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Government of the Republic of Trinidad and Tobago
Ministry of Planning and Development

Initiative for Climate Action Transparency – ICAT

Transformational Change Potential of the Transport Sector and Insights for Developing an E-Mobility Policy for Trinidad and Tobago

FINAL REPORT

UNEP DTU PARTNERSHIP

Initiative for Climate Action Transparency - ICAT -

Transformational Change Potential of the Transport Sector and Insights for Developing an E-Mobility Policy for Trinidad and Tobago: Final Report

Deliverable: Presentation of the Results of the Study

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Executive Summary

Background

Trinidad and Tobago is a Small Island Developing State. It is the leading Caribbean producer of oil and gas and the highest consumer of fossil fuel. Its relatively small economy accounts for less than 1% of global greenhouse gas emissions. However, the country ranks among the top five emitters per capita.

The current dominance of private transportation confirms that any effective strategy to reduce GHGs from the transportation sector must include efforts to decarbonize private transportation, in addition to reducing kilometres travelled. Public transportation has become far less attractive to middle and upper-class riders and as a result the Public Transport Service Corporation (PTSC), which is the Government-owned public transport provider, experiences very low ridership among segments of the population that prefer travel by automobile to using any public transportation mode.

Objectives of the Study

This ICAT pilot study focuses on two key components:

1. Use the ICAT transformational change methodology to analyse the transformational change potential of the mitigation activities relevant for the transport sector, identified by Trinidad & Tobago in their NDC Implementation Plan.
2. Analyse the role of e-mobility in the transformational change of the transport sector in Trinidad and Tobago and generate policy recommendations for the development of an e- mobility policy.

These objectives have been accomplished by employing the use of the ICAT Transformational Change Assessment Guide to provide guidance for assessing the transformational impacts of climate policies and actions

ICAT Transformational Change Methodology

The methodology guides users to assess the transformational impact of policies and actions, by analysing their effects on processes and outcomes of transformations. The analysis revealed that the main process categories that can contribute to transformational change are technology and incentives. Research and development funding for technological improvements in the transport sector is needed to meaningfully achieve a sustained reduction in carbon emissions. Incentives that encourage the use of low carbon modes of transportation and the use of public transport may have a greater impact on the outcome of the policies. The study identified several barriers that can potentially impede the transformational success of the policy. The main barriers are the high cost of technology associated with low carbon transport modes and a lack of consumer knowledge about alternatives to privately owned gasoline powered vehicles.

A quantitative assessment was conducted on process and outcome impacts and the final aggregated score determined for the transformational potential of the package of policies outlined in the NDC. The results indicate the extent of transformation expected by the policy or action and how likely it is that this expected transformation will be sustained. The assessment concludes that the extent of transformation expected to be achieved by the package of policies range between minor to moderate and the outcome is possibly or likely to be sustained over time.
The package of policies is potentially on the right course, however, greater attention is needed in addressing some of the process and outcome characteristics. E-mobility is a viable option that can help Trinidad and Tobago redress the adverse issues faced with conventional transportation systems.

E-Mobility Policy Barriers

The concept of E-mobility is relatively new in Trinidad and Tobago, with very few Hybrid Electric Vehicles and Battery Electric Vehicles. The nation can learn from the experiences of the countries that have achieved success in their development of an e-mobility landscape. However, there are significant barriers to e-mobility that will challenge the transition from the use of conventional fuels to electric vehicles. The literature review has led to the identification of five major categories of barriers. These e-mobility barriers include:

1. Technical/Infrastructural Barriers - Battery performance issues, lack of training and repair facilities, lack of charging infrastructure, battery recycling standards and location of charging infrastructure.
2. Economic Barriers - Purchase price of EVs and high fleet cost
3. Social Barriers - Lack of awareness campaigns, range anxiety/charging time, lack of customer demand/personal taste
4. Financial Barriers - Lack of private sector investment and high electricity price
5. Institutional Barriers - Lack of national transportation planning roadmap, lack of political will and inadequate service provision

Critical Issues in Developing an E-Mobility Policy for Trinidad and Tobago

Trinidad and Tobago's intended Nationally Determined Contribution for mitigation actions and activities planned for the transport sector for the period 2015 to 2030 are as follows:

1. Creating an enabling Environment (policy, Legislation) for Transport Sector
2. Improving the National Public Transport System
3. Promoting vehicle energy efficiency and fuel switching
4. Promote alternative fuels in transport sector
5. Reduce private vehicle use
6. Promote fuel (and energy) efficiency in transport sector
7. Improve data collection and information sharing systems

There is currently no agency of Government responsible for national transportation planning and administration. There is a division for highways, including a special project unit for new and

upgrading of highways and bridges; there is a division for licensing vehicles; and there is a Government-owned company for operating buses. There is need for a Road Transportation Authority charged with the responsibility for planning, administering and developing the transportation system for the nation. This Road Transportation Authority would conduct planning and analysis to meet short, medium and long-term mobility needs. It would formulate policies and implement public involvement programmes to secure public understanding and support. The Authority would be responsible for building, expanding and maintaining the road network and improving transportation infrastructure. It would also undertake traffic surveys and data collection and reporting, and road safety education and accident reduction schemes. Future mobility improvements in Trinidad and Tobago must consider managing vehicle ownership. The demand for personal vehicle ownership needs to be balanced with the number of vehicles using the roads. If these two competing demands are not managed properly, the result would be continued traffic congestion and increases in greenhouse gases.

Another critical component in the transport sector not being addressed is in the domain of public transportation. There is no coordination and monitoring of the planning for locations of public buildings, housing communities, schools, etc. with respect to the transportation needs of the users. At present, no single agency of Government is responsible for monitoring, controlling or coordinating the operations of the public transportation industry. The Public Transport Service Act, which created the PTSC in 1965, does not give them responsibility for regulating taxis, or later, maxi-taxis. The Transport Division of the Ministry of Transport is responsible for the licensing and inspection of taxis, and maxi-taxis. In other words, PTSC is a publicly owned bus operator governed by its Act, while other privately supplied public transport services (taxis and maxis) are effectively deregulated and operate on their own. So, there is a critical need for the administration, rationalisation and control of the industry. This would include, planning, organising and administering services, routes and terminals, collection and analysis of data pertaining to passenger demand and potential suppliers, and an ongoing monitoring of the industry, including vehicle standards.

Our decision-makers need to carefully consider who they are providing these components for. They need to determine the following: (a) What are we trying to achieve, and why; and, (b) How do we coordinate this information? The answers to these questions would involve the planning and administration of transport services, routes, and terminals and parking facilities; collection and analysis of data pertaining to who are the persons desiring to travel, where they are coming from, and where they are going; and, what are the accessibility needs of the travellers.

Our country has been desperately in need of continued transportation planning and policies to guide our sustainability ever since the first and only national transportation plan was completed in 1967. Many were related with the award of the Government commissioned Comprehensive National Transport Study (CNTS) in February 2005, and this was to be completed by September 2006. A report was submitted in November 2006, but it was not accepted by the Government. So, there is a long outstanding need for a comprehensive national transport plan and associated policies, and consequently there is a severe shortage of data for transportation decision-making.

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1. Transport Sector Transformational Change Assessment

1.1. General Information

Trinidad and Tobago is a Small Island Developing State (SIDS) having a mixed economic system in which there is a variety of private investment, combined with centralized economic planning and government regulations. In spite of its limitations in size and technological resources it is considered as having the wealthiest economy in the Caribbean and is the fifth richest by GDP (PPP) per capita in the Americas. It is the leading Caribbean producer of oil and gas, and its economy is mainly based upon these resources. Its relatively small economy accounts for less than 1% of global greenhouse gas emissions. However, it is acutely vulnerable to the adverse impacts of climate change. As a SIDS, Trinidad and Tobago is vulnerable to temperature increases, changes in precipitation and sea level rise. The country is also vulnerable to increased flooding, increased frequency and intensity of hurricanes, hillside and coastal zone erosion.

On February 22nd, 2018, Trinidad and Tobago deposited its instrument of ratification to the Paris Agreement on climate change. The Paris Agreement represents a universal treaty on climate change in support a low-carbon resilient future.

Key to the fulfilment of the Paris Agreement is Nationally Determined Contributions (NDCs) which represent each country's public commitments to reduce greenhouse gases. The Government of the Republic of Trinidad and Tobago is among the first set of countries to develop an Implementation Plan for achieving the NDC. Trinidad and Tobago's NDC seeks to satisfy three main objectives:

- An overall reduction in cumulative emissions from the power generation, transport and industry sectors of 15% by 2030 from business as usual (BAU), or 103 MtCO2e, conditional on international financing.
- Unconditional reduction in public transport emissions by 30% or 1.7MtCO2e by 2030 in comparison to emissions in 2015 through domestic financing.
- The total cost of implementing the NDC is estimated at USD $2 billion.

The Initiative for Climate Action Transparency (ICAT) was established in 2016 to respond to the critical need to accelerate climate actions by providing countries and policymakers with tools and support to measure and assess the impacts of their climate policies and actions. The Transformational Change methodology developed by ICAT gives guidance on how to perform and report transformational impact assessment associated with the implementation of existing or new policies fostering low-carbon economy and sustainable development.

The objective of this ICAT pilot study focuses on (i) assessing the potential impact of the mitigation actions identified in the Carbon Reduction Strategy (GORTT, 2015) on emission levels in Trinidad and Tobago and (ii) determining the barriers associated with the development and implementation of an E-mobility policy in Trinidad and Tobago. The key components of this work are as follows:

1. Use the ICAT Transformational Change methodology to analyse the transformational change potential of the mitigation activities relevant for the transport sector, identified by Trinidad & Tobago in their NDC Implementation Plan. Under this component the project will:

1.1. Assess the relevance of processes and outcomes of transformation for the transport sector in Trinidad & Tobago. The assessment will be informed by the documentation made available by the Ministry of Planning and Development, further data collection, and will be complemented by interviews with relevant stakeholders;

1.2. Assess how political, institutional, social, technology, and financial barriers can hamper processes of transformation, in accordance with the ICAT Transformational Change methodology;

1.3. Map the mitigation actions of the transport sector using the ICAT Taxonomy;

1.4. Perform a qualitative, and as far as possible a semi-quantitative assessment of the processes and outcomes of transformation deemed relevant. The assessment will be informed by the documentation made available by the Ministry of Planning and Development, stakeholders interviews, and further data collection drawing from the most recent developments of the actions and policies considered;

1.5. Analyse and discuss of the transformational change potential of the package of mitigation actions for the transport sector analysed;

1.6. Develop recommendations for improving the current list of actions to enhance their transformational change potential.

2. Building upon the previous work package, and keeping in mind the evolving recognition of the role that e-mobility can play in reducing emission in the transport sector, analyse the role of e-mobility in the transformational change of the transport sector in Trinidad & Tobago and generate policy recommendations for the development of an e-mobility policy. Under this component the project will:

2.1. Perform a background review to compile a list of actions that could/should be part of an e-mobility policy. The list of recommended actions will draw from UNEP DTU experience with e-mobility, and insights from national stakeholders;

2.2. Assess how barriers linked to the development and implementation of an e-mobility policy can hamper processes of transformation, in accordance with the ICAT Transformational Change methodology;

2.3. Map the list of actions identified using the ICAT Taxonomy;

2.4. Perform a qualitative assessment of these actions on the processes and outcomes of transformation deemed relevant. The assessment will be informed by the documentation made available by the Ministry of Planning and Development, and will be complemented by interviews with relevant stakeholders;

2.5. Based on the assessment, discuss the transformational change potential of the package of e-mobility actions analysed, and identify additional actions required, with a view to making appropriate policy recommendations;

2.6. Discuss synergies between the e-mobility actions identified and the mitigation actions planned for the transport sector identified in the NDC, with a view to revising and improving the overall policy and action framework;

2.7. Generate recommendations for the development of an e-mobility policy. Discuss recommendations with the Ministry of Planning and Development to arrive at a final list of concrete policy recommendations;

1.2. Description of the Policy

The mitigation actions identified in the Carbon Reduction Strategy (GORTT, 2015) represent a transportation mitigation plan, which identifies how Trinidad and Tobago will contribute towards meeting the NDC targets for Trinidad and Tobago. The mitigation actions and activities planned for the transport sector are as follows:

- Create enabling environment
- Improve national public transport system
- Promote vehicle energy efficiency, fuel efficiency and fuel switching
- Promote alternative fuels
- Reduce private vehicle use
- Improve data collection and information sharing systems

The policies and actions assessed are on national level within the transportation sector. The ’baseline scenario’ represents the Trinidad and Tobago for the year 2015. The policy scenario consists of assessing the impacts associated to the implementation of the mitigation actions to the year 2040. The description of the mitigation actions can be found in Appendix A.

1.3. Understanding the Context of the Policies

1.3.1 Phase of Transformation

It is a key recommendation to identify the phase of transformation to understand the context in which the policy is being planned or implemented. Figure 1.1 can be used to identify the phase of the system at the starting situation (ICAT, Transformational Change Methodology 2020).

Figure 1.1 Criteria to identify the phase of transformation for a system (ICAT, Transformational Change Methodology 2020)

The existing transportation system in Trinidad and Tobago is the cumulative result of countless separate decisions and investments made by public and private organizations and individuals. These organizations and individuals naturally view the system with an eye to their own requirements. They may all have a general interest in national transportation improvement, but their individual priorities are diverse and often conflicting. These decisions have affected the adoption of planned policies along the journey towards a low-carbon transport sector. As such, the policy context can be considered to be in between pre-development and take-off phase of transformation. The following factors highlight the current socio-political environment in which the transport sector in Trinidad and Tobago exist:

- The current dominance of private transportation confirms that any effective strategy to reduce GHGs from the transportation sector must include efforts to decarbonize

private transportation, in addition to reducing kilometres travelled. Removing carbon from road commuting can be attained by expanding public transit, increasing fuel economy of vehicles, improving fuel quality, and substituting EVs for internal combustion engines.

- Over the last few decades the country has experienced a significant increase in vehicle ownership. The ratio of population to car ownership has drastically decreased from 21:1 in 1965 to a 3:1 in 2006. Currently, the ratio is of the order of 2:1, according to the Central Statistical Office (CSO). The distribution of vehicles over the entire population is not equitable and as such many persons are at the mercy of public transit providers.

- Bus transport in facing a serious image problem. Buses has become far less attractive to middle and upper-class riders and as a result the Public Transport Service Corporation (PTSC), which is the Government-owned public transport provider, experiences very low ridership among segments of the population that prefer travel by automobile to using any public transportation mode. Public transport ridership is thus largely limited to persons who do not own a vehicle, the mobility-restricted and the elderly.

- The Government must see itself as being responsible for securing the provision of a well-organised public transportation system that delivers a high quality, equitable, safe and environmentally sound service. The implementation of policies has been slow due to social and economic challenges. However, new initiatives are being planned to help meet the Nationally Determined Contributions (NDCs) outlined in Trinidad and Tobago's climate change plans for the transport sector. These include measures to influence the choice of mode (e.g. park and ride facilities; car-pooling; auto-restricted zones; parking controls; public transport development; and, improvement in its characteristics such as, schedules, regularity, terminal and stop locations, pedestrian facilities, assessment of possibilities for new modes of transport to supplement the existing road network, such as maritime or ferry transport, or rail transport, and transfers between modes.

- The degree of awareness and acceptance of energy efficiency measures are generally low. However, the National Gas Company of Trinidad and Tobago (NGC) has embarked upon an energy efficiency and energy conservation campaign in 2018. NGC has been working with our Light Industrial and Commercial (LIC) customers to drive energy efficiency and promote gas optimisation. This initiative was also promoted through the Point Lisas Energy Association (PLEA), working to support energy efficiency projects and initiatives on the estate. NGC has stated that at the country level, "*we have been working with organisations in the non-profit sector to promote energy efficiency to secondary school youth*."

- NGC CNG was incorporated in 2013 as a special purpose state company and a subsidiary of the NGC Group of Companies with the mandate to expand the supply and use of Compressed Natural Gas (CNG) nationally. Phase 1 of the mandate was to convert 17,500 vehicles (sedan equivalents) and increase the number of supply points to
  22. CNG produce less exhaust emissions as a result, and harmful emissions such as carbon monoxide (CO), carbon dioxide (CO2 and nitrous oxide (N2O) are generally reduced by as much as 95% when compared to gasoline powered vehicles.

1.3.2 Description of the Vision for Transformational Change

Transformational change is hereby defined as: 'A fundamental, sustained change of a system that disrupts established high-carbon practices and contributes to a zero-carbon society, in line with the Paris Agreement goal to limit global warming to 1.5–2°C and the United Nations SDGs'. Table 1.1 describes the vision for transformational change in the transport sector based on the mitigation actions outlines in the NDC. The vision is described over three time periods.

Table 1.1 Description of the Vision for Transformational Change

Time periods	Description of the vision for desired societal, environmental and technical changes
Long-term **(≥15 years)**	Over the long term, it is estimated that 10% of natural gas consumption can be replaced by alternative fuels by 2050. A holistic transformation of the transport sector can be achieved which results in a decrease of population socio-economical differences and increased equity in the provision of transportation services. A sustainable way to contribute to nature conservation and help tackle climate change is to promotion of public transport services. Greater utilization of public transport over personal vehicle use reduces the national carbon footprint, improves air quality and helps reduce harmful particles, which increase the risk of respiratory diseases that affect respiratory health
Medium-term (≥5 years and <15 years)	The policies serves to ensure alignment with SDG targets (SDG7), (SDG8) and (SDG11). In the intermediate future the activities identified below will contribute to meeting some of the established SDG targets. 1. In the medium term it is expected that biofuel feasibility programme will lead to the establishment on new industries surrounding the production of biofuel can lead to lower import bill in the energy sector. Biofuels and other alternative fuel could have a significant role to play to accelerate early decarbonisation action across the transport sector. Its use aids in reducing some undesirable aspects of fossil fuel production and use, including conventional and greenhouse gas pollutant emissions, exhaustible resource depletion, and dependence on unstable production outputs. 2. CNG is more environmentally friendly since it produces 30% less carbon dioxide than gasoline and diesel. Its use aids in reducing some undesirable aspects of fossil fuel production and use, including conventional and greenhouse gas pollutant emissions, exhaustible resource depletion, and dependence on unstable production outputs. 3. The reduction in traffic and congestion levels on urban radial routes and in the CBD itself contributes to air quality improvement that implies health benefits and less public health costs. Correspondingly reducing the need for increased road capacity and reducing emission levels, energy use and other environmental impacts can be realized. Additionally, the policy leads to Job formation in relation to specialised companies and parking management.
	4. The traffic and congestion levels through modal switch policies and improvement in public transportation can contribute significantly to air quality improvement that implies health benefits and less public health costs. Additionally, corresponding community benefits in accessibility to opportunities, environmental quality and social inclusion will also be experienced.

