

TRANSPORT SECTOR

6. Improved Urban/Suburban Public Transport System using LPG Buses

SECTOR: TRANSPORT	
TECHNOLOGY: Improved Urban/Suburban Public Transport System using LPG buses	
Introduction	Belize's public transportation service is currently regulated by the Transport Department under the Ministry of Works and Transport. For both inter and intra municipality operations, bus routes are licensed to private entities (companies and individuals). The main type of buses being used currently are used school busses imported from the United States. These buses have an average carrying capacity of 50 - 55 persons, and use large diesel engines with total displacements sometimes in excess of 8.0 litres. These buses average 5 – 8 miles per gallon [2.1 – 3.4 kilometres per litre]. The level of bus service provided to the public is best described as poor to average. The main issues faced by passengers are lateness, overcrowding, unreliable buses (frequent breakdowns), and unacceptable condition of many buses, such as uncomfortable seats and holes in the floor board – just to name a few. This technology intervention seeks to improve the public transportation system through the revamping of the current bus fleet to allow for newer, cleaner and more comfortable buses with reduced carbon dioxide emission rates (CO₂ per mile). An additional spin-off effect would be the increased use of an upgraded, public transportation on a daily basis by private citizens who own vehicles, but choose to use the public transport system for one reason or another. This should contribute to the reduction in private vehicle usage, and consequently carbon emissions. The technology intervention will initially take the form of a pilot project. This pilot will see the purchasing and operational use of the desired buses on specific bus routes. Discussions with the Transport Department suggests the route between Belize City and Banque Viejo del Carmen is best suited for this pilot as it's a main bus route, and the department has some data (bus owners, bus runs, etc.) for this route.
Technology characteristics	The explanation for using this technology is quite simple. On a phased basis, replace the existing bus fleet with more reliable and fuel-efficient buses. Currently there are 46 daily bus runs between Belize City and Benque Viejo del Carmen. That is a total of 3,726 miles [5,960 km] per day. Online documentation as well as bus owners states that these busses average between 6 to 7 miles per gallon [2.55 – 2.97 km/litre].

	Using an average of 6.5 mpg [2.76 km/l], these buses on the Belize City – Benque Viejo run use a total of 573 gallons [2,169 litres] of diesel fuel per day. At an emission rate of 22.2 lb. CO₂ /gallon of diesel [2.67 kg CO₂/litre], these buses emit a total of 12,720.6 lb. CO₂/daily [5,770 kg CO₂] – or approximately 4.64 Million lb. [2106.04 tonnes CO₂] annually. To replace these busses, it will be necessary to double the number of runs to 92 to ensure the same carrying capacity. Using an average of 16 mpg [6.8 km/l], these buses on the Belize City to Benque run use a total of 465 gallons [1,760 litres] of diesel fuel per day. At an emission rate of 22.2 lb. CO₂ /gallon of diesel [2.67 kg CO₂/litre], these buses will emit a total of 10,340 lb. CO₂/daily [4,700 kg CO₂]. Or approximately 3.77 Million lb. [1,715 tonnes CO₂] annually. See comparison table below. Table 1. Carbon dioxide emission comparison for current and proposed bus fleet <table><tr><th colspan="3">Belize City to Benque Viejo del Carmen Bus Route (81 miles/130 km)</th></tr><tr><th colspan="3">Public Bus Carbon Emission Comparison</th></tr><tr><th>Description</th><th>Existing Fleet</th><th>Proposed Fleet</th></tr><tr><td>Bus Runs</td><td>46</td><td>92</td></tr><tr><td>Distance Travelled miles[km]</td><td>3726 [5961]</td><td>7452[11923]</td></tr><tr><td>Bus Type</td><td>Used Bluebird/Thomas Buses (55 seater)</td><td>New Toyota Coaster Buses (28 seater)</td></tr><tr><td>Est. Fuel Economy mpg[km/l]</td><td>6.5[2.76]</td><td>16[6.80]</td></tr><tr><td>Fuel Used gallons[litres]</td><td>573[2169]</td><td>465[1760]</td></tr><tr><td>% Reduction in fuel use</td><td>-</td><td>19%</td></tr><tr><td>Carbon Emission lb. [kg] of CO₂</td><td>22.2[2.67]</td><td>22.2[2.67]</td></tr><tr><td></td><td></td><td></td></tr><tr><td>Carbon Emission Annually lb. [tonnes]</td><td>4.64 million [1970]</td><td>3.77 million [1715]</td></tr><tr><td>% Reduction in Carbon Emission</td><td></td><td>18.75%</td></tr></table>	Belize City to Benque Viejo del Carmen Bus Route (81 miles/130 km)			Public Bus Carbon Emission Comparison			Description	Existing Fleet	Proposed Fleet	Bus Runs	46	92	Distance Travelled miles[km]	3726 [5961]	7452[11923]	Bus Type	Used Bluebird/Thomas Buses (55 seater)	New Toyota Coaster Buses (28 seater)	Est. Fuel Economy mpg[km/l]	6.5[2.76]	16[6.80]	Fuel Used gallons[litres]	573[2169]	465[1760]	% Reduction in fuel use	-	19%	Carbon Emission lb. [kg] of CO ₂	22.2[2.67]	22.2[2.67]				Carbon Emission Annually lb. [tonnes]	4.64 million [1970]	3.77 million [1715]	% Reduction in Carbon Emission		18.75%
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Costs, including cost to implement adaptation options	Currently, the bus system is privately owned by numerous bus companies that are given licenses to run buses along designated routes. The Government’s only role is to regulate. This proposal calls for a Public Private Partnership (PPP) between the Government and the private bus operators. As the regulatory body, the Government through the Department of Transport and would mandate that buses over a certain age should be phased out of the system over period (2 - 5 years) and replaced with new and more efficient buses. To assist operators with purchasing — the Government would then grant tax waivers for bus imports and also facilitate low interest loans.																																							

