

Challenges to Alternative Fuel Vehicle Usage in Trinidad

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Abstract: The Government of the Republic of Trinidad and Tobago has set itself some lofty targets in terms of reducing CO₂ emissions from public transportation by 2030. Several initiatives have been launched since 2015 in order to fulfill these targets. One key strategy is the adoption of a higher percentage of alternative fuel vehicles (AFVs) into the overall fleet of vehicles. This article reviews the history and implementation of the various AFV oriented policies and examines the effectiveness of these initiatives. The authors describe the current state of the motorised vehicle fleet in terms of fuel type and highlight where adoption levels have fallen short of the target. The percentage of AVFs per public transit mode ranges from about 2 to 20 percent, where the higher percent represents the CNG buses belonging to the Public Transport Service Corporation (PTSC). In Trinidad, the natural gas supply is already well-established, refuelling stations are in operation and up to 20 original equipment manufacturer CNG vehicles are available on the market, supplemented by the option of vehicle conversion. The opposite is true for electric vehicles. The article further identifies the four key issues affecting the improved adoption of AFVs namely: (i) Fuel Prices (ii) Availability of Alternative Fuels, (iii) Consumer Perception and Resistance, and (iv) Lack of Institutional Support. In addition to presenting the proposals by others for improvements to the local transportation system, the authors recommend six key actions that should be taken to achieve the targets set for 2021 and beyond.

Keywords: Alternative Fuel Vehicle, Clean Transport, Compressed Natural Gas, Sustainability, Trinidad and Tobago

1. Introduction

A transportation system can be defined as “a set of elements and the interactions between them that produce both the demand for travel within a given area and the provision of transport services to satisfy that demand” (Cascetta, 2009, 1). The role of the transportation system is to (i) provide for the safe, efficient and economical movement of people and goods, (ii) address regional, economic objectives of government, and (iii) support governmental priorities as they relate to tourism, industry, agriculture, education and settlement (MOWT, 1996).

The transportation system of Trinidad and Tobago is a unique one when compared with other small states in the Caribbean. Although small island developing states (SIDS) are characterised by scarce resources, Trinidad and Tobago has the benefit of more abundant and diversified resources in the form of oil and natural gas reserves. Notwithstanding, alternative fuel vehicles are in use but not prevalent in the transportation system. A switch from conventional to alternative fuel can have a significant impact on the sustainability of the entire system, but “to comprehensively advance the sustainability discourse, methods should be developed

for linking social, economic, and environmental impact analyses” (Fischer and Amekudzi, 2011).

For the sake of clarity, in this paper, an alternative fuel vehicle (AFV) is defined as a vehicle that runs solely on a non-traditional alternative fuel, but the possible benefits of hybrid alternatives will be considered where relevant. An alternative fuel is defined by Ramadhas (2011, 8) as “all the fuel used in vehicles other than gasoline and diesel” with the advantages of “cleaner burning than petroleum-derived fuels, producing lower emissions” and sometimes with the potential to “decrease the dependency on non-renewable petroleum”. Recent studies (Ramadhas (2011), Browne et al. (2012) and Yavuz et al. (2014)) identified the alternative fuel options as alcohols (methanol and ethanol), biofuels, gaseous fuels (natural gas, hydrogen, and liquefied petroleum) and electricity. Of those identified, compressed natural gas (CNG) and electricity appear to be the most feasible for mass implementation in the Caribbean region in terms of availability, cost effectiveness, product efficiency, environmental impact, safety, and resilience. The likelihood of a less ubiquitous alternative fuel surpassing the current benefits of natural gas and electricity in Caribbean SIDS in the near future

is relatively low.

The majority of the AFVs in Trinidad and Tobago are powered by CNG, which, like gasoline, is a fossil fuel and a non-renewable source of energy. Raghoo et al. (2017) recommend that CNG be developed alongside electricity from renewable energy resources to improve the energy security of small islands. However, the more viable fuel options for Trinidad and Tobago, CNG and electricity, have technical, social and economic drawbacks that challenge their widespread use. While cost and the limited range of AFVs have been identified as major concerns for both users and implementing agencies, several non-cost barriers also exist (Browne et al., 2012; Shepherd et al., 2012; Stephens, 2013).