Short-term (<5 years)	In the short term the package of policies activities geared towards achieving the Sustainable Development Goals (SDGs) adopted by United Nations Conference on Sustainable Development in 2012. The policies serves to ensure alignment with SDG targets (SDG7) and (SDG11). In the immediate future the activities identified below will contribute to meeting some of the established SDG targets. 1. Increasing switching to cleaner fuels such as Compressed Natural Gas (CNG) can contribute to lower carbon emissions as compared to fossil fuels. CNG is more environmentally friendly since it produces 30% less carbon dioxide than gasoline and diesel. Additionally, CNG engines operate quieter than gasoline or diesel engines which reduces noise pollution 2. The government of Trinidad and Tobago is seeking to develop a biofuel feasibility programme. If the biofuel study programme yields positive results in favour of local production of biofuel, the dependence on imported biofuel can be removed. 3. Jet fuel generally contributes to a significant volume of carbon emissions. Upgrading aircrafts can aid in the reduction of the transport carbon emissions over a 5 year period. 4. Reducing the amount of parking required in the CBD (where land is scarce and expensive and large car parks may be out of scale with the CBD townscape) and replacing it with parking in other locations. It is anticipated that the policy would lead to a 1.75% of transport emissions reduction. 5. The reduction in travel demand contributes to a reduction in vehicle noise and improves the general ambience of the journey. The travel time of each journey reduces which can lead to a decrease in travel related stress. It was assumed that the measure would reach the 10% of its potential, leading to a 1.5% of transport emissions reduction. 6. Land use policy reform serves to encourage more compact, mixed, multi- modal development to allow more parking sharing and use of alternative modes. It helps to adapt to climate change through reducing the demand for vehicle travel, and thus the number of vehicles on the roads, resulting in less risk of accidents due to adverse weather conditions and less added pressure on infrastructure, which will be affected by the adverse effects of climate change. This mitigation policy has a potential reduction of 0.83% of transport carbon emissions. 7. Improving public transport systems has the potential to increase the proportion of people who use public transport to meet their travel needs. It is assumed the 10% of the transportation activities would be affected by policy changes which can contribute to a 2% of transport emissions reduction.

1.3.3 Description of the Barriers to Transformational Change

A barrier adversely affects the achievement of a target (Nygaard and Hansen, 2015). It is an obstacle to reaching the full mitigation potential of a system that can be overcome by designing and enacting measures to prevent the undesired effect (Halsnaes et al., 2007). A comprehensive analysis was conducted on the mitigation actions outlined in Trinidad and Tobago's NDC to determine the factors that will affect the achievement of the policies. The barrier analysis for each of the mitigation actions can be found in Appendix B.

1.4 Choosing Transformational Change Characteristics

The ICAT Transformational Change methodology (ICAT, 2020) provides guidance for assessing the transformational impacts of climate policies and actions. The methodology guides users to assess the transformational impact of policies and actions, by analysing their effects on processes and outcomes of transformations. Processes of transformation represent the main drivers that can lead to system change. These processes can be broken down into specific characteristics representing the specific intermediate steps potentially

addressed by an intervention through which systemic changes can be stimulated. Outcomes, on the other hand, relate to GHG emission reductions and sustainable development, and are characterised according to their scale, and sustained nature (Figure 1.2).

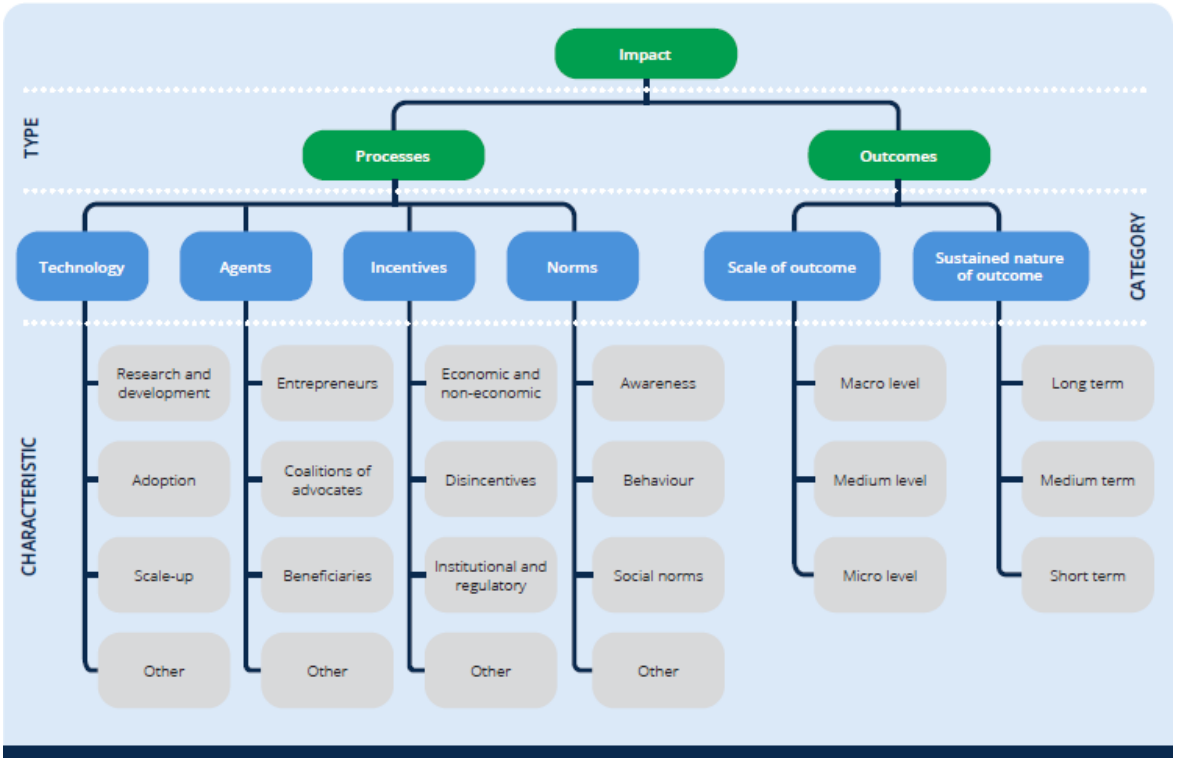

Figure 1.2 Transformational change taxonomy developed by the ICAT (ICAT, 2020)

1.4.1 Process Categories and Characteristics Policy Mapping

The mitigation actions are being developed in the same timeframe as part of the Strategy for Reduction of Carbon Emissions in Trinidad and Tobago, 2040 (GORTT, 2015). This gives reason to assess the mitigation actions as a package of policies. Figure 1.3 depicts the policy map used to determine the process characteristics that were consistent so that a single overarching policy can be analysed in subsequent segments of this assessment.

Category	Process Characteristic	Relevant/Possibly/Not Relevant
Technology	Research and development (R&D)	
	Adoption	
	Scale-up	
Agents of change	Entrepreneurs	
	Coalitions of advocates	
	Beneficiaries	
Incentives	Economic and non-economic	
	Disincentives	
	Institutional and regulatory	
Norms	Awareness	
	Behaviour	
	Social norms	
	Relevant Possibly Relevant Not Relevant	

Figure 1.3 – Policy Map showing mitigation actions

1.4.2 Description of the Process and Outcome Characteristics for the Mitigation Actions

Appendix C and Appendix D give a summary of the descriptions of the chosen process and outcome characteristics and their justifications.

1.5 Impact Assessment

1.5.1 Assessment of Starting Situation

1.5.1.1 Describe the starting situation for relevant process and out characteristics for transformational change.

Appendix C and Appendix D give a summary of the descriptions of the starting situation for relevant process and outcome characteristics for transformational change.

1.5.2 Ex-Ante Assessment

Describe the final ex-ante assessment result explaining the extent of transformation expected and the likelihood that the expected transformation can be realized over the assessment period

1.5.2.1 Description of Process and Outcome Characteristics for Ex-Ante Assessment

The scoring of the process and outcome characteristics describe the likelihood and extent of transformational change expected from the mitigation actions. A description of the scales used for scoring can be found in Appendix E. Table 1.2 and Table 1.3 below represent the assessment and scoring of process and outcome characteristics, taking into consideration the assessment boundary and period.

The assessment considers several policies in the transport sector on various scale-levels and beneficiaries. It is important to note that the impact one policy might have on the process and outcome characteristics would differ from another policy.

The ICAT Transformational Guide noted that "*to arrive at a more general conclusion on the transformational potential of a policy, it is necessary to aggregate the results from the in-depth assessment conducted in the previous steps. It is a key recommendation to aggregate the results for all characteristics and barriers to the process and outcome level*." The relative importance of each process category is documented by using percentages. Each category is expressed as a share of 100%. The relative importance of all four process categories should add up to 100%.

Table 1.2 - Defining Transformational Assessment: Describing Results of the Ex-Ante Analysis at Process Category Level

Category	Score	Rationale for scoring	Relative importance of category including rationale
Technology	3	Vehicles that are powered by conventional fuels are the main contributors to greenhouse gases in Trinidad and Tobago. The policy will directly target the land based transportation sector by encouraging a shift from fossil fuel use to cleaner fuels. The CNG initiative has impacted the transport industry more than other forms of alternative fuel which are still in pre-development stages. Over the next decade CNG adoption expected to experience significant scale-up. Additionally, investment in public transport infrastructure and environmental friendly buses that ensure equitable transport, ICT and efficient service provision will greatly increase public transport ridership in Trinidad and Tobago.	30% The use of CNG powered vehicles is growing in Trinidad and Tobago. CNG is still in the early stages of rollout. However, the fuel is becoming more available while CNG vehicles are more accessible than other alternatively powered vehicle. CNG or battery powered public transportation vehicles can also contribute to the reduction of carbon emissions in the transport sector.
Agents	2	The current road network do not facilitate safe pedestrian movement. Ancillary infrastructure that compliments the use of public transportation can create a safe environment for pedestrian movement and also encourage the use of public transport. These include cycling facilities, walkable spaces and car free zones. The policy provides an opportunity for private investment by entrepreneurs.	30% Most commuters experience greater convenience while using a personal vehicle. Public transportation does not meet all the needs of the commuters. However, there are few entrepreneurs who are involved in the provision alternative fuel transport services.

Incentives	3	The policy considers incentives and disincentives as measures to facilitate a transition away from excessive private auto use to an energy efficient means of travel.	Disincentives such as the increase in fuel prices has had little impact in the travel patterns in Trinidad and Tobago. Incentives that encourages the use of public transport may have a greater impact.
Norms	2	The increase in the number of vehicles and the resulting traffic congestion has to be addressed. Increased awareness can encourage a change in norms of society. Public transportation in Trinidad and Tobago has to be reformed so that it becomes attractive for commuters to consider switching for their current mode of travel.	20% There has been an upward trend for car ownership over the last decade. Unless public transportation meets the demand of an unsatisfied society, there will not be an increase in its use.

Table 1.3 - Defining Transformational Assessment: Describing Results of the Ex-Ante Analysis at Outcome Category Level

Category	Score	Rationale for scoring
Scale of outcome-GHGs	1	The policy will result in GHG impacts that represent minor emissions reductions, relative to the starting situation.
Scale of outcome – sustainable development	2	Minor net positive sustainable development impacts in transport mobility, walkability of communities and road safety is expected.
Outcome sustained over time – GHGs	2	The policy will result in a sustained reduction of GHG impacts over the assessment period.
Outcome sustainable over time – sustainable development	1	The policy will result in sustainable development impacts in the form of increased employment and the expansion of new sustainable industries.

1.6 Transformational Impact Matrix

The results indicate the extent of transformation expected by the policy or action and how likely it is that this expected transformation can be realized. Figure 1.4 illustrates the matrix of possible qualitative scores for process and outcome impacts and includes the final aggregated score for the transformational potential of the package of policies outline in the NDC. When the result for the policy or action falls in the green area, it indicates that the policy or action is expected to be transformational. When it is situated in the red area, the policy cannot be considered transformational. The colour gradient of the matrix reflects the qualitative nature of the analysis and the high uncertainty associated with the assessment. The assessment concludes that the extent of transformation expected to be achieved by the package of policies range between minor to moderate and the outcome is possibly or likely to be sustained over time.

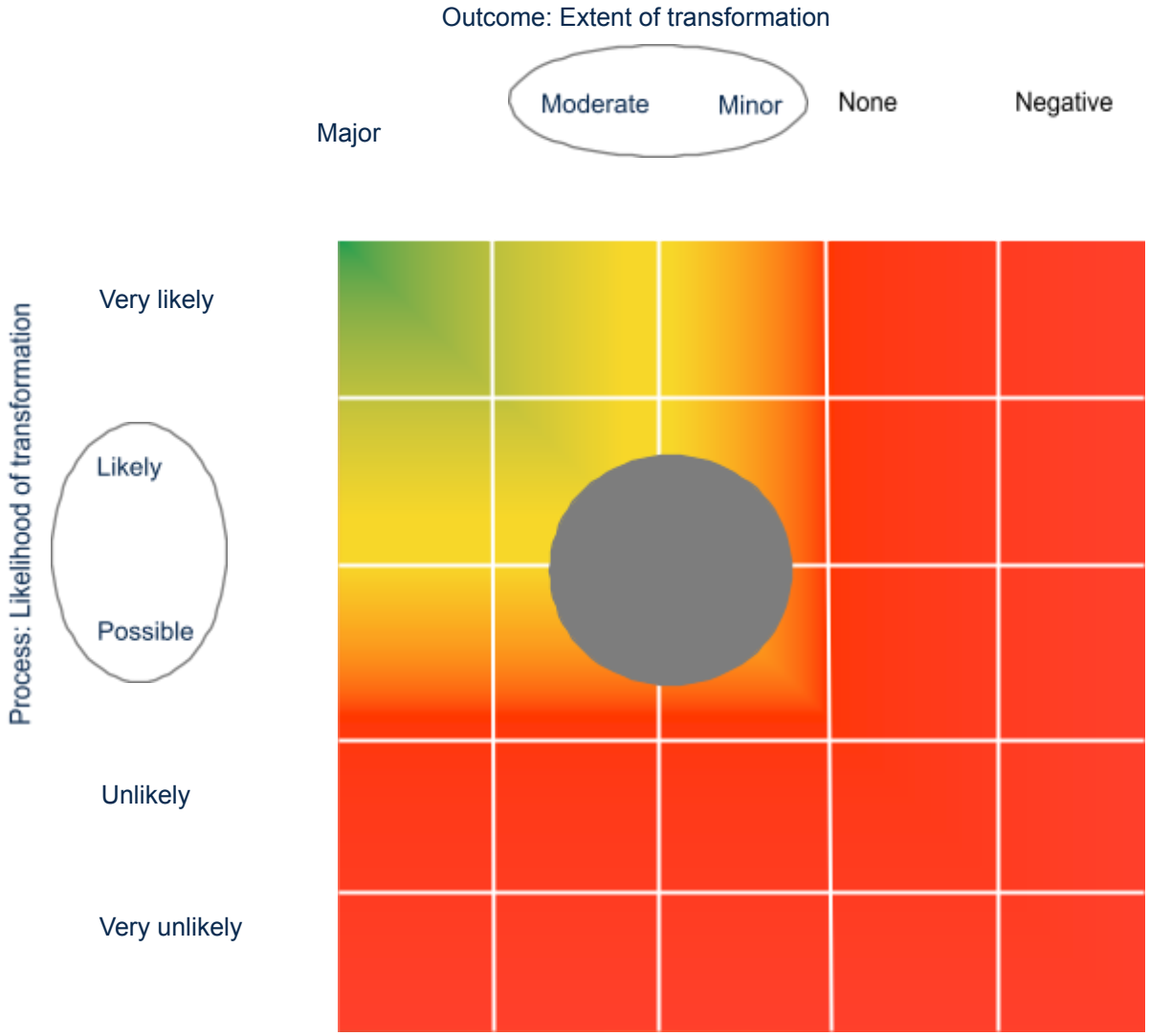

Figure 1.4 Transformational Impact Matrix for the Transport Mitigation Actions.

The package of policies is potentially on the right course and with greater attention on some of the process characteristics such as incentives, disincentives, norms and behaviour, it may be possible to bring a transformation of the transport sector that is aligned with the goal of the Paris Agreement and SDGs. While ambitious objectives have been set regarding the development of mitigation actions, there are significant barriers that can impede the performance of the policies. The main barriers identified are due to a lack of consumer demand, high cost of technology associated with the policies, lack of political will and the lack of alternative fuel options available for consumer choice. The development of an E-mobility policy can address the main barrier to achieving a fuel-efficient transportation sector. E-mobility is a viable option that can help Trinidad and Tobago redress the adverse issues faced with conventional transportation system. The implementation of the policy can possibly increase the extent and likelihood of achieving and sustaining transformational change.

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2. E-Mobility Policy Literature Review

2.1 Background

Electric mobility (or e-mobility) is defined as the systems, services, and equipment that support the movement of passengers and freight by electric-powered means of transport. Electric means of transport include all types of transport powered directly by electricity from, for example, electric scooters and pedal assisted e-bikes, and fully powered 2- and 3-wheeled vehicles such as e-rickshaws and electric cargo bikes, and also very light 4-wheelers, cars and vans to trucks, buses, trolley buses, trams, trains, aircraft and ferries. The conventional Internal Combustion Engine (ICE) vehicle burns gasoline or diesel to generate motive power.

There are currently four broad classes of vehicles that can be used to deliver electric Mobility, and these are now described (adapted from Pollution Probe and the Delphi Group, 2018):

Hybrid Electric Vehicle (HEV): Combines an ICE with a battery-electric propulsion system. Uses regenerative braking and/or the ICE to charge the battery; no external source of power is used. Vehicle hybridization has emerged as an option for most modes of vehicles and has helped to achieve modest GHG reductions. HEVs are normally not counted as part of electric vehicle (HEV TCP Annual Report 2021). HEVs are more a technology that can improve efficiency of conventional vehicles.

Plug-in Hybrid Electric Vehicle (PHEV): An HEV with the option to charge the battery with an external source of electricity. These vehicles typically have larger batteries and longer all-electric ranges than HEVs. Modern PHEVs tend to have electric ranges anywhere from 25 to 85 km. This means that their users can conduct a significant amount of day-to-day driving exclusively using electric propulsion, while having the option to make longer trips using petroleum if charging is unavailable or too time-consuming.

