

Present Scenario of Compressed Natural Gas (CNG) as a Vehicular fuel in Bangladesh

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Abstract

Compressed Natural Gas (CNG) is an important vehicular fuel in Bangladesh because the country has a significant natural gas resources and the natural gas transmission and distribution network is well developed. The use of CNG in Bangladesh is increasing day by day due to the environmental benefits as well as economic benefits. The air quality has improved for the major cities and the air pollution has reduced in Dhaka city the capital of Bangladesh due to the use of CNG. In 1999-2000 the government of Bangladesh has decided to use CNG as a vehicular fuel and was controlled by the state and limited to a few number of cars with inadequate facilities but the CNG activities in Bangladesh has increased and it is very popular to the people. Now 582 CNG filling stations, 167 CNG conversions workshops are established and 193,702 vehicles are using CNG as a vehicular fuel and lots of manpower are involved in this sector. It gives a new employment opportunity to Bangladeshi people. This paper describes the suitability of CNG as vehicular fuel, environmental and economic benefits and also the commercialization of CNG as well as the growth pattern of CNG filling stations, CNG conversion workshops in Bangladesh.

Keywords: CNG, fuel, benefits, quality, vehicle and profit.

1. Introduction

Bangladesh is blessed with natural gas resources and at present natural gas is the main source of power sector. For the maximizing the use of natural gas to reduce the air pollution and decrease the import of liquid fuel, the Government of Bangladesh has undertaken the business of Compressed Natural Gas (CNG) in transport sector. CNG was first familiarized through a project under Bangladesh gas, oil and mineral corporation (Petrobangla) with the financial assistance of World Bank in early eighties. Rupantarita Praktik Gas Company Limited (RPGCL), an enterprise of Petrobangla, is entrusted to convert the petrol vehicles to run by CNG and to install of CNG refueling Station. Government has given permission to the private sector entrepreneur to install CNG refueling station and to establish of CNG conversion workshop and Government has also provided land to some private entrepreneurs for establishment of CNG conversion workshop and CNG refueling station.[1]

Natural gas, its major component is methane and methane has physical and thermodynamic properties that make it suitable fuel for vehicles. Due to its low energy density, natural gas is compressed inside a cylinder mounted at 3000 Psi. Methane has a very high knock resistance. In the conventional octane scale natural gas has an equivalent octane number greater than 120. [2]. Wobbe Index, which indicates heat input to the engine, is another important property of gaseous fuels. A change of Wobbe index may affect the power output and performance of the engine. A Wobbe Index of 48.5 to 52.59 MJ/m³ is recommended for vehicle fuel and 44.7 to 46.6 MJ/m³ has been accepted for use in high altitude area. The Wobbe Index of Natural gas of Bangladesh ranges from 50.60MJ/m³ to 51.3 MJ/m³. The motor octane number of NG is 134. The calorific Values of natural gas of different fields in Bangladesh are in the range of 930 to 960 BTU/SCFT. [3-4]. This paper describes the suitability of CNG as vehicular fuel, environmental and economic benefits and also the commercialization of CNG as well as the growth pattern of CNG filling stations, CNG conversion workshops in Bangladesh.

2. CNG Technology

Two important components of CNG technology system are the refueling station and vehicle technology. A CNG refueling station is complicated than a conventional refueling station. Both the refueling station and the CNG vehicles have high-pressure components. A slow fill station is the least complex of the CNG station systems designed to fuel vehicles. This type of station is especially suitable for a fleet of vehicles parked overnight at place since it requires a few hours to fill the vehicles. But the fast fill system, with modern equipment, refueling rates equivalent to 50 liters of liquid fuel/min can be achieved.

Natural gas is an excellent fuel for the internal combustion engines. Retrofitting is the conversion or modification of an existing petrol or diesel engine so that the vehicle can use CNG as an alternate fuel. Both spark engine and diesel engines can be converted to CNG. One particular advantage of the retrofitting is that the user can switch between the CNG and the original fuel as needed. A petrol engine converted to CNG can run either on petrol or CNG (dual fuel operation). The fuel mixes with air in the carburetor before it enters the cylinders and it is compressed by the pistons. An electric spark ignites the compressed air-fuel mixture [4, 5]. A Technical review of CNG as an alternative fuel for internal combustion engine was studied by Semin [6]. He studied that CNG is attractive for five reasons and CNG are highlighted to keep the output power, torque and emissions of natural gas engines compared to their gasoline and diesel counterparts.

3. Commercialization Effort OF CNG IN Bangladesh

The RPGCL a company under the petroleum corporation of Bangladesh was tasked with developing cost effective ways to commercialize the use CNG in the Transport sector. The figure 1 and 2 shows the growth pattern of CNG filling stations and CNG converted vehicles. In the period of 2003-2004 the CNG filling station and natural gas vehicle (NGV) is quite high due to Government policy and from that time the CNG sector was increasing rapidly. Figure.3 and 4 shows the CNG filling Stations and the NGV vehicles in six Divisions of Bangladesh and Due to unavailability of natural gas there is no CNG station and NGV is in the Khulna and Barisal Division [7].