2. Data Collection

Due to the qualitative nature of this research, the archival data collection approach was employed for the majority of the data collection process, which involved the review of the literature and policies available regarding alternative fuel vehicles. The material reviewed included but was not limited to journal papers and conference proceedings on AFV implementation and sustainability evaluation techniques, relevant legislation, cabinet discussions, budget reports, news articles, and international agency publications.

Yeh (2007) identified the major stakeholders of alternative fuel technologies as the fuel suppliers, governments, equipment suppliers, consumers, and NGOs. The sample size was not expected to exceed 10 persons/firms due to the limited number of stakeholders initially identified, but evolved during the research, resulting in a total of 20 consultations. The research sample comprised persons falling within these general categories, as summarised in Table 1.

The collection of primary data on the present-day developments in AFV implementation took the survey approach, employing semi-structured interviews to obtain feedback from the identified stakeholders in the alternative fuel and energy industries. The salient points from their involvement with alternative fuels or AFVs were requested and recorded by means of detailed notes since permission for audio recording was not given. Supplementary information was provided via email or other digital means in a few cases.

3. AFV Oriented Policy

In 2015, the Government of The Republic of Trinidad and Tobago (GORTT) set a national target to achieve 10 percent of renewable energy generation by 2021. In addition, the intended nationally determined contribution (NDC) is to achieve a 15 percent (103 million MtCO_{2e}) reduction in overall emissions from the business as usual (BAU) case by 2030, in three sectors namely power generation, transportation and industrial (MPD, 2015; MEEI, 2019). “Trinidad and Tobago will commit to unconditionally reduce its public transportation emissions by 30 percent (compared to 2013 levels) or 1.7 million MtCO_{2e} by 2030” (MPD, 2015). Although both the renewable energy and emission reduction targets for Trinidad and Tobago are low in comparison with the other CARICOM countries who have smaller populations and are less industrialised, these commitments still mark progress towards sustainability. The sequencing of the recent and intended AFV policy developments are summarised in Figure 1.

Notwithstanding the above target, intention and commitment, none of the ongoing fiscal incentives, measures or pilot projects by the Ministry of Energy and Energy Industries (MEEI) and the Ministry of Public Utilities (MPU) that are associated with renewable energies are directly linked to the transportation sector, but rather to basic electrical needs for residential, commercial, recreational and institutional entities. The Queen’s Park Savannah Renewable Energy Project proposed under the International Renewable Energy Agency (IRENA) Grant will be the first pilot project that incorporates EV charging ports into its ambit, thereby catering to the transport sector. Upcoming modifications to the country’s legislation will have an indirect impact on the transport sector by providing a cheaper, greener and more efficient alternative to electricity generation, reducing the limitations to the widespread use of EVs and facilitating more options for the end user.

4. AFV Adoption and Development

The NGC CNG Company Ltd. a subsidiary of the National Gas Company of Trinidad and Tobago, was incorporated to accelerate the use of CNG as a major transportation fuel. The company has embarked on several initiatives as part of the CNG Expansion

Table 1. Summary of Data Collection Process Highlighting the Relevant Sources and Tools

Stakeholder Group/ Role	Firm/ Organisation	Semi-structured interviews	Other informal (email or data)
Fuel Supplier/ Retailer/ Regulator	NPMC, NGC CNG Co. Ltd., TTBS, T&TEC, MEEI, and MPU	3	1
Government Agency/ Policymakers	MPSD, MOWT, TTPS, and VMCOTT	2	5
Equipment/ AFV Supplier	Massy Motors, Ansa Automotive, Dumore Enterprises, SM Solar, Smart Energy Ltd., and Megapower Ltd.	4	4
Consumers	Anonymous	4	-
NGOs	AMTTT	1	-
Total:			20