Battery Electric Vehicle (BEV): Uses electric motors for propulsion, which are powered entirely by electricity stored in a battery. The battery is charged by plugging into an external electricity source (Element Energy Limited, 2021, pp. 3). Battery electric vehicles use chemical energy stored in batteries as their power source. The batteries are used to run electric motors to propel the vehicles. (UNEP DTU Partnership, 2021, p. 39)

Fuel Cell Electric Vehicle (FCEV): Uses a fuel cell and hydrogen gas to power an electric motor which drives the propulsion system. Hydrogen (H2) can be produced from methane (CH4) via a process called steam reforming, or from water (H2O) via electrolysis. Once the hydrogen is produced it must be pressurized, distributed and stored. Inside the vehicle, a fuel cell stack converts the hydrogen into electricity which is used to charge a small battery which in turn powers an electric motor. The FCEV refuelling process is similar to that of conventional ICE vehicles, and only takes several minutes to complete. As FCEVs use electric motors for propulsion, they are most often categorized as a form of electric mobility. Fuel-cell hydrogen electric vehicles are an option besides battery electric vehicles, and may be a future option for heavy-duty vehicles. However, the main barrier is the cost and the energy needed to produce the hydrogen. It is energy-intensive to produce hydrogen using renewable energy: producing 1 kg of hydrogen requires 40 kWh of renewable energy, while 1 kg of hydrogen can propel light- duty vehicles 100 km. In comparison, a battery electric light-duty vehicle will require only 22

Kwh of energy for 100 km. The high cost of hydrogen production is an obstacle to fuel-cell hydrogen electric vehicles. Therefore, in the short term, battery electric vehicles look like the more cost-effective option. (UNEP DTU Partnership, 2021, p. 39)

Trinidad and Tobago does not contribute significantly to the total worldwide Greenhouse Gases (GHG) emissions. In fact, as of 2019, Trinidad and Tobago was ranked 70th off all the countries if they were classified by total national GHG emissions. However, if the analysis considers not only total national emissions but population as well, the country would be ranked second in terms of GHG emissions per capita.

Trinidad and Tobago deposited its instrument of ratification to the Paris Agreement on climate change on February 22, 2018 in New York at the United Nations' Headquarters. This commitment means that we will have to reduce cumulative greenhouse gas emissions by 15 percent from industry, power generation and the transport sector by 2030 from a business as usual baseline. In 2018, transport contributed 7 percent of all carbon emissions, and 85 percent of that was from road transport. The distribution of fuels is estimated to be as follows: 0% electric mobility and biofuels, 0.1% CNG, 60% Petrol, and 39.9% Diesel.

E-Mobility offers two general advantages over fossil fuel powered vehicles. Firstly, by moving from conventional fossil fuels such as petrol and diesel to electricity, it is possible to move the source of pollution away from exhaust pipes and to centralise it at power plants. Secondly, with the increase of renewable energy generation capacity, it is possible to decarbonise transport to a great extent.

2.2 Opportunities and Potential For E-Mobility

Most of the major cities in the world are already plagued with severe traffic congestion and record-breaking pollution levels. They have adopted new mobility solutions, that include electric mobility. Trinidad and Tobago is currently importing all vehicle fuels. Shifting to EVs would reduce our dependence on oil imports. A widespread adoption of EVs in the market will increase electricity demand—often at new points of consumption, with a potentially higher peak demand and demand volatility. On balance, given the high energy efficiency of EVs and increasing the percentage of renewable energy in the energy mix, our overall energy import bill will reduce sharply.

2.2.1 Environmental Benefits

The adoption of EVs offers significant potential to reduce GHG emissions via the use of electricity as fuel for vehicles, as opposed to gasoline or diesel. The fact that battery EVs have zero tailpipe emissions helps to address poor air quality on the roads.

Strategies promoting battery electric vehicles should be coordinated with electrification plans and with improving the share of renewable sources of energy in electricity generation. (UNEP DTU Partnership, 2021, p. 42)

2.2.2 Social Benefits

EVs are far quieter than ICE vehicles, contributing to a more peaceful and serene quality of life for those that live near highly trafficked areas. Beyond GHGs, the deposition of particulate matter emitted from gas-powered vehicles is a major problem in cities.

2.2.3 Economic Benefits

EVs cost far less to operate and maintain than gas-powered cars. They have a small fraction of the number of moving parts that ICE vehicles have, and their fuel is far cheaper and more predictably priced than gasoline or diesel.

Since several developing countries depend on oil imports, battery electric vehicles offer a way to reduce fossil fuel imports and thereby save precious foreign exchange. Battery electric vehicles with fewer components are relatively easier to manufacture, compared to vehicles that run on an internal combustion engine. (UNEP DTU Partnership, 2021, p. 41)

BEVs are already the cheapest powertrain on a lifetime Total Cost of Ownership (TCO) basis for medium cars bought today, and will be for small and large cars in 2024 and 2026 respectively. Based on these forecasts, BEVs are likely to become the dominant powertrain for new car sales within the next decade. The transition to BEVs has the potential to rapidly reduce new car fleet emissions, while unlocking significant long-term savings for consumers (Element Energy Limited, 2021, p. 39). By 2025, as the purchase prices of BEVs become much more comparable to ICEVs, fuel/electricity costs become the deciding factor in which powertrain is cheapest on a TCO basis for consumers (Element Energy Limited, 2021, p. 12). The TCOs for BEVs and FCEVs will drop significantly over the next decade, driven by falling battery and fuel cell costs, leading to a lower upfront price, which removes a strong psychological barrier to consumers (Element Energy Limited, 2021, p. 9).

2.2.4 Financial incentives

An important parameter affecting EV profitability is also the fossil fuel price. Reducing fossil fuel subsidies and putting environmental taxes on fossil fuels will promote the shift toward EVs and is equitable as it follows the polluter-pays-principle.

Battery electric vehicles are more efficient than conventional vehicles, though this advantage can be offset by low fossil-fuel prices. Therefore fossil-fuel subsidies act as a significant barrier to battery electric vehicles. (UNEP DTU Partnership, 2021, p. 39)

It is important for government to use a mix of subsidies and tax breaks to incentivise all users to switch to electric (Element Energy Limited, 2021, p. 24). To ensure the greatest carbon reduction impact, it is essential high mileage user groups are early adopters of BEVs (Element Energy Limited, 2021, p. 26). It must be the first priority to encourage the highest mileage drivers to switch to BEVs and unlock the most financial savings while bringing about the fastest reduction to CO2 emissions (Element Energy Limited, 2021, p. 27).

One of the major advantages of BEVs is that they provide consumers with the additional flexibility to save cost by choosing a smaller battery with a lower maximum range. Consumers that purchase BEVs will be able to find the optimum balance between price and range, choosing a vehicle range to meet their own personal requirements and priced accordingly (Element

Energy Limited, 2021, p. 29). The reduction of battery costs in the last decade has been dramatic, which has meant that the total cost of battery electric vehicles and hybrids is now closer to conventional vehicles running on the internal combustion engine, especially for light- duty vehicles (UNEP DTU Partnership, 2021, p. 38).

2.2.4 E-Mobility Charging Infrastructure

Unlike conventional petrol stations, providing charging services to EVs does not require businesses to be equipped with large inventories, tanks, pumps and a lot of real estate. This allows small businesses, malls, parking operators, grocery stores, hotels, fast-food chains and restaurants to provide their customers with charging services. These businesses can benefit from attracting customers to their stores, from gathering customer data, from improved customer satisfaction and by positioning themselves as green. Conventional petrol pumps could also start providing charging facilities to their customers.

China has achieved the large-scale adoption of battery electric vehicles through stringent emissions regulations, higher taxes on older and more polluting cars, and the provision of extensive charging infrastructure (UNEP DTU Partnership, 2021, p. 41). A comprehensive and strategically located charging network offering attractive tariffs (which may include preferential pricing for frequent users, smart charging, EV charging linked to domestic electricity tariffs and roaming agreements with charging operators) is crucial to ensure drivers have confidence in publicly available infrastructure as this will encourage consumers to switch to BEVs more quickly. (Element Energy Limited, 2021, p. 41).

2.2.5 Parallel Priorities and Investments

The basic elements of a sustainable transport system—integrated and affordable public transport, safe walking and cycling facilities, car sharing, fuel economy standards, and parking management—should be pursued in parallel to investments in electric mobility. The lower running costs of electric cars and lower taxation of electric fuel may lead to increased use, contributing to congestion and reduced use of other modes; so, electric mobility policy and priorities must pay attention to which electric means of transport will be promoted and how. EV Policy should combine electrification of the existing fleet with promoting a modal shift toward more efficient modes such as walking, electric cycling, and use of public transport to capture the potentially great benefits of electric mobility while maximizing its contribution to the development of sustainable mobility.

Developing countries also need to think about battery disposal. Here, it might be necessary to ensure that lithium-ion batteries are recycled as effectively as lead acid batteries by making the sellers of batteries and electric vehicles responsible for the safe collection of batteries as well. Lithium-ion batteries used for automotive applications can be repurposed for stationary applications, can provide storage at 90 percent lower cost, and have the potential to contribute 60 percent of grid storage capacity. (UNEP DTU Partnership, 2021, p. 41)

2.3 **E-Mobility Status in the Caribbean** (Adapted from UNEP, 2020)

2.3.1 Antigua and Barbuda

The Antigua and Barbuda Sustainable Energy Action Plan mentions the use of incentives and communication campaigns to promote hybrid, electric and other low-carbon fuel vehicles as one of its main lines of action. The plan also foresees that from 2025, energy consumption in the transport sector will have been reduced by 40 %compared to 2010 levels. To this end, the government enacted a Low Emissions Development Strategy for the transport sector, which prioritizes the introduction of electric vehicles. As a result of the strategy, import taxes on electric vehicles were eliminated.

The country is advancing in a pilot project to introduce two electric buses for the transport of schoolchildren. Different types of vehicles that are part of the government's institutional fleet will be being tested. This project seeks to evaluate the technology and its adaptability to conditions in Antigua and Barbuda, as well as to provide visibility and familiarize the population with the technology.

Antigua and Barbuda launched in early 2020 a call for expression of interest for the introduction of electric buses and charging infrastructure.

2.3.2 Barbados

The government of Barbados launched its National Energy Policy for 2019-2030 with a view to becoming a carbon-neutral and 100% renewable energy country. This strategy calls for replacing the use of internal combustion vehicles in the next decade and increasing the percentage of electric and hybrid vehicles; as well as improving the efficiency of public transportation. This energy policy is accompanied by an implementation plan that proposes the start-up of pilot projects with electric vehicles.

It is estimated that the country already has more than 350 electric vehicles, including light-duty vehicles as part of the commercial fleet of several companies. By July 2018, more than 50 charging stations had been installed (several of which are publicly accessible), including parking lots integrated with photovoltaic systems. Given the size of the island, this provides a wide coverage of about one charging station every 5km. Public charging stations available in Barbados can be used through membership and special identification cards. It should be noted that efforts to deploy electric vehicles and associated charging infrastructure in this country have been led by the private sector.

In terms of public transportation, the Transportation Board has decided to modernize its fleet through electric buses. At the end of 2018, a tender was launched to provide between 120 and
180 electric buses. Thirty-three electric buses hit the road in Barbados in October 2020. Passengers are getting used to one big change—the absence of noise—they have to get used to looking for the bus instead of listening for it. (ECPA, 2020)

In 2018, more than 50 charging stations were installed (several of which are publicly accessible), including parking lots that integrate photovoltaic systems.

2.3.3 Grenada

The Grenada government has declared its intention to be a leader in electric mobility in the Caribbean. In 2015, the company Grenlec, in charge of electric service, launched a pilot project,

where it put into operation three electric vehicles (two Nissan Leafs and a five-seat Nissan E-NV200 Plus), as well as a limited number of charging points. The pilot was designed to test the energy efficiency, scope, cost savings, on-road performance and environmental benefits of electric cars compared to internal combustion engine cars.

2.3.4 Jamaica

In September 2019, the Government of Jamaica, through the Ministry of Science, Energy and Technology announced its intention to elaborate a national electric vehicle policy in order to generate conditions to promote this type of vehicle. Such announcement was made after a study tour by Jamaican government representatives to the United States as part of a feasibility study for the introduction of electric buses in the country. In June 2019, the Jamaica Public Utilities Company JPSco announced its intention to deploy public charging infrastructure as a strategy to promote electric mobility in the country. The company JPSco has also been analyzing the feasibility of electrifying its fleets.

2.4 Fiscal and Non-Fiscal Incentives to Promote E-Mobility

Appropriate incentive structures include financial and nonfinancial incentives as well as a creative packaging of incentives (Grütter and Kim, 2019):

- Financial incentives are critical toward reducing up-front costs and establishing charging infrastructures. However, an important parameter affecting EV profitability is also the fossil fuel price. Reducing fossil fuel subsidies and putting environmental taxes on fossil fuels will promote the shift toward EVs and is equitable as it follows the polluter-pays- principle.
- Cities have multiple instruments at their disposal to promote EVs, including city access restrictions, preferential lanes and parking access, preferential access for EVs, and demanding increasing shares of EVs in transport fleets. Such incentives can turn business models based on EV fleets profitable. For motorcycles, financial incentives have proven to be important, but not decisive. Even if electric scooters (e-scooters) have the same price tag as conventional motorcycles, customers will still be reluctant to purchase them due to anxieties over range, speed, power, and reliability. The core nonfinancial incentive to promote e-scooters is clearly to ban fossil-powered motorcycles from entering cities.
- Incentives should be targeted toward vehicles with high impact and toward sustainable business models. Subsidizing public charging infrastructure in cities is a good start. Incentives are often too much targeted toward private-vehicle owners, with a limited impact and a high cost. Linking subsidies to vehicle usage and mileage is more efficient. Access to capital, guarantee schemes, and nonfinancial incentives should be explored next to traditional up-front subsidies, which have proven to be effective (if sufficiently high), but very costly. Financial subsidies to private EV owners should be fiscally neutral and be paid by fossil fuel car owners to avoid negative social impacts.
- Non-price Incentives Non-price incentives depend very much on the country and should be related to factors which influence purchase decisions of potential EV customers. These include: special lane access; parking perks; exemption from road and congestion charges; exemption from driving restrictions; and, exemption from purchase restrictions.

Many of the nonprice as well as the financial incentives are of temporary nature until EVs have a certain market share. Norway, for example, in 2016 halted countrywide free parking for EVs due to the large number of such vehicles already being used.

A major reason behind the growth of the EV industry in China has been the support granted to it in the form of national subsidies by the Chinese government. The Chinese government began subsidizing EV purchases for government and public fleets in 2009, and individual car buyers in 2013. Effective 2019, a combination of credits and disincentives have been employed to improve the fuel efficiency of traditional-fuel vehicles, as well as to promote the deployment of EVs. EV's are also promoted through non-fiscal incentives, such as exemption from city license plate lotteries or restrictions. Getting a license plate for an ICE car can take years through a lottery which are held every other month in Beijing or in a monthly auction in Shanghai. An EV license plate is free and often can be obtained a lot faster. Furthermore, EV's are not subject to registration restrictions or driving bans on certain days, that apply to vehicles with ICE in Chinese megacities. (Nishith Desai Associates, 2019)

Norway is a pioneer with respect to the EV industry. In its efforts to cut down greenhouse emissions, the Norwegian Parliament has decided on a goal that all new cars sold by 2025 should be zero-emission vehicles. To boost EV demand among consumers, the Norwegian government has waived off the erstwhile hefty vehicle import duties, registration and sales taxes that were levied on buyers of electric cars. Conventional engine-powered cars, however, continue to be taxed heavily in Norway. Purchase of emission emitting vehicles is discouraged through an innovative calculation of registration tax. The registration tax for all new cars is calculated by a combination of weight, carbon dioxide and nitrogen oxides emissions. The tax is progressive, making big cars with high emissions are more expensive. Over time, registration tax has been adjusted gradually to have more emphasis on emissions and less on weight. Apart from tax incentives, EV owners do not have to pay road tolls and get free use of ferries and bus lanes in congested city centres. Gradually over time as the ecosystem matures subsidies for electric cars will be replaced by higher taxes on traditional cars. (Nishith Desai Associates, 2019)

Netherlands has been one of the leaders in EV adoption and promotion, with more than 49,000 EVs on its road. Netherland recorded sale of 24,024 EVs in 2018. The Netherland government has taken a comprehensive set of actions to achieve their ambitious target of 75,000 privately owned EVs on its roads by 2020, and 50% of all new car sales in plug-in electric of which a minimum of 30% of the vehicles should be fully electric by 2025. With respect to tax incentives, EVs have been exempted from registration and road taxes, and they also have the advantage of reduced taxes for the private use of company cars. Netherlands has a very dense network of public charging stations with 19.3 charging stations per 100 kilometres far ahead of countries like Japan, Germany and the UK. (Nishith Desai Associates, 2019)

2.5 Stakeholder Identification

The role of participative stakeholder consultation is according to the principle that the whole process has to be done in cooperation between the Government and stakeholders. The reasons for this are: (a) The stakeholders have to become co-owners of the problems and share a part of the responsibilities. (b) Stakeholders might have information about the character of the problems and ideas for possible solutions. They also have essential information which could influence the content and feasibility of the concepts. (c) There is a need to make sure that the stakeholders will be able and willing to cooperate in the workshop.

The primary focus of consultation is on fostering dialogue with and among the stakeholders, with the aim of building consensus with respect to the project. The consultation programme must obtain meaningful input from the complete spectrum of affected interests (transportation, environment, economy, community).

Table 1 gives the proposed Stakeholder Analysis for this initiative, as a performance-based system. The suggested stakeholders have been identified in the first column, and the first row gives the suggested stakeholder interests. Individual factors of influence have been input into all the cells of the matrix template. The sum of each row determines the critical stakeholders by rank, and the sum of each row determines the critical stakeholder interests by rank.

