comprehensive Monitoring and Evaluation system needs to be aligned with the strategy, to ensure that the deliverables of the project are achieved on time and a suitable system is instituted to ensure monitor progress.

The DoT will facilitate the following actions:

- Collaborate with DOT agencies (e.g. RTMC, ACSA, CAA, SANRAL, RAF, ATNS, RTIA, RSR, PRASA, PORTS REGULATOR, SAMSA and the C-BRTA.) and other SOEs such as SANEDI, to ensure that projects which lower GHG emissions are incorporated within their operations and Business Plans going forward. Transport entities will also need to report on their progress and implementation of environmental projects in their annual reports.

- 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, and 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. The DoT will therefore compile documentation to support project-specific funding requests to the Green Climate Fund, the World Bank and UNFCCC.

- DoT through consultation with National Treasury will develop an approach for engagement with other aid agencies, the IDC and South Africa’s commercial banks which will include guarantee and insurance products for green projects.

13.1 Implementation Plan

The following table shows the specific actions required, details thereof, the person responsible and the timeline.

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: (8 - 10 years)

- Long-Term: (11 - 20 years)

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

13.2 Monitoring and Evaluation

The DoT will use 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 analyse historical data vs. live data to decisively envision the future. Data requests and processing not take days, it should be instant - IoT. Once consolidated, the goal is to house a data centre for all needed parameters (congestion, GIS, GPS, buy in). 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.

Activity	Measures	Lead Department	Supporting Department/Institution	Time Frame
	FUNDING			
Preferential funding	Arrange preferential funding through development finance institutions or private sector participation in dual fuel conversions, EV's and high speed rail networks	All relevant stakeaholders		SHORT,MEDIUM AND LONG TERM
Global Funding	Compile documentation for project specific funding requests to the Green Climate Fund, world Bank, UNFCCC, USAID, and other Developmental Credit Agencies	All relevant stakeholders	National Treasury, EDD, DTI, DEA, DBSA, DST	SHORT,MEDIUM AND LONG TERM
	RAIL			
Passenger Rail	Invest in improvement of rail services and infrastructure. Initiate Marketing campaigns for rail to attract users.	PRASA, DoT	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,	NT, EDD	MEDIUM TERM
Cleaner Technologies	Encourage rail operators to invest in the use efficient and low carbon intensive technologies such as the use of fuel-cell or solar powered locomotives.	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.	DoT, DOE, DEA	SAA, ACSA, DST	SHORT TERM MEDIUM TERM

Activity	Measures	Lead Department	Supporting Department/Institution	Time Frame
Dual-fuel regulations	Draft regulations providing a conducive environment for public and quasi-public transportation to be converted to cleaner dual-fuel vehicles.	DoT	IDC, DOE, DPE, Taxi Associations, SANEDI, CSIR	LONG TERM
Fossil Fuels	Draft regulations requiring refineries to meet new standards and norms for cleaner fuels.	DOE	DOT	MEDIUM TERM
Operations and Procedures (Energy Efficiency)	Review and update existing operational procedures to ensure energy efficiency	DoT	DoT Agencies	SHORT TERM
Infrastructure (Energy Efficiency and Renewable Energy)	Implement rooftop PV and EE retrofits of ports and airports	DoT	ACSA	SHORT-MEDIUM TERM
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, DoT	CAA, IATA, ICAO	MEDIUM TERM
CLEANER FUELS AND TECHNOLOGIES				
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	MEDIUM 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	NT	DoT, DOE,	MEDIUM TERM

Activity	Measures	Lead Department	Supporting Department/ Institution	Time Frame
Integrated Transit System				
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
Fuel economy norms and standards	Develop vehicle fuel economy norms and standards used to label vehicles	DOE,NT	DOT,DOE,NT	SHORT TERM
Government Fleet Baseline analysis	Undertake baseline analysis of government fleet to determine specifications including CO emissions	DoT	DOE, DEA	SHORT TERM
Vehicle Energy Efficiency Programme	Government will procure Energy efficient Vehicles in incremental steps per annum	DoT	DTI,NT, DST, DOE	LONG TERM
Government/ Fleet Procurement Guidelines	Develop guidelines for the procurement of vehicles throughout government to procure efficient vehicles, using clean technologies.	DoT	NT, DTI, DEA	MEDIUM TERM
Electric/ Fuel Cell Vehicle Batteries	Finalise the feasibility of a local manufacturer of EV batteries / fuel cell batteries at a reduced cost.	DTI, DoT	DOT,DST	SHORT TERM
Electric Charging Stations	Expand electric charging stations powered by photo-voltaic panels by 40 per annum: accessible to general public	DTI.	IDC	SHORT-MEDIUM TERM

Activity	Measures	Lead Department	Supporting Department/ Institution	Time Frame
Single ticketing system	Develop smart tag enabled single ticketing system for use in public transport and taxi industry.	DoT	DTI, DPE, public sector, Government, PRASA, Transnet, Buses, Metrorail, Municipalities, all taxis (minibus and metered)	LONG TERM
Revise ITPs	Revise minimum requirements in ITPs 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
Metro-bus fleets	Draft regulations requiring 10% of Municipal bus fleets converted to cleaner technologies or cleaner fuel.	DoT	Local Government	LONG TERM
Emission standards	Develop regulatory regime with NT and DEA 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, DEA	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.	Local Government	Local Government	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 buslanes, EVcharger points, Bio Gas/ NCG/LNG stations.	DoT	SANRAL, Provincial Government	SHORT TERM

14 COMMUNICATION STRATEGY

A feasible communication plan to support the GTS needs 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. Behavioural change on the part of both consumers and service providers therefore has a critical role to play in reducing the environmental impact of transport.

A further illustration in which behaviour 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. These benefits 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 about 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 be introduced as part of the standard curriculum at all levels of the education system.

Robust public relations campaigns will need to be run in order to encourage the modal shift desired, especially when promoting public transport and/or from ICE to EV. 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 more time to read in this environment. Their attention is less available for billboards or TV/radio/internet. It's similar to advertising on public toilet doors, as people use these facilities frequently.

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