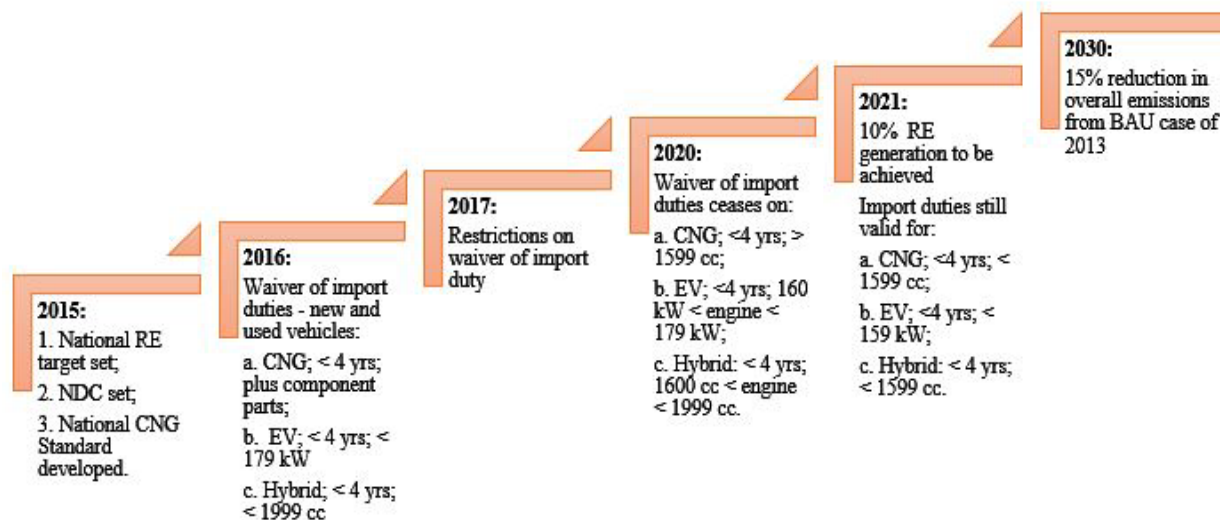


Figure 1. Timeline of AFV Related Policy Interventions
Source: Abstracted from Dolcy (2019)

Programme, including:

1. Waiver of value-added tax and motor vehicle tax on OEM CNG and Electric Vehicles;
2. Tax credits of up to 25% of the cost of conversions (gasoline/diesel to CNG) for individuals;
3. Capital uplift of 130% for wear and tear on the cost of commercial fleets conversions;
4. Establishment and expansion of CNG filling stations;
5. Mobile CNG refuelling units commissioned to distribute CNG between Trinidad and Tobago;
6. New maxi-taxi grants for OEM purchases of small and large maxi-taxis;
7. Free conversions offered to maxi-taxis and taxis owners (gasoline models only);
8. Pre-loaded fuel cards issued as a fuel incentive to the ordinary members of the Private School Transport Association of Trinidad and Tobago (PSTATT);
9. Free private vehicle conversions to members of the public through a biweekly raffle draw;
10. Training programme for CNG Engine Maintenance technicians in collaboration with the National Energy Skills Centre (NESC);
11. Development of a CNG Standard through the Trinidad and Tobago Bureau of Standards (TTBS).

According to the initial investment plan, 20 percent of the total vehicle population would be converted to CNG by year five, seeing a total of 100,000 natural gas vehicles (NGVs) in Trinidad and Tobago. Figure 2 shows the current status of CNG adoption alongside the 2015 targets, with various projection scenarios. By mid-2019, only 5,300 vehicles had been converted (Dolcy, 2019). NGC CNG Company Ltd. (2021) subsequently reported 7,268 conversions and 3,173 OEM purchases, reflecting a total of 10,441 CNG vehicle additions to the market since 2014. The most significant growth was seen

in the 2018 to 2019 period, with increases of 31 and 38 percent respectively above the previous year. While developments in CNG as an alternative fuel have been emerging and expanding, the advancement of electricity as an alternative fuel in Trinidad and Tobago is relatively slow. Of the nine initiatives under the CNG Expansion Programme, only Item (a) is also applicable to select categories of hybrid and electric vehicles. Even the options available for purchase of new EV or electric hybrid are limited to one local dealership who reports that the hybrid is a lot more popular than the pure EV.