Table 1 Proposed Stakeholder Analysis for this Initiative

	Stakeholder Interests																	
Stakeholders	**Establish a vision of the future of sustainable urban mobility**	**Identify viable segments of EV market**	**Apply fiscal and non-fiscal incentives to increase emobility**	**Develop standards, regulations and planning for charging infrastructure, recycling of batteries, parking and data sharing**	**Impact of EVs on Economic Growth and Employment**	**Adopt an ecosystem-based perspective for collaborative governance**	**Education and Training**	**Financing Infrastructure and Facilities**	**Legislation**	**Maintenance of Road Network**	**Mass transportation / Public Transportation**	**Networking Among stakeholders**	**Gender Considerations**	**Private Auto Ownership and Usage**	**Road Design/ Engineering standards**	**Standards for installation and maintenance of road furniture**	**Statistical Information / Data Collection**	**Vehicle engineering and safety standards**	**Total (identifies critical Stakeholders)**
Caribbean Development Bank (CDB) - projects - Financial Grants	1	3	3	2	3	2	2	3	1				1				1		22
Cellular Companies - Digicel/Bmobile	1	3	3	1	2	1	2	3											16
Chambers of Commerce - advocacy and funding	1	2	2	1	3	1	1	3	2				2				1		19
Customs and Excise		2	3	3	2		1	3	3				1				1		19
IDB - Project - Financial Grants	1	3	3	2	3	2	2	3	1				1				1		22
Licencing Office - Inspections, education and training, certification of licenses for all classes of vehicles, enforcement	1			3			3		3	2	2	1	1	3	3	3	3	3	31
Maxi Taxi Association	3	3	3	2	2	1	2	3	3	3	3	3	2	3	2	2	2	3	45
MEDIA - print, tv, radio, social, signage - public communication				1	3	1	1	2	2	2	2	3	3	1			1		22
Ministry of Education - EV Education at all Schools		2		2		2	3	1	2		2		2				2	2	20
Ministry of Finance	1	3	3	2	3	2	2	3	1				1				1		22
Ministry of Health - trauma and emgergency	1	2				3	1					2	2				1		12
Ministry of Labour			3	2	3	1	2	3	2			3	3	2			2		26
Ministry of National Security	3	2	3	2			2	2	3	1	1	2	2	2	3	3	3	3	37
Ministry of Planning - land use planning / spatial planning	3	3	3	3	3	3	3	3	3	1	2	3	3	1	1	1	3	2	44
Ministry of Science, Technology and Tertiary Education	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	3	1	38
Ministry of W orks and Transport - planning, design, construction and maintenance of road infrastructure	3			3		2	2	2	3	3	3	3	3	3	3	3	3	3	42
Multinational Companies - Corporate Social Considerations	3	3	1	1	3	1	1	3	3			2	2	3			2		28
National Training Agency - standardize instructor / driver training	2			2			3		3			2	2	3	3	3	3	3	29
Office of the Prime Minister	3	3	3	3	3	2	1	3	3			3	3				3		33
PTSC - buses	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3	3	52
State Enterprises - Government-Owned Vehicles	2	2	2	2	2	1	2	2	3			3	3			3	3		30
T&TEC - Protection of the road users from T&TEC infrastructure	3	3	3	3	3	3	3	3	3		3	3	3			3	3		42
Taxi Drivers Association	3	3	3	2	2	1	2	3	3	3	3	3	2	3	2	2	2	3	45
The Association of Professional Engineers (APETT)	3	3		3	2		2		2	2	2	3	3	2	3	2	3	3	38
The Joint Consultative Council (JCC)	3	3		3	2		2		2	2	2	3	3	2	3	2	3	3	38
Tobago House of Assembly (THA)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	54
Trinidad & Tobago Automobile Association (TTAA) - advocacy			3	3	3			3	3		3	3	3	3	3	3	2	3	38
Trinidad & Tobago Automobile Sports Association (TTASA) - advocacy			3	3	3			3	3	1	3	3	3	3	3	3	2	3	39
Trinidad & Tobago Automotive Dealers Association New Car Dealers	3	3	3	3	3		3	3	3	1	3	3	3	3	3	3	2	3	48
Trinidad & Tobago Society of Planners (TTSP)	3					3	3		3		3	3	3	3	1	2	3	1	31
TTPS	3	2		2			2		3	1	1	2	2	2	3	3	3	3	32
Used Car Dealers Association	1	3	3	3	3		2	3	3		2	3	3	3	3	3	2	3	43
UTT - Education and Research	3	3	2	3	3	3	3	1	3	1	2	2	2	2	3	3	3	3	45
UWI - Education and Research	3	3	2	3	3	3	3	1	3	1	2	2	2	2	3	3	3	3	45
Ministry of Energy	3	3	3	3	3	3	3	3	3	1	1	2	2	2	2	2	3	2	44
Total (identifies critical stakeholder interests)	**69**	**74**	**69**	**80**	**74**	**50**	**73**	**74**	**87**	**30**	**52**	**72**	**78**	**58**	**54**	**59**	**79**	**59**	

* Individual Factors of Influence are 1- lowest , 2 - medium, and 3 - highest

2.6 E-Mobility Opportunities

There is an opportunity to design a different future, and reap both environmental and economic benefits with a call to action around the following three principles to be acted upon (World Economic Forum, 2018):

1. Take a multistakeholder and market-specific approach. Stakeholders should plan for electrification while taking into account local characteristics, especially urban infrastructure and design, the energy system and the culture and patterns of mobility.
2. Prioritize high-use vehicles. The focus should be on electrifying fleets, taxis, mobility-as- a-service vehicles and public transport, which will have a greater impact as these represent a higher volume of kilometres travelled. Although personal-use vehicles will likely remain a significant portion of the vehicle stock for many years, they would represent a much lower volume of overall kilometres driven.
3. Deploy critical charging infrastructure today while anticipating the transformation of mobility. To keep pace with growing demand and to address range-anxiety issues, charging infrastructure is needed, especially along highways, at destination points, and close to public transport hubs. To minimize the risk of stranded investments, future mobility and vehicle ownership patterns should be considered, as some current charging locations (i.e. in apartment buildings, at parking meters along city streets) may not be needed in the future. The infrastructure should be deployed in combination with grid edge technologies – such as decentralized generation, storage, microgrids and smart buildings – and integrated into smart grids, to fully exploit the flexibility of EVs while enabling the stability of the energy system. Digitalization would help simplify and enhance the customer experience, support efficient infrastructure deployment and management as well as enable new services associated with electric, shared and autonomous mobility. Charging stations can become hubs for smart-city services.

One of the key barriers for a fast adoption of electric vehicles is the upfront capital cost of an electric vehicle. Owners of EVs would only see an overall economic benefit if their vehicle is driven for more than 150km a day. Such distances are typically not covered daily by private car owners. The required investment capital for a systematic transition to EVs, which includes the cost of EVs, the cost of developing charging infrastructure, the training of manpower for maintenance and service of vehicles. (TFE Consulting, 2018)

Battery End-of-Life Impact. As the number of EVs increases, so does the number of vehicle batteries that will eventually reach the end of their useful lives. EV batteries are expected to power their vehicles for at least eight to 10 years (about 3 to 4 years for larger vehicles), however, at retirement the batteries will likely still retain about 50-70% of their original capacity. EV owners in China and the EU are required by law to recycle or reuse vehicle batteries, and some experts expect the U.S. to follow suit with this requirement. Lithium-ion car and bus batteries are still useful for an additional seven to 10 years after retirement. Spent EV batteries still have reasonable energy storage and standby power capabilities that could be used in many applications. For example, EV batteries are being reused in California to power EV charging stations. In Europe, they are being used commercially to store energy for homes and grids. In Japan, Nissan has repurposed retired EV batteries to power streetlights. There are also cutting- edge recycling operations to recover valuable materials such as cobalt, lithium carbonate and ferrous scrap metal. Ensuring EV owners are aware of the reuse and recycling options available to them for their EV batteries can assist in ensuring retired EV batteries are dealt with responsibly. Additionally, stewardship programs could be implemented to assist in the safe decommissioning and/or reuse of EV batteries. (Pollution Probe and the Delphi Group, 2018)

Car Sharing and Ride Sharing. There are a number of car sharing and ride sharing services in Toronto, such as Zipcar, Maven, Enterprise CarShare, Communauto, Turo, Lyft and Uber. Uber has introduced the EV Champions Initiative, a one-year pilot project that is providing cash incentives to some of its drivers who use EVs. The pilot project is taking place in seven cities across the U.S. and Canada: Austin, Los Angeles, Montreal, Sacramento, San Diego, San Francisco and Seattle. Cash incentives for drivers who switch to EVs vary depending on the city. Recently, the City of Paris and automaker Renault announced that they will be deploying a fleet of 2,000 EVs for ride-hailing and car sharing services in Paris. Innovative and collaborative partnerships may offer a more attractive mechanism than regulations to increase the adoption of EVs in ride sharing and car sharing fleets. (Pollution Probe and the Delphi Group, 2018)

Awareness raising. As is common with new technologies, awareness and understanding of e- mobility is low among many citizens and local policy makers. Any policies to promote e-mobility should be accompanied by communication efforts to explain how e-mobility works, and its potential benefits for society. (Hunkin and Krell, 2019)
Procurement. Public procurement can be a powerful market driver for the introduction of new technologies. This is no different for e-mobility. Many authorities are already looking at their own fleet of vehicles and making the transition to electric vehicles. A range of public transport modes are ripe for electrification including buses, metro trains, trams and ferries. A European Clean Bus Initiative has been set up specifically to help local authorities deploy electric and other low emission vehicles. (Hunkin and Krell, 2019)

Public-private partnerships. Companies and start-ups are offering an ever increasing range of e- mobility services to citizens. This includes many transport sharing initiatives, as an alternative to private ownership, whereby customers pay for the use of a vehicle for a set time. Regional authorities can consider ways to encourage this activity in their territory, for example by entering public-private partnerships. Long standing car sharing schemes are transitioning to electric vehicles. Other car sharing schemes exclusively offer electric vehicles. In urban areas there is an increasing prevalence of electric bike, moped and scooter sharing schemes. These sharing schemes have great potential to be incorporated into a Mobility as a Service (MaaS) system, which integrates various forms of transport services into a single mobility service accessible on demand. (Hunkin and Krell, 2019)

In most countries, policies have been directed toward private vehicles with limited attention being given to commercial vehicles, although the latter would have a far bigger impact with a lower price tag. Policies which could be deployed for different commercial vehicle categories to foster adoption of EVs include the following (Grütter and Kim, 2019):

Buses

- Require operators to have a certain share of EVs in their bus fleet, which gradually increases until reaching 100%.
- Require new licensed routes to be operated by electric buses.
- Favour electric buses in public tendering of routes.
- Free charging infrastructure and/or reduced price for electricity as compensation for improved air quality and reduced noise (public goods).
- Up-front purchase subsidies.
- Limit access to city centre to electric buses;
- Support the creation of entities which purchase large fleets of electric buses and lease them to operators.
- Require all buses to be electric by a certain date.
- Increase the diesel tax.

Taxis, car-sharing organizations, shared mobility

- Support the establishment of public fast chargers at multiple locations.
- Free charging infrastructure and/or reduced price for electricity as compensation for improved air quality and reduced noise (public goods).
- Up-front purchase subsidies.
- Preferential access to new licenses or limit new vehicles to electric units.
- Limit access to city centre to EVs.
- Support car-sharing organizations which go pure electric.
- Ban fossil fuel vehicles in the city from a certain date.
- Increase the diesel and gasoline tax.
- Reduce or eliminate taxes on EVs.

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3. E-Mobility Policy Barrier Analysis

This section identifies the existing barriers faced for the proliferation of e-mobility technologies in Trinidad and Tobago. The concept of e-mobility is new to Trinidad and Tobago, however it is not a new invention, as the first concepts of electric vehicles were developed in the late 19th century. The concept has seen great success in many countries. Although there are already existing concepts and available models, the broad-based market diffusion of electric vehicles has not yet been successful. Trinidad and Tobago can experience high levels of electric vehicle uptake and improve its energy security by drastically reducing its total energy consumption and dependence fossil fuel. However, there are significant barriers to e-mobility that will challenge the transition from the use of conventional fuels to power vehicles. These barriers are mainly on the account of the high cost of acquisition, consumer acceptability, battery performance and the lack of charging infrastructure. The success of transforming the transportation sector to becoming more fuel efficient and less dependent on fossil fuel rests in developing an e-mobility strategy to eliminate the main barriers to the deployment of electric vehicles.

These barriers can be placed into 5 major categories, these include:

1. Technical/Infrastructural Barriers
2. Economic Barriers
3. Social Barriers
4. Financial Barriers
5. Institutional Barriers

Table 3.1 gives the barriers of transformational change classified by type of barriers in the context of the ICAT Transformational Change Methodology in the context of the e-mobility policy in Trinidad and Tobago.

Table 3.1 Barriers of Transformational Change Classified by Type of Barriers in the Context of the ICAT Transformational Change Methodology in the Context of the E- Mobility Policy in Trinidad and Tobago

Categories	Barriers	Explanation	Characteristics affected
Technical/Infrastructural Barriers	Battery Performance Issues	The main components that contribute to the propulsion of electric vehicles are the motor, batteries, chargers and controllers. These differ greatly from the gasoline engine of a conventional vehicle. The lithium-ion battery used in electric vehicles (EV) are expensive, and it many also need replacement more than once in the lifetime of the vehicle.	Adoption
	Lack of Training and Repair Facilities	Trained technicians are key stakeholders in the maintenance of electric vehicles. There are few workshops that specialize in EV repair and maintenance in comparison to those for internal combustion engine vehicles (ICEV). There is a low volume of electric vehicles in Trinidad and Tobago. This may be a disincentive for national training and development of local mechanics.	Research and Development
	Lack of Charging Infrastructure	Long road trips in a gasoline powered vehicle would require much less forethought than the EVs, in that, refuelling is less time consuming and more available. The same trip in an EV would require researching the location of charging stations along the way and setting aside time to recharge.	Scale Up
	Battery Recycling Standards	The batteries used in electric vehicles are designed to last between eight and ten years. In spite of its durability, it eventually experiences wear and tear. Batteries that have come to the end of its lifespan would require proper disposal. The scraping of batteries for elements like Lithium, Nickel, Cobalt, Manganese and Titanium can impose an unwanted risk to the environment if proper disposal protocols are not in place.	Research and Development

	Location of Charging Infrastructure	Another major ba... electric vehicle exists for those who live in multi-storey apartments and rely on street parking. These developments do not facilitate ease of access to electric vehicle charging stations. Residents who occupy single family units with the privilege of private parking have the option of independently installing charging infrastructure. Additionally, many units may not be well equipped to support increased load for charging EVs.	
	Purchase price of EVs	A major barrier to adoption is simply the purchase price of electric vehicles, which is typically higher than conventional ICEV. People are most responsive to up-front costs when purchasing vehicles and are less responsive to life cycle ownership costs. Additionally, at the end of the EV battery lifespan, its replacement is often borne by the user. Government tax concessions would be necessary to reduce the upfront cost for prospective customers.	Economic
	High Fleet Cost	The initial cost of upgrading or switching the current transit fleet has a substantial capital cost which is a major hurdle for state company budget allocations. In addition to providing incentives and concessions to EV buyers, the state should consider incentives for shifting the public transport sector to electric vehicles.	Economic
	Lack of Awareness Campaigns	Electric vehicles are still a relatively new technology and many consumers are either unaware or lack knowledge about the potential benefits of electric vehicles, such as the potential fuel-related savings and the positive environmental impacts. Electric vehicles are the future, and consumers will have to be made aware of the unavoidable changes in transportation technology.	Awareness
	Range Anxiety / Charging Time	In many instances, prospective EV owners experience "range anxiety", which is the fear of running out of electricity either along a journey or at a location without charging facilities. Many drivers, especially those who live in multi-storey apartment complexes may lack access to dedicated charging facilities.	Awareness

Financial Barriers	Lack of Customer Demand/ Personal Taste	People acquire vehicles based on subjective desires. Many people purchase vehicles based on its function, while others purchase because of the aesthetic appeal. Most electric vehicles lack the performance characteristics that vehicle enthusiast have appreciated over the years in the conventional ICEV. Additionally, EVs are limited in the number of options provided to the consumer. More design options should appeal to a greater audience.	Behaviour/Social Norm
	Lack of Private Sector Investment	Entrepreneurs are often hesitant to invest in new technologies, especially if they bear all of the risk. Difficulty in accessing credit and import subsidies serves as an additional barrier to the adoption of EVs in the transport sector.	Entrepreneur
	High Electricity Price	Vehicle owners are sensitive to the low cost of fuel in the country. Electric vehicles are solely dependent on electricity to be powered. High electricity prices could be a deterrent to potential EV users to purchase an EV.	Adoption
Institutional Barriers	Lack of National Transportation Roadmap	The potential increase in EV usage should be synced to the country's sustainable development policy vision. Appropriate legislation and long term planning by the government could contribute to faster adoption of electric vehicles. Procurement strategies, environmental awareness, subsidized purchasing, among other policies, should be included in long-term plans and goals.	Institutional and Regulatory
	Lack of Political Will	The dissemination of the necessary information at the national level to potential users can accelerate the diffusion of EVs in the country. Tools such as educational programs, media conferences and advertisement can be employed to raise awareness to the population.	Institutional and Regulatory
	Inadequate Service Provision	The Trinidad and Tobago Electricity Commission (T&TEC) stands to benefit by facilitating the transition in electric vehicle adoption. Customer satisfaction and grid reliability is crucial to ensure revenue generation. As the number of number of electric vehicles grow, more charging infrastructure is required and hence, higher demands for electrical energy.	Institutional and Regulatory

4. E-Mobility Policy Qualitative Assessment

4.1 Policy Interventions to be Assessed

The Government of the Republic of Trinidad and Tobago is seeking to develop a national e-mobility framework for the deployment of e-mobility technologies. The country is now entering the take-off phase of transformation, based on the phases' classification of the ICAT TC methodology. There are initiatives being undertaken to enable change in the system towards changing existing norms.

The existing e-mobility policy is oriented towards research and development and aims to implement technologies, processes and practices that can encourage awareness and uptake by the citizens of Trinidad and Tobago. The main objective of the policy is to promote vehicle energy efficiency and in transport sector. Specific interventions were identified that will aid in achieving the objectives of the policy.

These interventions are identified as follows:

- Evaluate the risks and opportunities for electric vehicle deployment in Trinidad and Tobago.
- Explore the various issues related to the implementation of electric mobility in the built environment.
- Research and develop mapping and data sharing tools for route planning and location electric vehicle infrastructure.
- Identify a viable combination of fiscal incentives including price subsidies, well-targeted tax breaks, and non-fiscal incentives to increase e-mobility in the early stages.
- Expansion of public awareness programmes through public events, exhibitions, demonstration and dissemination.
- Establish standards and regulations for the installation of charging infrastructure.
- Establish standards and regulations for battery acquisition and disposal.
- Creating the necessary policy environment and regulatory framework for the uptake of e- mobility.

4.2 Description of the Vision

The policy is still in the developmental stage. However, key milestones have been identified to assess the performance of the policy over an established time frame. Table 4.1 describes the vision for the e-mobility policy for Trinidad and Tobago.

Table 4.1 Description of the Transformational Change Vision for the E-Mobility Policy in Trinidad and Tobago

Time periods	Description of the vision for desired societal, environmental and technical changes
Long-term (≥15 years)	The complete ban of diesel vehicles in the urban centres. All city-owned vehicles emission free. All buses in Trinidad and Tobago will be zero-emission.
Medium-term 5 - 15 years **Short-term (<5 years)**	No importation of new petrol or diesel vehicles in Trinidad and Tobago. The reduction in non-electric energy consumption including transport. Establish efficiency standards for the importation of all vehicles. New policies to reduce the import duty paid on low emission vehicles. All new buses procured will be zero emissions vehicles.

4.3 Results of Relevance Assessment for the Process and Outcome Characteristics

4.3.1 Process Characteristics

Comprehensive research on existing e-mobility policies globally aided in the identification of barriers that can impede the development and implementation of an e-mobility policy in Trinidad and Tobago. It has also contributed to the selection of relevant process and outcome characteristics. With the exception of the process characteristic 'Disincentives' all the other process characteristics were seen as 'relevant' to the policy development. The description of the characteristics in the context of the e-mobility policy in Trinidad and Tobago and the rationale for the relevance assessment are presented in Table 4.2.