	The 2017 market price for a Toyota Coaster is BZD 118,000 (duty free). If the General Sales Tax (GST) were to also be removed, the price for each bus would fall to approximately BZD 105,000. The terms and conditions of the partnership are to be worked out between the Government and bus operators. To test the proposal, a pilot project involving two (2) buses should be implemented. These buses will run between Belize City and Benque Viejo del Carmen. One bus will execute the “express” return, run — meaning it only stops in San Ignacio and Belmopan, on its way to its destination in Benque Viejo, and back. While the other will execute the “regular” run, with regular stops as required by passengers. The parameters of passenger volume, fuel usage, maintenance requirements, financial viability will all be assessed during the proposed 1-year pilot project. A monitoring and evaluation program will be instituted for the duration of the pilot. An evaluation report shall be drafted and submitted to the relevant authority for their assessment and action. Preliminary cost breakdown: i. Purchase of two new buses @ BZD 118,000/bus = 236,000 ii. License and Insurance for two buses @ BZD 500/bus = 1,000 iii. M & E including hiring and training two Traffic Officers = 60,000 iv. Contingency including equipment, travel & subsistent = <u>25,000</u> Total BZD = 322,000 USD = 161,000
cost of not modifying the project	The status quo would remain as is with the use of unreliable, inefficient and uncomfortable buses. Carbon emissions from the Transport Sector will increase, as demands for public service transportation increases, and bus owners continue to import, inefficient and emission-control defective buses for their fleet.
Potential development impacts, benefits	
Economic	The economic cost to bus operators will be high, initially. However, once the terms and conditions of the PPP are reasonable, these additional costs can be manageable. Additionally, more information will be gathered during the pilot test phase. Once fully developed, this project will see additional employment for drivers and conductors. As the number of buses will essentially double.
Social	The social impact will be extensive. The public will now be able to travel in relative comfort and be free of the fear and effects of frequent bus breakdowns.

	Passengers will be less stressed and anxious about using the public transport system.
Environmental	It is envisioned that this proposed bus service will see an increase in usage by private car owners. This will result in a reduction in fuel usage and carbon emissions at the national level.
Status	Currently, there is an initiative by the Government to conduct a feasibility study on the transport system on a national level (National Transportation Master Plan). To date the project is still in the tendering phase.
Barriers	1) Political will; 2) Legislative modification to improve regulations; 3) Cultural shift in thinking by the Government and general public; 4) Infrastructure improvement in the form of providing better and more intra and inter-district bus terminals, upgraded road infrastructure including alternating bust stops at key localities along the right-of-way (ROW) of highways.
Acceptability to local stakeholders	Acceptability by the major stakeholders (bus operators) will be a challenge. The major issue will require them to spend money for new buses.
Endorsement by experts	Members of the National Transport Authority (NTA) were consulted on this matter. They are in full agreement with such a proposal in its current form.
Timeframe	Pilot project should be implemented over a period of 8 – 12 months.
Institutional capacity	The pilot project will require institutional strengthening in the form of personnel. Bus drivers and conductors and office staff stationed at the current NTA offices.
Adequacy for current climate	This mitigation measure is suitable for the current situation. What will be required is effective dialog between Government and the bus operators, informing them of the intent and purpose of this pilot exercise.
Size of beneficiaries group	The pilot study will benefit approximately 120 persons on a daily basis – two runs per day for each bus, at 30 persons per run. Employment will include two bus operators, four conductors and two additional Traffic officers to coordinate and manage the pilot project.
References: Consultation Session: Mr. Paul Schmidt – Snr transport Officer & Acting Operations Officer & Mr. Peter Williams – Transport Warden 2. National Transport Authority. July 1st, 2016.	

Source: U.S. Environmental Protection Agency. Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel.

<http://www.epa.gov/otaq/climate/420f05001.htm#calculating>

Belize Diesel Co. Ltd. - <http://www.belizediesel.com>