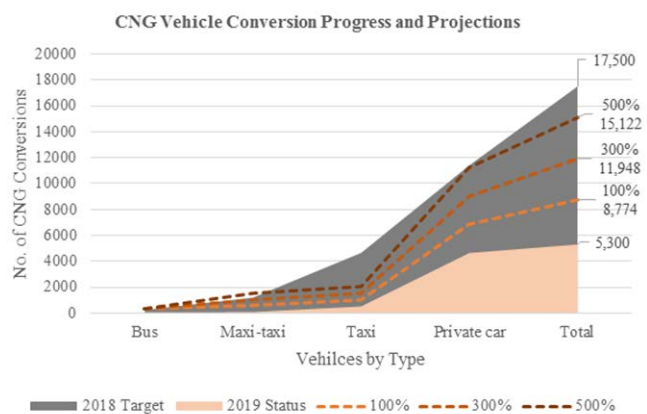


Figure 2. CNG Development as at Mid-2019 in Relation to the NGC CNG 2018 Target
Source: Abstracted from Dolcy (2019)

5. Current Vehicle Population

Espinasa and Humpert (2016) estimate that “in 2010, there were 518,831 motor vehicles on the road and in total more than one million vehicles have been registered in Trinidad and Tobago. Over the last decade alone, more than 250,000 cars have been added to the network

and the per capita ownership of motor vehicles is very high with a ratio of 2.5 people for each car”, while the US and the UK report a ratio of 2 (Agong, 2017; Rodrigue, 2017). The increase in the number of vehicles over the years has been reflected by an increase in energy consumption by the transportation sector (Dolcy, 2019) and is evident in the daily traffic congestion.

Data from the Ministry of Works and Transport confirms the significant growth in the vehicle population, recording a total number of 876,202 registered vehicles in 2017, some 86 percent of which are classified as private vehicles. Townsend (2016) reports that in Trinidad and Tobago, “95 percent of public transportation was provided by approximately 13,000 privately owned vehicles” and the Association of Maxi Taxis of Trinidad and Tobago estimates that the maxi-taxis serve approximately 75% of the travelling population with over 5,000 vehicles. The vehicle population consists of vehicles fuelled by gasoline, diesel, CNG, and electricity, some of which are hybrids and run on a combination of either of the fuel types.

Table 2 gives an overview of the public transportation system, highlighting the characteristics and scope of each transportation mode. The four public transportation modes, namely bus, maxi-taxi, taxis and private cars (locally known as ‘PH’), each have AFVs, primarily CNG vehicles. Each of the four modes has different ownership and operating arrangements but covers the same geographical areas and serve most citizens, regardless of demographics. Public transportation in the country has been described as poorly connected to residential communities, unmanaged, unscheduled, unreliable and confined to two main corridors, bordering on chaos in vehicular mobility and accessibility (Furlonge, 2007; Townsend, 2016; AGD 2016).

The PTSC operates a bus service with a fleet of 315

(Parliament, 2018), a decrease from 548 in 2014 (AGD, 2016) and has the advantage of transporting significantly more persons per trip than other transportation modes: PTSC buses have the advantage of not having a 25-passenger seating capacity restriction as do maxi-taxis (MAGLA, 2015). Despite this acknowledged imbalance in passenger-share by the review committee for amendment of the National Internal Transportation Policy (NITP) from as early as 1996, there has been no de-regularisation of nor an increase in the vehicle seating capacity for maxi-taxis.

The majority of the vehicles in the country are still fuelled by conventional fuels, and transportation falls into the category of ‘small consumers’ as it relates to natural gas utilisation in Trinidad and Tobago. The increase in the number of vehicles and the less than optimum driving speeds brought about by traffic congestion are accompanied by an increase in vehicle exhausts released in the combustion of these fuels. Mycoo (2018) highlights that “traffic congestion and associated air pollution in urban areas are on the rise in Caribbean cities. The automotive air pollution problem in the Caribbean is a metropolitan problem, resulting from rapid and uncontrolled urban growth, increasing traffic congestion, inadequate urban transport infrastructure and services, and an ageing and obsolete motor vehicle fleet”.