Table 4.2 Relevance Assessment for the Process Characteristics of the ICAT TC Methodology in the Context of the E-Mobility Policy in Trinidad and Tobago

Category	Process characteristic	Explanation of Process Characteristics	Relevant/ Possibly Relevant/ Not Relevant	Justification
Technology	Research and development (R&D	The policy supports research and development into best practices for the deployment of electric vehicles and innovative concepts for supporting climate-friendly mobility.	Relevant	Funding research in e-mobility is necessary to better understand potential market segments for early adopters in Trinidad and Tobago. The policy seeks to implement relevant measures including financial initiatives and those oriented toward infrastructure development.
	Adoption	The policy supports	Relevant	Despite its great

		awareness information sharing for early adoption of electric vehicles.		deployment of e-mobility is still rather limited in Trinidad and Tobago. The adoption by citizens are central to the transition to e-mobility.
	Scale-up	The policy supports the electrification of all government owned fleets.	Relevant	The public service employs the use of a large number of vehicles. The state should lead the initiative of e-mobility transition by incorporating electric vehicles into their public fleets. EVs in public fleets could inspire new consumer demand.
Agents of change	Entrepreneurs	The policy explores the development of niche markets that are favourable to the deployment of electric vehicles:	Relevant	The state can consider partnerships with private companies to complement electric mobility measures. Private companies can offer a variety of solutions including car sharing schemes, small sized urban electric cars, bikes and scooters.
	Coalitions of advocates	The policy considers the use of an advocacy program to encourage the transition to electric vehicles.	Relevant	Electric vehicle deployment can be further encouraged by the use of advocates. Local public figures can make it easier for citizens to understand the information being disseminated about electric vehicle technologies. Advocates can also voice concerns to central government on behalf of the population.

Incentives	Beneficiaries	The policy can support a diverse range of beneficiaries by such as consumers and raising their awareness on environmental and economic benefits electric vehicle transition.	Relevant	Fully electric cars have zero tailpipe emissions making them an ideal choice for environmental preservation than petrol or diesel cars. Less emissions mean reduced greenhouse gases.
	Economic and non-economic	The policy utilizes financial and non-financial incentives to make electric vehicles competitive.	Relevant	Providing additional financial and non-financial incentive can contribute to highly electric vehicle uptake. Indirect incentives for electric vehicles such as special lane access and parking perks can be cost-effective measures to promote e-mobility.
	Disincentives	No description necessary, since this characteristic is not relevant.	Not Relevant	The use of disincentives is not contemplated in a possible policy framework for e-mobility in Trinidad and Tobago.
	Institutional and regulatory	The policy encourages research and support the formulation of regulations addressing vehicle importation.	Relevant	The deployment of e-mobility solutions in a region requires co-operation between a wide cross-section of stakeholders, including public administrations, suppliers, parking operators, companies with transport fleets, private car owners, installers and suppliers of mobility services.

Norms	Awareness	The policy s awareness raising and education for e-mobility transition.		new technologies, awareness and understanding of e-mobility is low among many citizens and local policy makers. Any policies to promote e-mobility should be accompanied by communication efforts to explain how e-mobility works, and its potential benefits for society.
	Behaviour	The policy addresses consumer acceptance of e-mobility technology.	Relevant	Behaviour change is important for the transition towards e-mobility
	Social norms	The policy considers projects that enhance consumer perception of electric vehicles.	Relevant	Economic and information barriers such as high capital cost, lack of financial incentives and range anxiety contribute to the negative perception of electric vehicles.

4.3.2 Outcome Characteristics

For both the scale and the sustained nature of the outcomes, the characteristics are described in Table 4.3 and the boundaries of the assessment define whether each characteristic is relevant to assess.

Table 4.3 Relevance Assessment for the Outcome Characteristics of the ICAT TC Methodology in the Context of the E-Mobility Policy in Trinidad and Tobago

Category	Outcome characteristics	Description – specific to a policy or action
Scale of outcome – GHGs	Macro level: GHG outcome is large in magnitude at international/global level	The level is outside the assessment boundaries. No assessment necessary

	Medium level: GHG outcome is large in magnitude at national or sectoral levels	GHG reduction are expected to be net positive in magnitude at the subnational level by reducing the use of conventional fuels in vehicles.
Scale of outcome – Sustainable development	Micro level: GHG outcome is large in magnitude at subnational, subsector, city or local levels	At the local level, GHG outcomes are expected to achieve a reduction in emission levels by significantly reducing the use of fossils fuels energy for vehicle propulsion.
	Macro level: Sustainable development outcome is net positive in magnitude at international/global level	The level is outside the assessment boundaries. No assessment necessary
	Medium level: Sustainable development outcome is net positive in magnitude at national or sectoral levels	Sustainable development outcomes are expected to be net positive at national and sectoral levels. The policy intend to bring about significant decline in emissions of air pollutants; and meet global climate goals in line with the Paris Agreement.
	Micro level: Sustainable development outcome is net positive in magnitude at subnational, subsector, city or local levels	At the local level, sustainable development outcomes are expected to achieve a reduction in emission level by reducing the use of fossil fuel powered vehicles and the direct use of alternative fuel.
Outcome sustained over time – GHGs	Long term: GHG outcome is achieved and sustained ≥15 years from the starting situation	The policy aims at achieving its long term sustainable goals which includes the reduction in the net emissions of greenhouse gases from all transportation based human activities and a decrease in the concentrations of carbon dioxide and other greenhouse gases in the atmosphere.
	Medium term: GHG outcome is achieved and sustained ≥5 years and <15 years from the starting situation	In the medium term, prioritizing the development of national electric vehicle policy implementation and fostering electric vehicle infrastructure and technology development will further contribute to the reduction in GHGs.
	Short-term: GHG outcome is achieved and sustained <5 years from the starting situation	In the short term, the policy focuses on e-mobility solutions that can reduce GHGs by replacing vehicles that use fossil fuels such petrol and diesel.
sustained over time – Sustainable development	Long term: Sustainable development outcome is achieved and sustained ≥15 years from the starting situation	The policy aims at achieving its long term sustainable goals which includes making "cities inclusive, safe, resilient and sustainable". The population will also experience increased health standard through decreased air pollution which allows for a safer living environment.

Medium term: Sustainable development outcome is achieved and sustained ≥5 years and <15 years from the starting situation	In the development of national electric vehicle policy implementation and fostering electric vehicle infrastructure and technology development will further add to achieving sustainable urban transport development.
Short-term: Sustainable development outcome is achieved and sustained <5 years from the starting situation	In the short term, the deployment of zero-emission buses in urban public transport and the importation and use of electric powered vehicles is an important tool for reducing air pollution in Trinidad and Tobago and contributing to sustainable urban transport development.

5. Insights for Developing an E-Mobility Policy

5.1 Elements of a Typical National E-Mobility Policy

5.1.1 Awareness raising. As is common with new technologies, awareness and understanding of e-mobility is low among many citizens. Any policies to promote e-mobility should be accompanied by communication efforts to explain how e-mobility works, and its potential benefits for society.

5.1.2 Procurement. Public procurement can be a powerful market driver for the introduction of new technologies. This is no different for e-mobility. Local fleet owners should be looking at their own fleet of vehicles and making the transition to electric vehicles. A range of public transport modes is ripe for electrification including buses, maxi-taxis, and taxis.

5.1.3 Public-private partnerships. Companies and start-ups could offer an ever-increasing range of e-mobility services to citizens. This includes many transport sharing initiatives, as an alternative to private ownership, whereby customers pay for the use of a vehicle for a set time. Long standing car sharing schemes internationally are transitioning to electric vehicles. In urban areas overseas there is an increasing prevalence of electric bike, moped and scooter sharing schemes.

5.1.4 Prioritize high-use vehicles. The focus should be on electrifying fleets, taxis, mobility-as- a-service vehicles and public transport, which will have a greater impact as these represent a higher volume of kilometres travelled. Although personal-use vehicles will likely remain a significant portion of the vehicle stock for many years, they would represent a much lower volume of overall kilometres driven.

5.1.5 E-Mobility Charging Infrastructure. To keep pace with growing demand and to address range-anxiety issues, charging infrastructure is needed, especially along highways, at destination points, and close to public transport hubs. Convenient and affordable publicly accessible chargers will be increasingly important as EVs scale up. To help address this, governments should provide support for EV charging infrastructure through measures such as direct investment to install publicly accessible chargers or incentives for EV owners to install charging points at home.

5.1.6 Battery Technology. The battery pack and its management contribute more than 50% to the cost of an electric vehicle. Selling EVs without a battery package (or a considerably smaller battery package) and having swappable batteries available through a pay-as- you-go model decreases the capital cost of EVs by a large factor. EVs sold without the batteries would today be at par in cost with a conventional vehicle. Swappable batteries could also accelerate the transition to EVs for private users.

5.1.7 E-Mobility Incentives. Incentives should be targeted toward vehicles with high impact and toward sustainable business models. Subsidizing public charging infrastructure is a good start. Incentives are often too much targeted toward private-vehicle owners, with a limited impact and a high cost. Linking subsidies to vehicle usage and mileage is more efficient. Financial subsidies to private EV owners should be fiscally neutral and be paid by fossil fuel car owners to avoid negative social impacts.

5.1.8 City Promotions. Cities have multiple instruments at their disposal to promote EVs, including city access restrictions, preferential lanes and parking access, preferential access for EVs, and demanding increasing shares of EVs in transport fleets. Such incentives can turn business models based on EV fleets profitable.

5.1.9 Battery End-of-Life Impact. As the number of EVs increases, so does the number of vehicle batteries that will eventually reach the end of their useful lives. EV batteries are expected to power their vehicles for at least eight to 10 years (about 3 to 4 years for larger vehicles), however, at retirement the batteries will likely still retain about 50-70% of their original capacity. EV owners should be required by law to recycle or reuse vehicle batteries. Lithium-ion car and bus batteries are still useful for an additional seven to 10 years after retirement. Spent EV batteries still have reasonable energy storage and standby power capabilities that could be used in many applications.

5.1.10 Key Land Use and Transportation Planning Issues (Appendix F). An e-mobility policy has to work within the cyclical relationship between land use planning and transportation planning. The following are critical issues for the integral relationship between transportation and land use including the spatial location of facilities and activities: (a) Organisational Structure for Road Transportation Management, Regulation and Planning; (b) Institutional Strengthening: it is imperative to transform public agencies by making them market-oriented, by stimulating competition, and by increasing user participation; (c) Public Transportation Development and Management; (d) Transportation and Land use Development Planning: appropriate measures reflecting inter-relatedness need to be included consciously and consistently or applied effectively in the preparation of development plans and transportation projects; and, (e) A Balanced and Integrated Transport Solution for Trinidad and Tobago

5.1.11 The Republic of Trinidad and Tobago has few hybrid electric vehicles and even fewer battery electric vehicles in the more than a million vehicles on its roadways. Very high vehicle traffic densities are a serious and worsening problem and cause increases in both greenhouse gases and traffic congestion. Therefore, it is not only important to decrease carbon reduction through the use of electric vehicles, but also to reduce vehicle traffic densities while maximizing person densities on the roadways. Our decision-makers should not depend on market forces to provide guidance.

5.1.12 There is currently no agency of Government responsible for national transportation planning and administration. There is a division for highways, including a special project unit for new and upgrading of highways and bridges; there is a division for licensing vehicles; and there is a Government-owned company for operating buses. There is need for a Road Transportation Authority charged with the responsibility for planning, administering and developing the transportation system for the nation. This Road Transportation Authority would conduct planning and analysis to meet short, medium and long-term mobility needs. It would formulate policies and implement public involvement programmes to secure public understanding and support. The Authority would be responsible for building, expanding and maintaining the road network and improving transportation infrastructure. It would also undertake traffic surveys and data collection and reporting, and road safety education and accident reduction schemes. Future mobility improvements in Trinidad and Tobago must consider managing vehicle ownership. The demand for personal vehicle ownership needs to be balanced with the number of vehicles using the roads. If these two competing demands are not managed properly, the result would be continued traffic congestion and increases in greenhouse gases.

5.1.13 Another critical component in the transport sector not being addressed is in the domain of public transportation. There is no coordination and monitoring of the planning for locations of public buildings, housing communities, schools, etc. with respect to the transportation needs of the users. At present, no single agency of Government is responsible for monitoring, controlling or coordinating the operations of the public transportation industry. The Public Transport Service Act, which created the PTSC in 1965, does not give them responsibility for regulating taxis, or later, maxi-taxis. The Transport Division of the Ministry of Transport is responsible for the licensing and inspection of taxis, and maxi-taxis. In other words, PTSC is a publicly owned bus operator governed by its Act, while other privately supplied public transport services (taxis and maxis) are effectively deregulated and operate on their own. So, there is a critical need for the administration, rationalisation and control of the industry. This would include, planning, organising and administering services, routes and terminals, collection and analysis of data pertaining to passenger demand and potential suppliers, and an ongoing monitoring of the industry, including vehicle standards.

5.1.14 Our decision-makers need to carefully consider who they are providing these components for. They need to determine the following: (a) What are we trying to achieve, and why; and, (b) How do we coordinate this information. The answers to these questions would involve the planning and administration of transport services, routes, and terminals and parking facilities; collection and analysis of data pertaining to who are the persons desiring to travel, where they are coming from, and where they are going; and, what are the accessibility needs of the travellers.

5.1.15 Our country has been desperately in need of continued transportation planning and policies to guide our sustainability ever since the first and only national transportation plan was completed in 1967. Many were elated with the award of the Government commissioned Comprehensive National Transport Study (CNTS) in February 2005, and this was to be completed by September 2006. A report was submitted in November 2006, but it was not accepted by Government. So, there is a long outstanding need for a comprehensive national transport plan and associated policies, and consequently there is a severe shortage of data for transportation decision-making.

Table 5.1 gives the mitigation actions and activities planned for the transport sector for 2015-2030, taken from Trinidad and Tobago's intended Nationally Determined Contribution (GORTT, 2015).

Table 5.1 Mitigation Actions and Activities Planned for the Transport Sector for 2015-2030 (GORTT, 2015).

No.	Action	Activity
1.	Creating an enabling Environment (policy, Legislation) for Transport Sector	Designing and conducting a national transport study
		Developing and approving National Transport Plan (NTP) which mainstreams climate change
		Reviewing and amending the Public Transport Service Act, the Maxi Taxi Act, Civil Aviation Act and the Motor Vehicles and Road Traffic Act to support NTP and NDC implementation
		Developing guidelines to integrate transport plans in urban and regional development plans
		Establishing and strengthening enforcement mechanisms to support NTP and NDC implementation

2.	Improving the National Public Transport System	Establishing a national transit authority with responsibility for public transport planning
		Developing and implementing strategic roadmap for improved national public transport system which is sustainable and integrated. Engage in consultations with all national transport sector actors
		Designing and implementing capacity-building programme in public transport planning, management and operations disciplines for Ministry Of Work and Transport (MOWT) and its agencies
		Developing and undertaking a fleet management programme for Public Transport Service Corporation (PTSC), including guidelines and specifications for fleet acquisition and conversion, retooling, re-equipping, infrastructure upgrade and retraining
		Research, development and implementation of appropriate Information Communication Technology (ICT) systems for integrated public transport system in order to improve reliability, efficiency and safety
		Designing and implementing NAMA for the Transport sector on Integrated Public Transport System
3.	Promoting vehicle energy efficiency and fuel switching	Support to CNG conversion programme for the Public Transport Service Corporation (PTSC) and maxi taxi fleets. Upscale to include vehicle fleets in Ministries and State agencies
		Expansion of public awareness programmes on CNG conversion and available fiscal incentives and funding schemes
		Support training programme for vehicle mechanics and technicians to promote CNG and hybrid conversion
4.	Promote alternative fuels in transport sector	Conduct research on feasibility of biofuels in the national transport systems, including feasibility of biofuel production and viability of use in car engines
		Develop and implement pilot project on biofuel production and car use in Trinidad and Tobago
		Conduct research on feasibility of using alternative fuels including biofuels and LNG in sea transport vessels, including analysis of financing sources
		Design and implement pilot project on parking management for selected urban areas e.g. park and rides, metered street parking, mobility centres etc
5.	Reduce private vehicle use	Design and implement long-term, coordinated awareness programme for general public, schools and sectors to reduce the use of private vehicles and promote the benefits of using public transport system and other transport modes
		Design and implement incentive programmes to encourage and reward shifts towards other transport modes including public transport, ridesharing, cycling and walking
		Conduct research on feasibility best practices in parking management to reduce use of private vehicles in urban areas
		Design and implement pilot project on parking management for selected urban areas e.g. park and rides, metered street parking, mobility centres etc
6.	Promote fuel (and energy) efficiency in transport sector	Conduct assessment of current fuel (and energy) efficiency practices in sea transport sector in Trinidad and Tobago, including recommendation for energy efficiency actions
		Implement fuel (and energy) efficiency actions for sea transport sector
		Develop and implement capacity building programme for sea transport sector on best practices and technologies for fuel and energy efficiency in the sector
		Develop and implement improved air management system for air transport in Trinidad and Tobago
		Develop and implement programme for adoption of best practices in operations and aircraft related technology for air transport in Trinidad and Tobago
7.	Improve data collection and information sharing systems	Develop data collection protocols for fuel consumption and GHG emissions from transport supply, demand and operations and travel preferences
		Develop online monitoring and reporting templates and set standards for monitoring and reporting of GHG emissions to promote voluntary GHG emissions reporting by transport sector
		Create online platform to collect and share best practices, case studies, success stories and challenges in implementing GHG emissions reduction measures in the transport sector in Trinidad and Tobago

5.2 Recommendations

5.2.1 Limit the Number of New License Plates for Cars. Implement restrictions on vehicle ownership by limiting the number of new license plates issued. Very high traffic densities are a serious and worsening problem and cause increases in both greenhouse gases and traffic congestion and can be improved by provision of transit incentives and simultaneous auto disincentives. Therefore, it is not only important to decrease carbon reduction through the use of electric vehicles, but also to reduce vehicle traffic densities while maximizing person densities on the roadways. Our decision-makers should not depend on market forces to provide guidance. (NDC Nos. 1, 2, 5 and 7)

5.2.2 New diesel and petrol cars and vans to be banned from say, 2035. (NDC Nos. 3, 4, 6, and 7)

5.2.3 Suggested sixty percent of new cars and vans to be electric vehicles by say, 2030; 100% of new cars and vans electric by say, 2040. (NDC Nos. 3, 5, and 7)

5.2.4 In the next 2-3 years, every sixth (or other value) bus, including maxi-taxi, will be replaced by an electric one and all public transport to be electric by say, 2030. (NDC Nos. 2, 3, 5, and 7)

5.2.5 Limit the Import of Second-Hand ICE Vehicles. Limit the import of second-hand fossil fuel motor vehicles beyond a maximum age, including 2-wheelers. (NDC Nos. 1, 2, 3, 4, 5, 6 and 7)

5.2.6 Support Vehicle Connectivity and Smart Charging Regulations. Implement regulations supporting internationally harmonized vehicle-to-everything (V2X) technologies and smart charging solutions, both in terms of hardware and software, to facilitate the growth of e-mobility. (NDC Nos. 1, 2, 3, 6 and 7)

5.2.7 Use Public Procurement to Support Vehicle Electrification. Encourage transport electrification through the public procurement of electric vehicles, for example electric buses for public transport. (NDC Nos. 1, 2, 3, 6 and 7)

5.2.8 Develop Infrastructure for Road Transport Electrification. Develop infrastructure for road transport electrification, such as charging stations, electric road systems, including electricity power for trucks, cars, buses, etc. (NDC Nos. 1, 2, 3, 6 and 7)

5.2.9 Integrate New Mobility Solutions to Existing Transport. Support the complementarity of new shared solutions such as car-sharing, electric vehicles rentals and autonomous vehicles with existing public transport networks, for instance by supporting new solutions to direct traffic to public transport stations or as a replacement after operating hours. (NDC Nos. 1, 2, 3, 6 and 7)

5.2.10 Provide Sustainable Alternatives for Commuting Trips. Encourage initiatives that provide sustainable mobility options for employees, such as employer-sponsored transport programs, carpooling schemes, and public transport commuter benefits. (NDC Nos. 1, 2, 3, 6 and 7)

5.2.11 Develop Vehicle Rental Platforms for Different Types of Use. Provide effective shared car and bicycle-sharing systems as an alternative to vehicle ownership. (NDC Nos. 1, 2, 3, 6 and 7)

5.2.12 Mobilize Public and Private Capital for Transport Finance. Mobilize public and private capital for transport finance, using PPPs to improve sector efficiency when appropriate, and help bridge the transport infrastructure gap. (NDC Nos. 1, 2, and 7)

5.2.13 Implement Fuel Taxes and Phase Out Fuel Subsidies. Implement and increase fuel taxes while phasing out fossil fuel subsidies to offset the social cost of greenhouse gas emissions and air pollution. (NDC Nos. 1, 2, 3, 4, 5, 6 and 7)

REFERENCES

GORTT. (2015). *Trinidad and Tobago's intended Nationally Determined Contribution (iNDC)*. http://www4.unfccc.int/Submissions/INDC/Published Documents/Trinidad and Tobago/1/Trinidad and Tobago Final INDC.pdf

APPENDIX A

Defining Transformational Assessment: Describing the Policy or Action

A.1 The Template

A.2 Biofuels

Information	Description
Title of the policy or action	Promote alternative fuels in transport sector
Type of policy or action	Research and development policy
Description of specific interventions	• Conduct research on feasibility of biofuels in the national transport systems, including feasibility of biofuel production and viability of use in car engines • Develop and implement pilot project on biofuel production and car use in Trinidad and Tobago • Conduct research on feasibility of using alternative fuels including biofuels and LNG in sea transport vessels, including analysis of financing sources • Design and implement pilot project on parking management for selected urban areas e.g. park and rides, metered street parking, mobility centres etc
Status of the policy or action	The policy has been implemented (currently in effect)
Date of implementation	2020
Date of completion (if relevant)	Estimated completion in 2022
Implementing entity or entities	Ministry of Energy and Energy Industries, Ministries of Agriculture, Land and Fisheries
Objectives and intended impacts or benefits of the policy or action	Definition of program of activities for the development of biofuel studies, including both the feasibility of producing biofuels in Trinidad and Tobago: land availability, crop type, impact on agricultural sector, economic feasibility; and the viability and benefits of its use as fuel: technical viability of its use in the engines of vehicles, type of biofuel that should be produced or percentage of biofuel to be used substituting fossil fuels. This task will also comprise the analyzing possible financing sources for the program from national and international sources.
	Development of biofuel studies programme. If the results obtained are positive, a pilot implementation action could be developed. The development of the action would depend on the results obtained from the biofuel studies. If the growing of crops for biofuel uses in Trinidad and Tobago is evaluated positively, the action could include the plantation of crops for the production of biofuels, their production and use. Otherwise, it could be limited to the use of imported biofuels.
Level of the policy or action	National
Geographic coverage	Trindad and Tobago
Sectors targeted	Transport Industry
Other related policies or actions	
References	Report on Measures: Phase 2 - Analysis of mitigation measures and mitigation options to support the preparation of T&T's TNC - Potential Mitigation Measures
	ICAT Concept Note - Using the ICAT Transformational Change methodology to inform the development of transportation policies in Trinidad and Tobago.
	GORTT. (2015). Carbon Reduction Strategy - Action plan for the mitigation of GHG emissions in the electrical power generation , transport and industry sectors.

A.3 Fuel Switching

Information	Description
Title of the policy or action	Promoting vehicle energy efficiency and fuel switching
Type of policy or action	Implementation of technologies, processes or practices.
Description of specific interventions	• Support to CNG conversion programme for the Public Transport Service Corporation (PTSC) and maxi taxi fleets. Upscale to include vehicle fleets in Ministries and State agencies • Expansion of public awareness programmes on CNG conversion and available fiscal incentives and funding schemes • Support training programme for vehicle mechanics and technicians to promote CNG and hybrid conversion
Status of the policy or action	The policy has been implemented (currently in effect)
Date of implementation	2019
Date of completion (if relevant)	Estimated completion in 2023
Implementing entity or entities	Ministry of works and Transport, Public Transport Service Corporation
Objectives and intended impacts or benefits of the policy or action	The policy leads to a reduction in the consumption of fossil fuels in the transport sector through the convertion of the PTSC and maxi taxi fleet into CNG fuelled engines.
Level of the policy or action	National
Geographic coverage	Trinidad and Tobago
Sectors targeted	Transport Sector
Other related policies or actions	
References	Report on Measures: Phase 2 - Analysis of mitigation measures and mitigation options to support the preparation of T&T's TNC - Potential Mitigation Measures
	ICAT Concept Note - Using the ICAT Transformational Change methodology to inform the development of transportation policies in Trinidad and Tobago.
	GORTT. (2015). Carbon Reduction Strategy - Action plan for the mitigation of GHG emissions in the electrical power generation , transport and industry sectors.

A.4 Fuel-Efficient Transport

Title of the policy or action	Promote fuel (and energy) efficiency in transport sector
Type of policy or action	Research and development policy Implementation of technologies, processes or practices.
Description of specific interventions	• Conduct assessment of current fuel (and energy) efficiency practices in sea transport sector in Trinidad and Tobago, including recommendation for energy efficiency actions • Implement fuel (and energy) efficiency actions for sea transport sector • Develop and implement capacity building programme for sea transport sector on best practices and technologies for fuel and energy efficiency in the sector • Develop and implement improved air management system for air transport in Trinidad and Tobago • Develop and implement programme for adoption of best practices in operations and aircraft related technology for air transport in Trinidad and Tobago
Status of the policy or action	The policy has been implemented (currently in effect)
Date of implementation	2018
Date of completion (if relevant)	Estimated completion in 2028
Implementing entity or entities	Ministry of Works and Transport, Ministry of Energy and Energy Industries Caribbean Air Lines and Civil Aviation.
Objectives and intended impacts or benefits of the policy or action	Definition of program of activities in order to characterize the aviation fleet of Trinidad and Tobago. The objective of the characterization is to determine the features of the existing fleet and assess the existing options to improve it. This analysis will determine the technical viability of the upgrade and replacement of aircrafts and assess the economic impact that the upgrade and replacement could have. In this initial task, funding opportunities from national and international sources will be detected as well (see section 6 for more information on funding opportunities).
	Development of characterization. The results of it will establish the existing scope of improvement of the aviation fleet of Trinidad and Tobago compared to the latest trends in the international aviation. Based on that and on the economic assessment of the costs and benefits of upgrading and replacing the aircrafts, a roadmap establishing targets will be proposed, setting GHG emissions limits for the aircrafts.
	Development of the programme of activities. The results of the analysis will include a selection of possible alternative fuels to be used in aviation, the technical implications of their use, mainly regarding airplane mechanics and the quantification of the costs of the implementation. Additionally, in this stage, the outcomes from TAc4 will be analysed as well, trying to detect synergies between both actions and considering the plan roadmap developed for the upgrade and replacement of aircrafts when proposing the alternative fuels options and targets.
	Creation of program of activities to develop an analysis of possible efficiency practices to be implemented in the waterborne transport sector in Trinidad and Tobago. To do so, the waterborne transport will be characterized, additionally, different energy efficiency measures will be analysed in terms of GHG emissions reductions and implementation costs and benefits. In this first task, national and international funding sources will be detected as well (for more information on funding sources

Information	Description
	Definition of program of activities for the assessment of the viability of using alternative fuels in the navigation sector. The objectives of the program of activities include research on types of alternative fuels that can be used in navigation according to the state-of-the- art, the assessment of the technological implications of using alternative fuels such as biofuels or LNG and the quantification of the costs and benefits as well as of the GHG emissions reductions that could be achieved. In this first task, national and international financing sources will be analysed. Development of the programme of activities. The results of the analysis will include a selection of possible alternative fuels to be used in navigation, the technical implications of their use, mainly regarding vessel mechanics and the quantification of the costs of the implementation.
Level of the policy or action	National
Geographic coverage	Trinidad and Tobago
Sectors targeted	Aviation, Marine and Public Transport Sector
Other related policies or actions	Upgrading and replacement of Caribbean Airlines aircrafts
References	Report on Measures: Phase 2 - Analysis of mitigation measures and mitigation options to support the preparation of T&T's TNC - Potential Mitigation Measures
	ICAT Concept Note - Using the ICAT Transformational Change methodology to inform the development of transportation policies in Trinidad and Tobago.
	GORTT. (2015). Carbon Reduction Strategy - Action plan for the mitigation of GHG emissions in the electrical power generation , transport and industry sectors.

A.5 Reduce Private Vehicle Use

Information	Description
Title of the policy or action	Reduce private vehicle use
Type of policy or action	Information instruments policy
Description of specific interventions	• Design and implement long-term, coordinated awareness programme for general public, schools and sectors to reduce the use of private vehicles and promote the benefits of using public transport system and other transport modes • Design and implement incentive programmes to encourage and reward shifts towards other transport modes including public transport, ridesharing, cycling and walking • Conduct research on feasibility best practices in parking management to reduce use of private vehicles in urban areas • Design and implement pilot project on parking management for selected urban areas e.g. park and rides, metered street parking, mobility centres etc
Status of the policy or action	The policy has been implemented (currently in effect)
Date of implementation	2018
Date of completion (if relevant)	Estimated completion in 2027
Implementing entity or entities	Ministryof Planning and Sustainable Development; Ministry of Works and Transport; Ministry of Rural Development and Local Government
Objectives and intended impacts or benefits of the policy or action	Development of program of activities for the assessment of transport modes in Trinidad and Tobago
	Development of program of activities, the results will include a characterization of the transport modes and routes in the country
	Development of program of activities for the assessment of transport modes in Trinidad and Tobago. Development of program of activities, the results will include a characterization of the transport modes and routes in the country. Development of ridesharing web platform. Development of awareness raising campaigns on the car sharing platform.
	Definition of program of activities, in order to determine the best solution in terms of parking management in Trinidad and Tobago. Development of program of activities. As a result of it, different parking management options will be detected and analysed. Selection of company in charge of managing the parking system.
Level of the policy or action	National
Geographic coverage	Trinidad and Tobago
Sectors targeted	Transport Sector
Other related policies or actions	
References	Report on Measures: Phase 2 - Analysis of mitigation measures and mitigation options to support the preparation of T&T's TNC - Potential Mitigation Measures
	ICAT Concept Note - Using the ICAT Transformational Change methodology to inform the development of transportation policies in Trinidad and Tobago.
	GORTT. (2015). Carbon Reduction Strategy - Action plan for the mitigation of GHG emissions in the electrical power generation , transport and industry sectors.

A.6 Transport Policy Reform

Information	Description
Title of the policy or action	Creating an enabling Environment (policy, Legislative) for Transport Sector
Type of policy or action	Research, development and deployment policy
Description of specific interventions	• Designing and conducting a national transport study • Developing and approving National Transport Plan (NTP) which mainstreams climate change • Reviewing and amending the Public Transport Service Act, the Maxi Taxi Act, Civil Aviation Act and the Motor Vehicles and Road Traffic Act to support NTP and NDC implementation • Developing guidelines to integrate transport plans in urban and regional development plans • Establishing and strengthening enforcement mechanisms to support NTP and NDC implementation
Status of the policy or action	The policy is at the proposal stage
Date of implementation	2025
Date of completion (if relevant)	2035
Implementing entity or entities	Ministry of Planning and Development; Ministry of Works and Transport; Ministry of Rural Development and Local Government; Ministry of Finance and the Trinidad and Tobago Civil Aviation Authority.
Objectives and intended impacts or benefits of the policy or action	This policy serves to encourage more compact, mixed, multi-modal development to allow more parking sharing and use of alternative modes. Current land use policies limit development density disperses destinations and favour automobile access over alternative modes. Smart growth policies reduce vehicle travel and create more complete, self-contained communities, and promote locating schools, parks and shops within neighbourhoods.
Level of the policy or action	National
Geographic coverage	Trinidad and Tobago
Sectors targeted	Transport, Planning and Construction Sectors.
Other related policies or actions	N/A
Reference	Report on Measures: Phase 2 - Analysis of mitigation measures and mitigation options to support the preparation of T&T's TNC - Potential Mitigation Measures
	ICAT Concept Note - Using the ICAT Transformational Change methodology to inform the development of transportation policies in Trinidad and Tobago.
	GORTT. (2015). Carbon Reduction Strategy - Action plan for the mitigation of GHG emissions in the electrical power generation , transport and industry sectors.

A.7 Improve Public Transport System

Title of the policy or action	Improving the National Public Transport System
Type of policy or action	Research, development and deployment policy
Description of specific interventions	• Establishing a national transit authority with responsibility for public transport planning • Developing and implementing strategic roadmap for improved national public transport system which is sustainable and integrated. Engage in consultations with all national transport sector actors • Designing and implementing capacity-building programme in public transport planning, management and operations disciplines for Ministry Of Work and Transport (MOWT) and its agencies • Developing and undertaking a fleet management programme for Public Transport Service Corporation (PTSC), including guidelines and specifications for fleet acquisition and conversion, retooling, re-equipping, infrastructure upgrade and retraining • Research, development and implementation of appropriate Information Communication Technology (ICT) systems for integrated public transport system in order to improve reliability, efficiency and safety • Designing and implementing NAMA for the Transport sector on Integrated Public Transport System
Status of the policy or action	The policy is at the proposal stage
Date of implementation	2021
Date of completion (if relevant)	2025
Implementing entity or entities	Ministry of Works and Transport; Public Transport Service Corporation (PTSC); Maxi Taxi Association
Objectives and intended impacts or benefits of the policy or action	To improve public transit services, and encourage transit use, including increased service area and frequency, increased transit speed and reliability. There are many ways to improve public transit services, including increased service, HOV priority, improved comfort, lower fares, more convenient payment options, improved user information, marketing programs, transit-oriented development, improved security, and special services such as express commuter buses and Bus Rapid Transit.
Level of the policy or action	National
Geographic coverage	Trinidad and Tobago
Sectors targeted	Public and Private Transport Sectors
Other related policies or actions	
References	Report on Measures: Phase 2 - Analysis of mitigation measures and mitigation options to support the preparation of T&T's TNC - Potential Mitigation Measures
	ICAT Concept Note - Using the ICAT Transformational Change methodology to inform the development of transportation policies in Trinidad and Tobago.
	GORTT. (2015). Carbon Reduction Strategy - Action plan for the mitigation of GHG emissions in the electrical power generation , transport and industry sectors.

A.8 Improve Data Collection

Information	Description
Title of the policy or action	Improve data collection and information sharing systems
Type of policy or action	Research and development policy
Description of specific interventions	• Develop data collection protocols for fuel consumption and emissions from transport supply, demand and operations preferences • Develop online monitoring and reporting template monitoring and reporting of GHG emissions to pro emissions reporting by transport sector • Create online platform to collect and share success stories and challenges in impleme measures in the transport sector in Tri
Status of the policy or action	N
Date of implementation	/
Date of completion (if relevant)	A
	N
	/
	A
	N
	/
	A
Implementing entity or	N/A

entities	
Objectives and intended impacts or benefits of the policy or action	N/A
Level of the policy or action	
Geographic covera	
Sectors targete	
Other relate or actions	

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APPENDIX B

Defining Transformational Assessment: Barriers to Transformational Change

B.1 Biofuels

Barriers	Explanation	Characteristics affected	Barrier directly targeted by the policy or action
Lack of Customer Demand	The lack of willingness of the customer to pay more for environmentally friendly services may reduce the inclination of auto industry businesses to supply the market with low emission vehicles.	Awareness	No
High Technologies and Costs	Converting the cellulosic biomass into liquid fuel has a major cost component. The feasibility of conversion has been proven possible globally, however the ability to lower cost to a competitive level has hampered the uptake of biofuels.	Research and Development	No

B.2 Fuel Switching

Barriers	Explanation	Characteristics affected	Barrier directly targeted by the policy or action
Lack of Alternative Fuel Option	Availability of renewable fuel options are limited.	Scale up	Yes
Vehicle Ownership Cost	The acquisition cost of low emission private vehicles may be higher without government tax concessions.	Beneficiaries	No
Consumer Knowledge and Awareness	There is a lack of awareness and uptake of low carbon technologies (vehicles/CNG fuel) by vehicle owners. This is due to consumers lack of fundamental information about how low emission vehicles and practices can improve the environment and ensure they receive cost-savings in the long run.	Awareness	Yes
Lack of Customer Demand	The lack of willingness of the customer to pay more for environmentally friendly services may reduce the inclination of auto industry businesses to supply the market with low emission vehicles	Behaviour	Yes

B.3 Fuel-Efficient Transport

Barriers	Explanation	Characteristics affected	Barrier directly targeted by the policy or action
High Capital Cost	The initial cost of upgrading or switching the current transit fleet has a substantial capital cost which is a major hurdle for state company budget allocations.	Adoption	No
High Operating Cost	The cost of traditional energy (fossil fuel) is subsidized by the Governement of Trinidad and Tobago therefore making it substantially cheaper than renewable energy.	Adoption	Yes

B.4 Reduce Private Vehicle Use

Barriers	Explanation	Characteristics affected	Barrier directly targeted by the policy or action
Absence of Strategic Planning	The measure is not part of an overall parking strategy but is reducing parking from the CBD , and so can result in opposition to the measure, and an overall parking management strategy would be required.	Institutional and regulatory	No
Consumer Knowledge and Awareness	Car trips are perceived as being cheap for those that already have a car. Once the car has been purchased, little consideration is taken of its cost or the number of public transport journeys that could be made for the same amount of money. The car therefore usually appears to be an economical alternative compared with public transport. The car has also many advantages such as high comfort, convenience and flexibility. The car also satisfies other needs such as status, prestige and feeling of control of one's journey. Therefore, it is hard for the public transport to compete with the car.	Social Norms	Yes
Inadequate Management Arrangements.	Management solutions represent a change from current practices and so various obstacles (such as, public officials, planners and the public changing the way they think about parking problems and solutions, and limited enforcement of parking) must be overcome for parking management to be implemented as much as optimal. Current planning practices are based on the assumption that parking should be abundant and provided free, with costs borne indirectly, incorporated into building construction costs or subsidized by governments. Parking management requires changing current development, zoning and design practices. This requires that public officials, planners and the public change the way they think about parking problems and solutions.	Institutional and regulatory	No
Lack of Financing Opportunities	Lack of appropriate funding for appropriate located park-and-ride garage as well as transit user directed subsidies.	Incentives	Yes
Lack of Popular Support and Political Will	Lack of bus priority measure which gives preferential treatment for buses and other transit vehicles.	Incentives	Yes