6. Key Issues Affecting AFV Adoption

The Trinidad and Tobago transportation system is comparably larger and supposedly more advanced than that of the remaining SIDS in the region. The citizens of Trinidad and Tobago benefit from relatively cheap fuel options, an efficient new and used vehicle market, and an extensive road network of arterials and highways, including a dedicated bus route along the East-West Corridor.

Table 2. Overview of the Public Transportation System in Trinidad and Tobago

Public Transport Entity	Mode of Transport (capacity)	No. of Vehicles	% of AFVs per mode	Estimated Annual Ridership	Characteristics
PTSC	Bus (33 – 50 seats)	315	~ 20	12.6 million (2010) 7.6 million (2014)	State-owned; no fare increase since 1990; express services; subsidised fares; scheduled services ranging from 30 mins to three times a day but not reliable; PBR access.
	ELDAMO (8 seats + 3 wheelchairs)	24			
AMTTT, AMTSTC, PSTATT, Other	Maxi taxis – small and large (12 – 25 seats)	5000+	~ 2	70%-80% of public transport trips (Townsend, 2017)	Frequent stops; reliable; PBR access but some restricted to the EMR; privately owned. AMTSTC and PSTATT cater to students under specific agreements.
Taxis (H plates)	Route (Shared) Taxis	13000+	~ 5	275 million pass. trips annually (Townsend, 2016)	Generally operate from taxi stands around cities and towns; reliability varies with the route; off route transfers cost more.
	Private Taxis (H) (5-7 seats)				Operate from air and sea ports; private tours
TTRS, PinkCab, DROP, etc.	Private Cars – ridesharing (5-7 seats)	unknown			Custom location requests – includes airport transfers and shopping trips or other errands.

Source: Developed by Dolcy (2019) from multiple local sources, including Townsend (2016, 2017), and AGD (2016)



Figure 3. Trinidad and Tobago Land Use, Economic Activity and Communication Links
 Source: Abstracted from MPSD (2014)

The transport sector has however been identified as one of the highest contributors to the total GHG emissions in Trinidad and Tobago (Solaun et al., 2015; MPD, 2015). The transportation system is fraught with issues that affect its effectiveness and efficiency. Figure 3 is a snapshot of the twin-island country which gives an overview of the land use, economic activity, and communication links.

6.1 Fuel Prices

The country is currently one of the cheapest fuel retailers in Latin America and the Caribbean, preceded by Venezuela, Panama, and SIDS, like Puerto Rico and Haiti. In Trinidad and Tobago, heavily subsidised lower grade fuels coupled with relatively cheap imported vehicles, have resulted in affordable car ownership and little financial incentive to use alternative modes (Globe Consultants International Ltd., 2013).

Both conventional and alternative fuels are commercially available in Trinidad and Tobago in the form of gasoline (super and premium grades), diesel, CNG and electricity. The retail prices of the conventional fuels have been increased by factors of 1.84, 1.92 and 2.27 respectively in the past 10 years while the price of CNG and electricity has remained unchanged (Dolcy, 2019).

Notwithstanding, MEEI has reported a decline in the volume of natural gas sold through the service station network from 2010 to 2015 (MEEI, n.d.). More recently, in the national budget statement for the 2021 financial year, the Minister of Finance announced a new policy of de-regulation of the retail fuel sector including private ownership of service stations and liberalised pricing. At the date of writing of this paper, these policies have not yet been rolled out.

6.2 Availability of Alternative Fuels

CNG is a cleaner fuel and generates fewer emissions than conventional fuels (US DOE, n.d.), making it an attractive solution for reduced pollutants generated through transportation. The CNG expansion programme (initiated in 2014) has generated significant economic activity in vehicle conversions, equipment supplies, servicing of CNG vehicles and training of CNG technicians. However, NGVs from conversions emit much more pollutants and use more fuel than original equipment manufacturer (OEM) NGVs (Janssen et al., 2006). Electric vehicles (EVs) also claim to be carbon neutral, but the cleanness of the electricity depends on the source (Curran et al., 2014; Yavuz et al., 2014). In Trinidad and Tobago, 99% of the electricity is generated primarily from natural gas (Marzolf et al., 2015) and therefore the difference in the quality of emissions from the two types of AFVs being considered is ultimately dependent on the efficiency of the fuel supply infrastructure and the vehicles.