B.5 Transport Policy Reform

Barriers	Explanation	Characteristics affected	Barrier directly targeted by the policy or action
Lack of Popular Support and Political Will	Lack of political will to revitalise urban centres and to decentralise public services from cities like Port of Spain and San Fernando.	Institutional and regulatory	Yes
Lack of Expertiste	Lack of knowledge and experience by decision-makers in public-private financing of urban development	Institutional and regulatory	No
Lack of Popular Support and Political Will	The Government of Trinidad and Tobago has yet to accept this policy.	Institutional and regulatory	No
Lack of Popular Support and Political Will	Lack of appropriate legislation and policy frameworks to create an enabling environment for facilitating a shift from the status quo.	Institutional and regulatory	No

B.6 Improve Public Transport System

B.7 Improve Data Collection

Barriers	Explanation	Characteristics affected	Barrier directly targeted by the policy or action
No Information			
No Information			

B.8 Overarching Vision

NDC Transport Policies	Description
Create enabling environment	• Designing and conducting a national transport study • Developing and approving National Transport Plan (NTP) which mainstreams climate change • Reviewing and amending the Public Transport Service Act, the Maxi Taxi Act, Civil Aviation Act and the Motor Vehicles and Road Traffic Act to support NTP and NDC implementation • Developing guidelines to integrate transport plans in urban and regional development plans • Establishing and strengthening enforcement mechanisms to support NTP and NDC implementation
Improve national public transport system	• Establishing a national transit authority with responsibility for public transport planning • Developing and implementing strategic roadmap for improved national public transport system which is sustainable and integrated. Engage in consultations with all national transport sector actors • Designing and implementing capacity-building programme in public transport planning, management and operations disciplines for Ministry Of Work and Transport (MOWT) and its agencies • Developing and undertaking a fleet management programme for Public Transport Service Corporation (PTSC), including guidelines and specifications for fleet acquisition and conversion, retooling, re-equipping, infrastructure upgrade and retraining • Research, development and implementation of appropriate Information Communication Technology (ICT) systems for integrated public transport system in order to improve reliability, efficiency and safety • Designing and implementing NAMA for the Transport sector on Integrated Public Transport System
Promote vehicle energy efficiency, fuel efficiency and fuel switching	Trinidad and Tobago, including recommendation for energy efficiency actions • Implement fuel (and energy) efficiency actions for sea transport sector • Develop and implement capacity building programme for sea transport sector on best practices and technologies for fuel and energy efficiency in the sector • Develop and implement improved air management system for air transport in Trinidad and Tobago • Develop and implement programme for adoption of best practices in operations and aircraft related technology for air transport in Trinidad and Tobago • Support to CNG conversion programme for the Public Transport Service Corporation (PTSC) and maxi taxi fleets. Upscale to include vehicle fleets in Ministries and State agencies • Expansion of public awareness programmes on CNG conversion and available fiscal incentives and funding schemes • Support training programme for vehicle mechanics and technicians to promote CNG and hybrid conversion

Promote alternative fuels	• Conduct research on feasibility of biofuels in the national transport systems, including feasibility of biofuel production and viability of use in car engines • Develop and implement pilot project on biofuel production and car use in Trinidad and Tobago • Conduct research on feasibility of using alternative fuels including biofuels and LNG in sea transport vessels, including analysis of financing sources • Design and implement pilot project on parking management for selected urban areas e.g. park and rides, metered street parking, mobility centres etc

NDC Transport Policies	**Description**
Reduce private vehicle use	• Design and implement long-term, coordinated awareness programme for general public, schools and sectors to reduce the use of private vehicles and promote the benefits of using public transport system and other transport modes • Design and implement incentive programmes to encourage and reward shifts towards other transport modes including public transport, ridesharing, cycling and walking • Conduct research on feasibility best practices in parking management to reduce use of private vehicles in urban areas • Design and implement pilot project on parking management for selected urban areas e.g. park and rides, metered street parking, mobility centres etc
Improve data collection and information sharing systems	• Develop data collection protocols for fuel consumption and GHG emissions from transport supply, demand and operations and travel preferences • Develop online monitoring and reporting templates and set standards for monitoring and reporting of GHG emissions to promote voluntary GHG emissions reporting by transport sector • Create online platform to collect and share best practices, case studies, success stories and challenges in implementing GHG emissions reduction measures in the transport sector in Trinidad and Tobago

APPENDIX C

Describing the Process Characteristics and the Starting Situation for Selected Process Characteristics

Category	Process characteristic	Score	Rational for Score	Relevant/ Possibly Relevant/ Not Relevant	Description of Starting Situation	Indicator	Indicator value at starting situation (2013)	Indicator value for expected transformation (2030)
Technology	Research and development (R&D	3	An assessment of current fuel efficiency practices in air, land and sea transport sector in Trinidad and Tobago will be conducted to determine the best practices in operations. Developing and undertaking a fleet management programme for Public Transport Service Corporation (PTSC), including guidelines and specifications for fleet acquisition and conversion, retooling, re-equipping, infrastructure upgrade and retraining of staff.	Relevant	Research and development efforts are being undertaken at the University of the West Indies. However, the state has shown little interest in creating a policy that guides the country towards adopting alternative fuel. PTSC is currently making provisions to increase their fleet of buses. The current fleet does not operate at full capacity and as a result many routes are not serviced.	Investments in public transport infrastructure.	35 Buses (a)	200 Buses*
						R&D expenditure on clean transport fuels and environmentally friendly vehicles.	None	TT$1.463B (b)

* The information used is based on projection.

Category	Process characteristic	Score	Rational for Score	Relevant/ Possibly Relevant/ Not Relevant	Description of Starting Situation	Indicator	Indicator value at starting situation (2013)	Indicator value for expected transformation (2030)
Technology	Adoption	3	The policy considers the design and implementation of a pilot project on parking management for selected urban areas e.g. park and rides, metered street parking, mobility centres. The policy will directly target land based transportation to encourage a switch from conventional fuels to CNG. It will also determine the technical viability of the upgrade and replacement of aircrafts and assess the economic impact that the upgrade and replacement could have.	Relevant	The service provided by the Public Transport Service Corporation (PTSC) has experienced low ridership due to a lack of proper schedules and route options. These factors affect large scale adoption. The energy sector has launched a CNG campaign through NGC in a bid to encourage vehicle conversions from petrol to CNG.	Number of automobiles converted to CNG.	None	17,500
						Number of aircrafts upgraded/replaced.	None	10*
						Annual number of passengers transported.	9662340 (a)	1,2500,000*

* The information used is based on projection.

Category	Process characteristic	Score	Rational for Score	Relevant/ Possibly Relevant/ Not Relevant	Description of Starting Situation	Indicator	Indicator value at starting situation (2013)	Indicator value for expected transformation (2030)
Technology	Scale-up	2	PTSC is seeking to develop and implement a roadmap for improved national public transport system which is sustainable and integrated. Both waterborne and aviation transport vehicles will be characterized and analysed to determine features for improvement. With respect to land based vehicles, the National Gas Company has embarked upon a CNG campaign.		Urban areas are prone to high levels of congestion and street parking. Both conditions negatively affect the environment since urban area are often among the zones with the highest air pollution. Waterborne transport vehicles and the current aviation fleet do not used alternative fuel. The potential exist for national scale-up of fuel switching to low carbon alternatives. However, supporting initiatives and polices are needed to encourage vehicle owners to consider CNG or electric vehicles.	Numbers of alternative-fuelled vehicles	<5%	50%*
						Availability and quality of affordable modes (walking, cycling, ridesharing and public transport).	None	2*
Agents of change	Entrepreneurs	3	The initiatives paves the way for investment in urban cycling facilities and low carbon transport vehicles.	Relevant	The current transportation infrastructure restricts the movement of cyclists. Pedestrians are forced in some instances to manoeuvre the same road network that was designed for vehicles.	Number of public transit facilities installed.	None	5*
						Number of electric charging facilities installed.	None	25 (C)
	Coalitions of advocates	-		Not Relevant	-	-	-	-

* The information used is based on projection.

Category	Process characteristic	Score	Rational for Score	Relevant/ Possibly Relevant/ Not Relevant	Description of Starting Situation	Indicator	Indicator value at starting situation (2013)	Indicator value for expected transformation (2030)
Agents of change	Beneficiaries	3	The policy creates an avenue for research, development and implementation of appropriate Information Communication Technology (ICT) systems for integrated public transport system in order to improve reliability, efficiency and safety. It also seeks to conduct research on best practices in parking management. It aims to reduce the use of private vehicles in urban areas. It can also provide employment.	Relevant	PTSC has not been able to ensure the adequacy and reliability of its fleet. Improvements in the delivery of its services to the travelling public have not been achieved over a period of years.	Number of routes added.	6 new routes (a)	10 additional routes

Category	Process characteristic	Score	Rational for Score	Relevant/ Possibly Relevant/ Not Relevant	Description of Starting Situation	Indicator	Indicator value at starting situation (2013)	Indicator value for expected transformation (2030)
Incentives	Economic and non-economic	2	The policy considers an incentive programmes to encourage and reward shifts towards other transport modes including public transport, ridesharing, cycling and walking. The National Gas Company considers a few incentives to create avenues to owners of gasoline powered vehicles to consider the use of CNG. Incentivising research & development and the production of biofuel in Trinidad and Tobago and contribute to the growth of a renewable transport fuel industry.	Relevant	There are tax concessions for the importation of hybrid vehicles.	Number of transport facilities installed.	None	10*
						CNG consumption (road transport)/ Total road fuel consumption	0%	6%
						Number of new economic incentives to promote fuel switching	None	4*
	Disincentives	3	The removal of fuel subsidies can significantly contribute to a change in travel pattern.	Relevant	The government subsidizes fuel at an average of 2% of GDP per year. Low fuel prices act as an incentive for private vehicle use.	Annual value of fuel subsidies.	TT $3.6 Billion (d)	TT $0
						Motor vehicle fuel prices and taxes (for gasoline and gas/ diesel).	$2.70 per litre	$4.97 per litre

* The information used is based on projection.

Category	Process characteristic	Score	Rational for Score	Relevant/ Possibly Relevant/ Not Relevant	Description of Starting Situation	Indicator	Indicator value at starting situation (2013)	Indicator value for expected transformation (2030)
Incentives	Institutional and regulatory	4	The objective is the establishment of a national transit authority with the responsibility for public transport planning.	Relevant	A robust regulatory and institutional set-up to design and implement measures, enhance coordination and build capacity at all levels does not exist. Currently, public transportation in Trinidad and Tobago lacks coordination and proper planning to manage both publicly and privately owned transportation.	N/A	N/A	N/A
Norms	Awareness	3	The objective of the policy is to design and implement a long-term, coordinated awareness programme for general public, schools and sectors to reduce the use of private vehicles and promote the benefits of using public transport system and other transport mode.	Relevant	Very little has been done to promote the use of public transportation. PTSC faces many issues which include poor service provision and public dissatisfaction.	Number of awareness campaigns instituted.	2	5*

* The information used is based on projection.

Category	Process characteristic	Score	Rational for Score	Relevant/ Possibly Relevant/ Not Relevant	Description of Starting Situation	Indicator	Indicator value at starting situation (2013)	Indicator value for expected transformation (2030)
	Behaviour	-	-	Not Relevant	The policy may not directly affect the behaviour of the population.	-	-	-
Norms	Social norms	2	The introduction of awareness campaigns and public education initiatives can encourage a change in the attachment society has with their private vehicles.	Possibly Relevant	Societal norms currently favour the use of private vehicles. The convenience associated with owning a vehicle outweighs the cost of vehicle ownership and use. Raising the awareness of the benefits of alternative fuel and the mitigating effects on the environment can aid the policy in achieving transformational change.	Private vehicle occupancy ratio	2:1	4:1
						Percentage (%) shift to public transportation.	0%	30%*

* The information used is based on projection.

APPENDIX D

Describing the Outcome Characteristics and the Starting Situation of the Outcome Characteristics

Category	Outcome characteristics	Score	Description – specific to a policy or action	Indicator	Indicator value at starting situation (2013)	Indicator value for expected transformation (2030)
	Macro level	-	This level is outside the assessment boundary. No description necessary.	Beyond the assessment period.	Indicator value if monitoring outside the assessment boundary.	Indicator value if monitoring outside the assessment boundary.
Scale of outcome – GHGs	Medium level	1	Trinidad and Tobago will commit to unconditionally reduce its public transportation emissions by 30% or one million, seven hundred thousand tonnes (1,700,000) CO2e compared to 2013 levels by December 31, 2030.	-	-	-
	Micro level	-	The cohort of transport policies are implemented at national levels. No information on GHG levels is available at this level.	-	-	-
Scale of outcome – Sustainable development	Macro level	-	This level is outside the assessment boundary. No description necessary.	Beyond the assessment period.	Indicator value if monitoring outside the assessment boundary.	Indicator value if monitoring outside the assessment boundary.
	Medium level	2	At the medium level, the cohort of policies seeks to achieve sustainability by meeting SDG 11 and SDG 13. The policy seeks to provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport. This is will be achieved by increasing the public transportation fleet and by improvement in education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.	Percentage increase in public transit vehicle capacity	None	25%

Category	Outcome characteristics	Score	Description – specific to a policy or action	Indicator	Indicator value at starting situation (2013)	Indicator value for expected transformation (2030)
	Micro level	2	At the subnational level, the policies serves to encourage more compact, mixed, multi-modal development to allow more parking sharing and use of alternative modes. These strategies will contribute to a reduction of vehicle trips.	Reduction in vehicle travel	None	Reduce vehicle trips 5-15%
	Long term	-	The period is longer than the assessment period. No description necessary.	Beyond the assessment period.	Indicator value if monitoring outside the assessment boundary.	Indicator value if monitoring outside the assessment boundary.
Outcome sustained over time – GHGs	Medium term	2	In the medium term, the NGC CNG programme expected to sustain a reduction in Carbon Emission to the order of 35,000 tCO2e. The policy satisfies sustainable development goal 7 which seeks to provide access to affordable, reliable, sustainable and modern energy.	-	-	-
	Short-term	0	The cohort of transport policies are implemented at national levels. No information on GHG levels is available at this level.	-	-	-
Outcome sustained over time – sustainable development	Long term	-	The period is longer than the assessment period. No description necessary.	Beyond the assessment period.	Indicator value if monitoring outside the assessment boundary.	Indicator value if monitoring outside the assessment boundary.

Category	Outcome characteristics	Score	Description – specific to a policy or action	Indicator	Indicator value at starting situation (2013)	Indicator value for expected transformation (2030)
Outcome sustained over time – sustainable development	Medium term	1	At the medium level, the cohort of policies seeks to achieve sustainability to some degree. The sustainability development goals that is expected to met is as follows: 1. SDG 7 target includes enhancement of international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology. 2. SDG 8 target includes promotion of development- oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium sized enterprises, including through access to financial services. 3. SDG 11 target is to provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport. 4. SDG 13 target includes improvement in education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.	-	-	-
	Short-term	-	Trinidad and Tobago does not have specific sustainable development goals set for this time period in the transport sector. However, the country is expected to sustain an increase in employment in the public transport sector through policy reform.	-	-	-

APPENDIX E

Description of the scoring scales for Process and Outcome Characteristics

Score	Description
Process Characteristics	
4	It is very likely (e.g. a probability of 90–100%) that the policy will have a significant positive impact on this characteristic over the assessment period.
3	It is likely (e.g. a probability of 66–90%) that the policy will have a significant positive impact on this characteristic over the assessment period.
2	It is possible (e.g. a probability of 33–66%) that the policy will have a significant positive impact on this characteristic over the assessment period. Instances where the likelihood is not fully known or cannot be determined with certainty should be considered possible.
1	It is unlikely (e.g. a probability of 10–33%) that the policy will have a significant positive impact on this characteristic over the assessment period.
0	It is very unlikely (e.g. a probability of 0–10%) that the policy will have a significant positive impact on this characteristic over the assessment period.

Outcome Characteristics - Scale for which outcome is sustained.		
Score	**GHG Impacts**	**Sustainable development impacts**
3	The policy will result in GHG impacts that represent large emissions reductions, relative to the starting situation, at the level of assessment targeted.	The policy will result in large net positive sustainable development impacts, relative to the starting situation, at the level of assessment targeted.
2	The policy will result in GHG impacts that represent moderate emissions reductions, relative to the starting situation, at the level of assessment targeted.	The policy will result in moderate net positive sustainable development impacts, relative to the starting situation, at the level of assessment targeted.
1	The policy will result in GHG impacts that represent minor emissions reductions, relative to the starting situation, at the level of assessment targeted.	The policy will result in minor net positive sustainable development impacts, relative to the starting situation, at the level of assessment targeted.
0	The policy will not result in GHG impacts relative to the starting situation at the level of assessment targeted.	The policy will not result in sustainable development impacts, relative to the starting situation, at the level of assessment targeted.
-1	The policy will result in GHG impacts that represent a net increase in emissions, relative to the starting situation, at the level of assessment targeted.	The policy will result in GHG impacts that represent a net increase in emissions, relative to the starting situation, at the level of assessment targeted.

Outcome Characteristics - Time for which outcome is sustained.		
Score	**GHG Impacts**	**Sustainable development impacts**
3	The policy will result in GHG impacts that are very likely (e.g. a probability of 90–100%) to be sustained over the assessment period.	The policy will result in sustainable development impacts that are very likely (e.g. a probability of 90–100%) to be sustained over the assessment period.
2	The policy will result in GHG impacts that are likely (e.g. a probability of 66–90%) to be sustained over the assessment period.	The policy will result in sustainable development impacts that are likely (e.g. a probability of 66–90%) to be sustained over the assessment period.
1	The policy will result in GHG impacts that will possibly (e.g. a probability of 33–66%) be sustained over the assessment period. Instances where the likelihood is unknown or cannot be determined should be considered possible.	The policy will result in sustainable development impacts that will possibly (e.g. a probability of 33–66%) be sustained over the assessment period. Instances where the likelihood is unknown or cannot be determined should be considered possible.
0	The policy will result in GHG impacts that are less likely (e.g. a probability of 10–33%) to be sustained over the assessment period.	The policy will result in sustainable development impacts that are less likely (e.g. a probability of 10–33%) to be sustained over the assessment period.
-1	The policy will result in GHG impacts that are unlikely (e.g. a probability of 0–10%) to be sustained over the assessment period and risk being reversed to negative impacts.	The policy will result in sustainable development impacts that are unlikely (e.g. a probability of 0–10%) to be sustained over the assessment period and risk being reversed to negative impacts.