“The adoption of alternative fuel vehicles requires the co-existence of fuel supply, refuelling stations and AFVs” (Yeh 2007, 5869). In Trinidad, the natural gas supply is already well-established, refuelling stations are in operation and up to 20 OEM CNG vehicles are available on the market, supplemented by the option of certified vehicle conversion. The typical refuelling station in Trinidad and Tobago currently offers at least one grade of gasoline, along with diesel, and only 11 of the 140 refuelling stations currently open for public use in Trinidad (Tobago excluded) offer CNG as a fuel option. The fuel supply situation is different for electric vehicles, with only one recognised new vehicle dealer offering EVs and only five public charging stations in existence, four of which are at that company’s locations. However, since car owners can recharge their vehicles overnight, the lack of public charging stations would only affect taxis and maxi-taxis which may need recharging during their daily operations.

6.3 Consumer Perception and Resistance

Notwithstanding the policies and initiatives of the GORTT, the adoption of AFVs by the population has been well below target. A recent study by Maharaj and King (2020) compared the actual and predicted energy use and running costs for an internal combustion engine vehicle (ICE) and an EV in typical Trinidad and Tobago driving conditions. It showed that even with current pricing structures, although an EV costs 13% more in terms of capital costs, the lifetime ownership costs are 7% less when compared with an ICE. Similarly, lower CNG fuel prices outweigh the long-term cost of ICE to CNG conversion and result in lower operational costs for CNG vehicles owners. However, there appears to be a resistance to converting to or purchasing a new OEM CNG vehicle. This is based upon:

1. *Higher Purchase Prices* – Trinidad and Tobago imports a significant number of foreign used passenger cars annually, presenting a more affordable alternative for buyers. In January 2021, the permissible age of foreign used imports was reduced to three years and the importation quota reduced to 30% (MOF, 2020). Additionally, measures were introduced to remove all tax concessions on the importation of private motor cars, effective October 2020 (MOF, 2020). However “the lowest rates of duty and tax are being imposed on hybrid cars, electric cars, CNG cars and small engine cars below 1,500 cc to encourage their use”, while concessions “remain in place for commercial/industrial and public transport vehicles” (MOF, 2020).
2. *Inconvenience* – The use of CNG requires sacrificing trunk space of most passenger cars and SUVs. Many drivers of private vehicles consider this to be a significant inconvenience despite the cost benefit of switching to the CNG technology.
3. *Safety*. – There are still many drivers who believe that having a tank of CNG in the vehicle is unsafe. A CNG school bus owner sustained injuries when her CNG tank exploded after an approved CNG conversion (Loop News, 2018) but such occurrences have been rare in Trinidad and Tobago.
4. *Performance* – There is a perception among many operators (including members of both the AMTATT and the PTSC), that CNG powered vehicles do not perform as well as conventionally powered vehicles, especially in hilly terrain. However, “recent dynamometer tests by NGC CNG on converted diesel vehicles which now run on both CNG and diesel are showing an increase in both power and torque with the mixed-fuel conversions, as opposed to diesel only” (Khan, 2018).

6.4 Lack of Institutional Support

Programmes and policies have been established to promote the use of CNG as an alternative fuel geared toward mass transit in Trinidad and Tobago, but “there is currently no single body responsible for the organisation, coordination and regulation of the public transport sector” (Townsend, 2017), nor the monitoring of their effectiveness. Similarly, the performance of the state-owned PTSC, which operates the largest AFV fleet has not been adequately monitored nor evaluated (AGD, 2016).

In Trinidad and Tobago, some of the identified barriers to AFV adoption (e.g., driving range, filling time, safety, reduction in cargo space and loss of power) have been overcome but are still perceived to exist. Elimination of these barriers will require a combination of increased education and awareness, behavioural change, policy and technological updates, along with continuous evaluation.