K. H. Olsen, N. Singh (2020). Transformational Change Methodology. Assessing the transformational impacts of policies and actions. Initiative for Climate Action Transparency (ICAT). UNEP DTU Partnership and World Resources Institute. Pg 74-75.

APPENDIX F

Some Key Land Use and Transportation Planning Issues

5.1 Suggested Organisational Structure for Road Transportation Management, Regulation and Planning

(Adapted from Furlonge, 1996, pp. 45-52)

5.1.1 General

Almost all previous studies on road transport have examined the question of the administration of the transport system. In particular they have noted, not only the large number of organisations involved in transportation management and regulation and their overlapping functions, but also the separate ministerial arrangements. A common theme in the recommendations from these studies has been the need to have all the agencies and functions brought under single administration. The National Internal Transportation Policy (NITP) Committee recommended that because of the size and multiplicity of the transportation sector there is a need to establish a Department of Transportation (Furlonge, 1996). This department would be charged with the responsibility for planning, administering and developing the internal transportation system for the nation. The NITP Committee suggested that it could be conveniently divided into four sectors namely (a) Roads, (b) Marine, (c) Air and (d) Strategic Planning. The rest of this segment of the current report deals with the road sector.

5.1.2 Roads Sector

The agencies within this sector are:

- The Highways Division - responsible for the design, construction and maintenance of the major road network;
- The Transport Division - responsible for the registration and licensing of motor vehicles, the licensing of drivers and the enforcement of regulations under the Motor Vehicles and Road Traffic Act;
- The Traffic Management Branch - responsible for traffic planning and control, the design and implementation of traffic management schemes and road safety education; and,
- The Public Transport Service Corporation - responsible for the transportation of passengers.

The NITP Committee recognized that overlapping functions still exist among the various divisions, as well as between different Ministries. For example, the legal control for traffic signs and traffic lights lies with the Transport Division whereas actual implementation and administration is done by the Traffic Management Branch. Further, for some unknown reason, in 2005 the TMB was placed under the Highways Division. There is also some confusion concerning the role and function of local government bodies as opposed to the Central Government with respect to management of roads. The NITP Committee recommended that rationalisation of overlapping functions between various divisions and Ministries be pursued as a matter of urgency.

5.1.2 Strategic Planning

There is currently no agency or group of agencies responsible for strategic transportation planning. Strategic Transportation Planning should be carried out on a continual basis within the Ministry. The data to be used would come from the various agencies as well as be collected by those responsible for strategic planning. The main function of the planning unit would be to plan the transportation development of the country on a system wide basis and thus to determine the appropriate distribution of resources within the transportation sector. This unit might be in the form of a standing grouping of planning officers from the agencies within the Ministry and should be able to contract services as required.

5.2 Institutional Strengthening

Managers in both the public and private sectors are forced to think in terms of efficiency, that is, obtaining the best product with the least input and meeting the challenge of the competitive environment in which society finds itself. According to the World Bank, in a report on Infrastructure and Economic Development, if we analyse characteristics of efficient companies, whether public or private, we find that they have a number of characteristics in common, such as:

- They are guided by commercial principles.
- They have clear and coherent objectives based on their fundamental tasks.
- They rely on the twin principles of the delegation of powers and accountability for results.
- They are financially independent.

While these characteristics may seem obvious in the context of private companies, they are hardly common in the public sector. The public sector is overwhelmed by a series of problems arising out of a diverse multitude of its economic, social, and political objectives. Frequently, the solutions to its problems impact very negatively on the productivity of the agencies responsible for infrastructure and the delivery of services, and thus on the country's productive apparatus as well.

Employees of public agencies may exert collective pressure for salary increases not necessarily associated to any increase in productivity. Political groups may lobby to have the problem of unemployment solved by swelling the ranks of the public work force. At the same time, service providers must receive a return on their investment in order to grow, make reinvestments to modernise, carry out maintenance to preserve their assets, and gain access to new technologies. These needs require the availability of financing all too often earmarked for other uses under public policies. In such a scenario, the results are high transportation costs and rates as well as investment difficulties. All these elements combine with each other and tend to conspire against the sound management of the public agencies.

In view of this situation, it is imperative to transform public agencies by making them market-oriented, by stimulating competition, and by increasing user participation. The errors of the past and the prospects of current opportunities are forcing us to take a hard look at the functions of government and of public agencies, as well as those of the private sector, so as to determine ways of providing more efficient infrastructure and services in response to demand. The difficulty lies in determining which activities can be delegated to the private sector in a competitive environment and which ones require the intervention of the public sector.

Within these broad outlines, there is a series of institutional options that will enable the public and private sectors to assume responsibility for various aspects of service delivery. These options are discussed in the next section.

5.2.1 Options for Institutional Structures

It is anticipated that the assessment as to the best institutional configuration for carrying out state functions will continue notwithstanding decisions taken in this regard in the past. It is a part of Government's responsibility to always pursue the most economical, expedient and efficient means by which it may provide its services and develop and maintain its infrastructure.

There are probably three distinct types of organisational structure that can be adopted. They represent three distinct approaches to the carrying out of tasks. In an absolute sense, therefore, the state could elect to:

I. Perform all its functions within a central body which relies on its salaried or career staff to, not only, ensure that the work is done, but carry it out as well. This is the Public Service option.
II. Execute works through a Statutory Body which is governed by a board made up of representatives from select interest groups. Such a body will be expected to operate within a given budget and, in the appropriate circumstances, raise revenue itself. A Public Service department will monitor its activities, ensuring administrative support on behalf of the Central Government.
III. Delegate and empower a Private Sector organisation (either of Government's making or otherwise) to carry out state functions. Private sector incentive will come via profits earned by virtue of the operator's efficiency. Funding may be by budget allocation and/or revenue generation. A Public Service department will supervise the activities of this body.

These alternatives are not mutually exclusive and can be combined in any proportion suitable to the nature of the particular area of Government activity. In fact, the current structural configuration may be mainly type I, but there are many examples of type II in existence, with consideration being given to creating more.

The most popular argument for converting Public Service activity into a Statutory or Private Sector one (even if only to a limited degree) is that greater efficiency would be possible and that the many constraints of the Public Service bureaucracy would be avoided. It is always assumed that the relatively independent nature of non-Public Service bodies (which lends to faster decision making and a control over hiring and firing, discipline and reward) is what guarantees such efficiency. However, it is possible, and this country's experiences with its attempts at new structures suggests, that closer examination is warranted as benefits have not been as might have expected.

Although the review of Public Service architecture is an undertaking, the scale and nature of which cannot be addressed in a policy document on only one of the state's areas of responsibility (in this case, Internal Transportation), the factors to be considered are common to all. As a matter of policy, therefore, any assessment of proposed organisational structures must include the following:

- Private sector efficiency is driven by a desire for profit and expansion. Functions which have set budgets or fees (for example, road and drainage infrastructure maintenance; the issue of permits and licenses) may not satisfy such a desire and, therefore, may not be appropriate. Experience shows, in fact, that the Public Service budgets for these

types of activities must be increased to attract Private Sector involvement, monetary increases which, if applied strategically in the Public Service could achieve even greater economic benefits overall. On the other hand, profit-driven activities are indeed best suited to the Private Sector psyche (for example, parking meters, transit and parking complexes, EV charging infrastructure, etc.).

- The very bureaucracy that slows down the functioning of the Public Service also slows down the rate at which the misappropriation of funds can occur. Public Service wastage and poor investment can easily be multiplied a hundredfold when basic checks and balances are removed. Furthermore, and ironically, it is the Public Service which is required to salvage when such occurs, even though its resources may be significantly less.
- The relative autonomy enjoyed by Statutory or Private Sector agencies can be granted to the Public Service. It is the absence of such a reform that continues to stifle Public Service potential and that lures organisational planners towards the false promise of other structures. In fact, it may be wise to deal with the limitations of the Public Service before the large-scale pursuit of other options. For example, the fundamental Private Sector principle of reward-by-merit could easily change Public Service achievables. In addition, the removal of outdated documentation requirements and systems of budgeting also demand to be addressed. Public Service reform should, however, be performed incrementally, allowing for modification to the reform process as experiences dictate. Such reforms deserve to be entertained before any other, especially those with proven disastrous track records.
- Redundancy in the Public Service is a main constraint to the economics of improving conditions for employees. The size of the Public Service needs to be reduced in accordance with the functions it carries out, such functions being those which, after careful assessment, are best suited to its advantages. All other functions should be reassigned to the other organisational options. It is, however, imperative that, as a matter of policy, no one option is assumed to be inherently better than another. Selection should always be made on the basis of suitability.

5.3 Public Transportation Development and Management

(adapted from All-Inclusive Project Development Services Ltd (APDSL) in Association with SoftCom Ltd, 2010, pp. 19-20, where this writer was lead investigator of the study and primary author of the report)

5.3.1 Transit Authority

A properly organised public transport sector could make a very large difference, especially to peak hour highway congestion and to accessibility in many areas. The necessary first step to organising public transport is to place control of the sector in a single dedicated agency. The setting up of a single professional public transportation agency is recommended. Its remit would be

- monitoring of public transport
- certification of public transport vehicles and drivers
- route planning
- route licensing
- recommending of subsidies and incentives

The Transit Authority would assess the long-term requirements for the development of the public transport services. Planning and analysis would be specific to transit development. It would set standards for service and maintenance and would regulate the operators (public

and private) of public transport systems to ensure that services are safe, reliable, and comfortable. It would licence public service vehicles, including all types of buses, maxi-taxis, taxis, and rental vehicles. It would also licence the drivers of private buses, excursion buses and school buses, and regulate their conduct.

Transit Authority functions would also include providing transit hubs and associated amenities approving transit routes, regulating transit service standards, and approving fares for scheduled transit services.

The Transit Authority would arrange for the contracting and management of Maxi-Taxis and taxis as part of the overall transit mix to provide proper schedules, location of stops, amenities at terminals, and information on routes and schedules.

It would ensure that transit service is (a) Accessible to all members of society, (b) Affordable, representing good value for money, (c) Caring, treating passengers with dignity and respect, (d) Comfortable, improving vehicle standards and ride quality, (e) Effective, serving a wide range of origins and destinations, (f) Environmentally sound, progressively reducing the environmental impact of transit services, (g) Responsive to changing travel needs and patterns of activity, (h) Safe, ensuring high standards of physical safety, (i) Secure, providing a travel experience that is not blighted by fear of assault, attack or other anti-social behaviour throughout the journey, and (j) Likely to increase the proportion of people who choose to use public transport to meet their travel needs.

5.3.2 Transit Incentive and Auto Disincentive

It is an advantage to a society that can offer high-quality public transportation services and other activities suited to walking access. These minimise the creation of second class citizens, or those not owning cars, or who cannot or do not want to drive. According to Professor Vukan Vuchic, in his book “Transportation for Livable Cities,” one of the fundamental characteristics of a livable nation should be the ability to travel conveniently without having to own or operate a car. He suggests that two sets of policies need to be implemented: transit incentives and auto disincentives. Transit incentives are measures that result in decreased disutility of transit travel, such as increased frequency of service, reliability, comfort, lower fares, and construction of higher-quality transit mode. Auto disincentives are measures that increase monetary costs or decrease the convenience of auto travel, such as higher gasoline taxes, parking charges, limitations on street and parking capacity.

5.4 Transportation and Land use Development Planning

(adapted from All-Inclusive Project Development Services Ltd (APDSL) in Association with SoftCom Ltd, 2010, pp. 34-37, where this writer was lead investigator of the study and primary author of the report)

The integral relationship between transportation and land use including the spatial location of facilities and activities is acknowledged among practitioners in both functions. However, while it is widely accepted in theory, in practice appropriate measures reflecting inter-relatedness are not included consciously and consistently or applied effectively in the preparation of development plans and transportation projects.

One reason for this is that responsibilities for the two functions are held by different agencies. Effective management of the inter-relationship in these circumstances is difficult and time-consuming and for these reasons is often not attempted or pursued. Another reason is that implementation timelines do not match. In many instances development plans have long gestation periods, are indicative rather than prescriptive and are, therefore,

considered much too nebulous to be addressed seriously by transportation engineers. In other instances, the practical demands of, often overdue, transportation projects are too pressing to await inputs from land use development planners on the implications or impacts.

Land use planning addresses the present situation and projected scenarios for development of communities and defines the movement needs that must be satisfied by the transportation system. The elements of land use planning that are linked with the transportation planning elements in the proposed framework for implementation of transportation projects are outlined below under each of the operational characteristics:

1. Encouragement of public transport use.

   Short-term objective—to ease existing inefficiencies; some of these are due to operational factors, but others are caused by the distorted travel-intensive patterns which are the result of the following

   (a) poor coordination between land use patterns and transportation provision
   (b) situations of conflict between the requirements for public transport use and land use development and spatial locations of facilities
   (c) mismatch of different types of land use and related transportation requirements (intensification of residential development and change of use to higher traffic generating uses are the most common causes of these situations);

   Long-term objective—to integrate public transport use and land use planning for development and redevelopment, encourage greater public transport use and facilitate users.

2. Establishment of minimum levels of accessibility for communities.

   Determination of accessibility requirements and ensuring adequate provision for satisfying them should be considered in land use planning for communities and in decision-making on locations of facilities and activity centres. There are two aspects to the requirements for accessibility for communities: (a) accessibility between communities, and (b) accessibility within communities. The situation is more acute in the main urban communities especially those which are targets for high volumes of daily commuting to jobs, such as, Port of Spain, San Fernando and Chaguanas.

   The long-term objective is to be decentralized out of the centres of high concentration of social and economic activities and so lessened the need for daily access to jobs and reduce the scale of commuting. This was proposed as a major land use development strategy in the National Physical Development Plan, approved by Parliament in 1984. The main blame for not pursuing the strategy falls on the Government which should have taken the lead in decentralizing certain governmental functions and generated the greatest impact on the distorted pattern.

   Although much time has been lost and the trend of centralization seems to have been reinforced with the building of the Government Office Campus in Central Port of Spain, it is possible to initiate a change by moving certain government offices and the associated jobs out of the Capital. A suitable location is the Frederick Settlement area. The Licensing Office, which has already been located in this area could be used to kick-start the development of a Complex of government office and related facilities. The positive impact on accessibility and traffic flows of shifting a significant number of jobs out of central POS to Frederick Settlement which is well served with

arterial roads can be readily demonstrated.

3. Congestion reduction

The issue of congestion and accessibility are closely linked and both affect the urban communities of the country. Reduction of congestion can result directly from changes in land use and the location of facilities and activity centres which generate high volumes of traffic in their operations.

The components of effective transportation services and related land use relationships include:

(a) Transport-sensitive land-use patterns.

Policy consideration: At every scale, national, regional and local, it is possible to project the movement needs and travel generating characteristics (volumes, flows, types of vehicles, etc.) of different types and patterns of land use and to determine the optimum transport means to meet them. This requires that transportation be planned and designed in close conjunction with land use so as to achieve stated objectives of both elements and the highest possible level of satisfaction for users. This is easier where new land use is being planned.

Example: Measures include:

- traffic management arrangements - creation of one-way streets, lay-bys to facilitate service to particular land uses, and
- land use planning measures, such as, the re-location of facilities, e.g. the re-location of the Licensing department.

(b) Policy-driven provision of transportation facilities for all segments of the population, including the elderly and physically challenged.

Policy consideration: Especially at the local or small spatial scale, this objective can be achieved by the application of appropriate design of land use and the location of facilities and activities.

Example: Relocation of facilities from roads and districts with high volumes of traffic—Dretchi from Wrightson Road and the Blind Institute from Duke Street.

(c) Improvement of overall traffic flow.

Policy consideration. The term “improvement” suggests dealing with an existing situation of unsatisfactory traffic flow and may be seen as a predominantly transportation issue. However, viewed from a land use planning perspective the objective should be to maintain travel flows at acceptable levels; these may either have been determined at the planning stage or be limited by the existing land use and street configuration of an area.

Example: Installation of speed bumps to slow the speed and discourage use of residential streets by through traffic. Turning through streets into cul de sacs or loops can limit traffic flows.

(d) Meeting of total transportation needs at affordable cost.

Policy consideration. Experience shows that transportation needs tend inevitably to increase over time resulting in increases in cost to meet them. Transport-sensitive land use planning can contribute to keeping transportation cost "affordable" by including "affordability" as an objective in the initial plan and by maintaining needs to predictable levels over time.

Example: Intensification of land use and the resulting increase in transportation needs should be planned and not happen in an ad hoc manner so that cost can be managed. Changes in land use that result in intensification, for instance from residential to retail commercial or entertainment, increases the transportation needs and the associated cost. Even the location of some schools is no longer appropriate because the traffic generated by these schools has grown considerably and meeting their needs will be costly.

5.5 A Balanced and Integrated Transport Solution for Trinidad and Tobago

5.5.1 Traffic Congestion Reduction

Traffic congestion is the time period where traffic demand equals or exceeds capacity. As soon as demand exceeds capacity, the excess vehicles and people are stored in queue(s) to be processed during subsequent hours. Road capacity improvement projects that reduce congestion cause additional peak-period vehicle trips due to generated traffic, consisting of trips diverted from other routes, times and modes, but over the long run consisting of induced travel, or an absolute increase in vehicle trips, until congestion once again constrains further growth. Thus traffic congestion tends to maintain a self-limiting equilibrium.

Transportation planning practices that ignore generated traffic can result in inaccurate predictions and faulty decisions. This overstates the benefits of highway capacity expansion projects in congested urban areas and understates the relative benefits of alternative strategies that encourage more efficient use of existing road capacity.

There is often a high density of vehicles on the roadways, that is, a large number of vehicles occupying a specific length of roadway. Congestion is only relieved when the numbers of vehicles in the traffic stream are reduced drastically, through penalties imposed on the private car users to coerce them to change their mode of transport.

5.5.2 Towards a Balanced and Integrated Transport Solution

Measures undertaken by countries that have successfully implemented balanced and integrated transport solutions are as follows:

(a) Development and management of the transportation system (with the emphasis on public transport);
(b) Congestion reduction (with emphasis on the systems of traffic management and parking in urban centres);
(c) Establishment of minimum levels of accessibility for communities;
(d) A system for prioritizing investment projects in the transport sector; and,
(e) The financing of transportation infrastructure and facilities and rationalising of subsidies.

The Singapore Public Transport Council recognized that "*The government has to take an important role in defining the role of public transport and pursuing policies that encourage and favour their use over that of private transport. This is unlikely to be a popular measure among the many car owners and aspiring car owners, but unless such a stand is taken, public transport will always be viewed as the mode of 'last resort' and as a residual mode for those with no access to cars*."

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