7. Proposed Solutions

While there has been much discussion and debate on the problems caused by the use of conventional fuels in the transportation system, a plethora of advice has been offered by local stakeholders and international agencies. Furlonge (2010) summarised the proposed policy measures and associated improvement projects for the consideration of the government of the Republic of Trinidad and Tobago (GORTT) and emphasised the importance of their integration and prioritisation in the country’s short- and long-term traffic and transportation plans. Townsend (2016) highlighted the requirements for sustainable transportation development.

Other suggestions for an improved transportation system, not currently in effect include: land use growth management (Furlonge, 2007); annual vehicle permit tax on households with multiple vehicles, fuel subsidy directed at public transport and goods vehicles, on-street parking charges, increased parking charges in urban areas (Furlonge, 2011); public sensitisation through electric car shows, free urban area parking and ferry transport for electric [green] vehicles, installation of charging ports at frequently visited locations (Smart Energy Ltd., 2018), increased private sector involvement and sustainable funding for the services in the form of user targeted and not producer targeted subsidies (Townsend, 2016).

Townsend (2011) highlights that the major hindrances to sustainability progress are: “i) lack of desire; ii) higher priority on affordability than sustainability, and iii) short-term rather than long-term

priorities”. Dolcy (2019) also determined that some of the identified barriers to AFV adoption are either not applicable to Trinidad and Tobago or have been overcome by the policy implementations and other AFV developments taking effect from 2014.

Since the measures of effectiveness for sustainability are not being closely monitored, Dolcy (2019) argues that the country cannot adequately determine its progress towards sustainability, and proposes that (i) renewable energy and energy efficiency in the use of fossil fuels be applied in transportation as both remedial and long-term measures towards achieving the SDGs; (ii) a monitoring, reporting and verification (MRV) system be implemented for the sustainability of the transportation system, and (iii) a more professional approach be employed in the management of the local transportation system.

The various solutions proposed for the issues facing the transportation system over the years are presented in Figure 4. It is to note that these recommendations remain open for immediate consideration, as they have not yet been implemented.

8. Achieving Sustainable Transport with AFVs

The authors’ observations suggest that sustainable transport can be achieved by making some progressive adjustments in the transportation and interrelated systems. Several recommendations are proposed to address the identified barriers and constraints. These include:

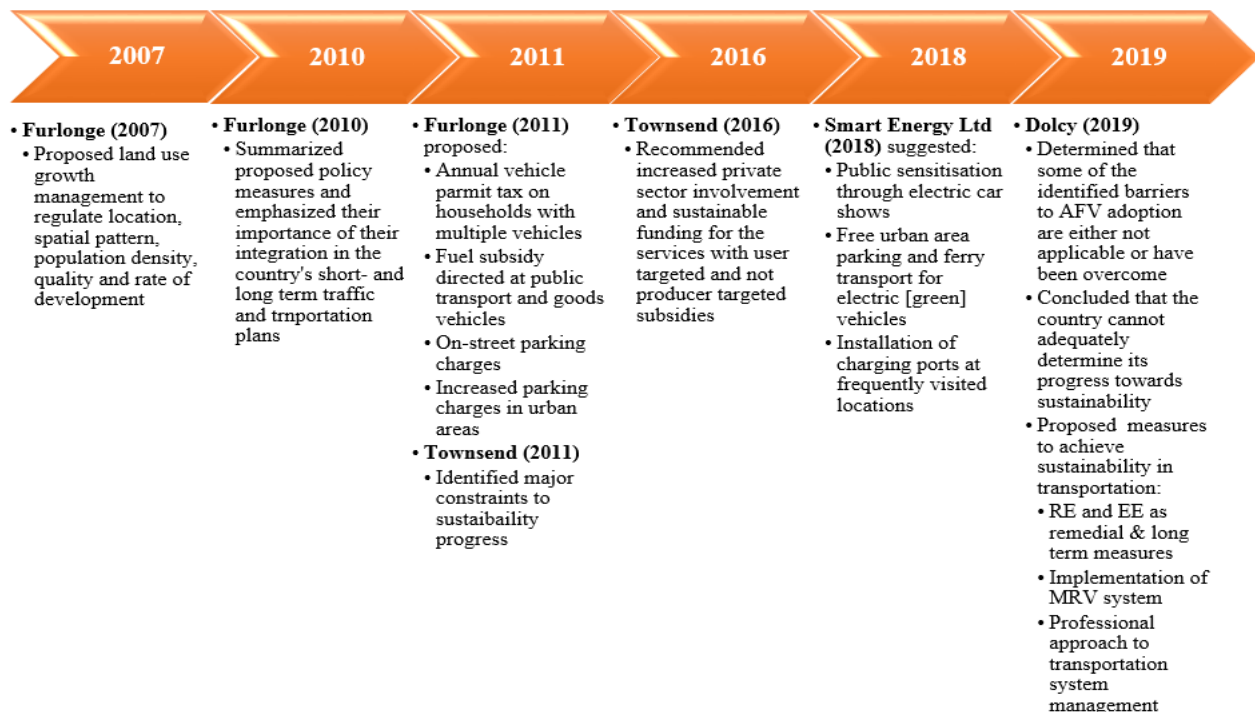


Figure 4. Summary of the solutions previously proposed for improvements to the transportation system of Trinidad and Tobago

1. Government entities and political leaders must be prepared to display the political will required to address the upsurge in the new technology, by setting the example as AFV trendsetters and allocating the necessary resources (manpower, equipment, and funding) to accommodate. Capacity building and institutional strengthening at all levels are required and should involve local specialists, like Transportation Planners, Transportation Engineers, Land-Use Planners, and Architects.
2. Clear and consistent policies aimed at encouraging the purchase and use of AFVs should be articulated, circulated and kept in place over the lifetime of the vehicles. If the private sector and consumers are going to invest in the infrastructure, training and equipment necessary to have AFVs supplant ICE powered vehicles over the next 10 years, there must be confidence that the GORTT will not make short-term decisions which undermine this progress.
3. Conversion of all vehicles owned by the GORTT and its agencies to CNG operations over the next two to three years will send a strong signal of the government's commitment to the expansion of AFVs in the country's current fleet of vehicles. This clear public mandate will undoubtedly encourage public buy-in.
4. Behavioural change is required to address the tendency of the stakeholders to see CNG and electric vehicles as competitors, as opposed to focusing on an increased proportion of clean fuels in the energy mix. This demands a continuous and evolving awareness and education approach targeting different age ranges, income brackets, educational backgrounds, and disciplines.
5. High occupancy and clean vehicle priorities can encourage persons to play their part in contributing to the transportation system sustainability. High Occupancy Vehicle (HOV) lanes assigned during peak hours on the various highways can also accommodate single occupancy vehicles that run on clean fuels. Limitations on intracity access should also see increased awareness and respect for clean fuel vehicle technologies and HOVs.
6. Any proposal for the improvement of intracity transit must give priority to cleaner fuel vehicles or non-motorised modes of transport operating within the city, whether it is for shuttle services from a central hub or from park and ride facilities. Persons whose vehicles still run on conventional fuels can make their contribution to transportation system sustainability through these facilities on a regular basis.

9. Conclusion

The GORTT has invested millions of dollars into the advancement of CNG as an alternative fuel to date but the uptake has not been as successful as anticipated. The

major impediments to its adoption include reduced cargo space, perceived safety issues; insufficient infrastructure and highly subsidised conventional fuel prices. Although the efficiency of the country's electricity generation from natural gas has been praised, the use of natural gas as a fuel is currently more viable than electricity.

The use of electricity as an alternative fuel is even less prevalent despite the recognised benefits of incorporating renewable energy into the energy mix. AFVs can play a subtle yet effective role in improving the sustainability of the transportation system. The increased uptake of AFVs, however, requires that the underlying legislative, technical and social hindrances be addressed by improving public awareness and prioritising both public transit and clean vehicle technologies. These inferences and recommendations would further highlight the need for more involvement of professionals in the management of the local transportation system.

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