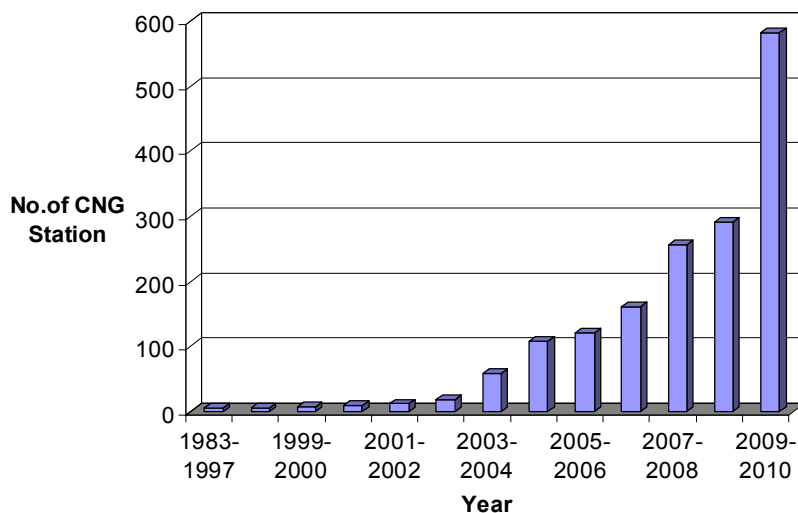


Fig.1: Growth of CNG filling stations in Bangladesh.

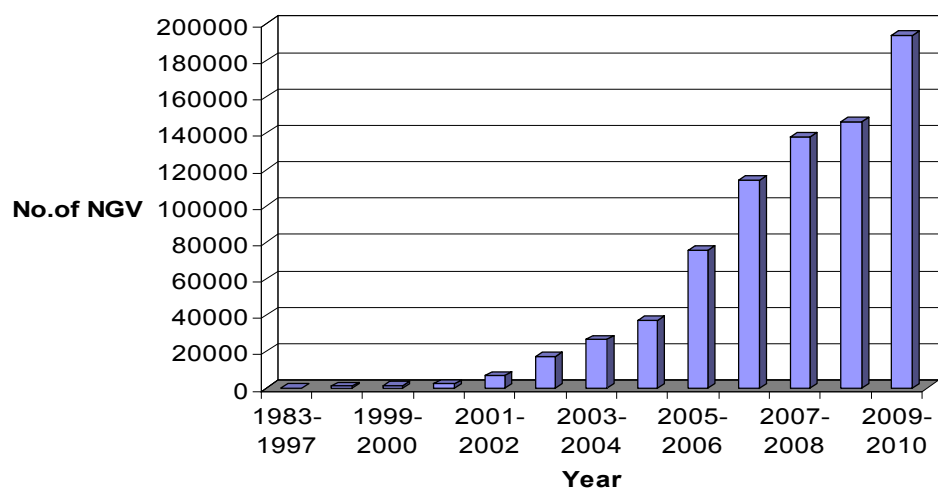


Fig. 2: Growth of Natural Gas Vehicles (NGV) in Bangladesh.

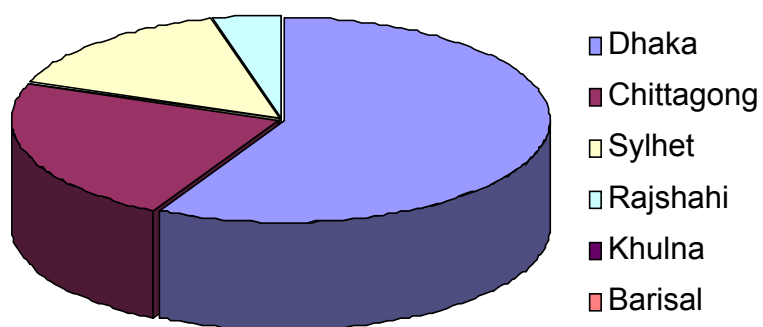


Fig. 3: No. of CNG filling stations in Six Divisions in Bangladesh.

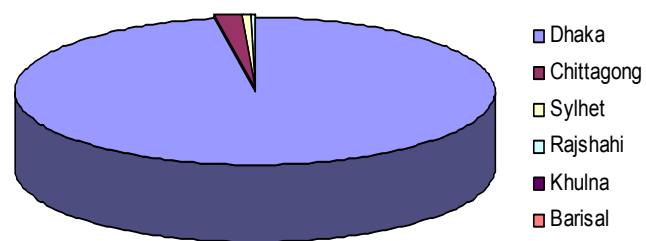


Fig.4: No. of converted CNG Vehicles in Six Divisions in Bangladesh.

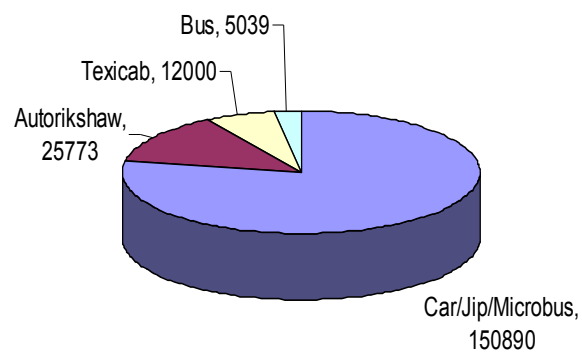


Fig.5: Different types of CNG converted vehicles in Bangladesh

Figure 5 shows the converted CNG driven Vehicles and it shows that people are in interested in converting their car/jip/microbus into CNG. After 2004 the growth of CNG sector in becoming popular and lot of

employment opportunities were increased. Many people are involved in this sector, such as technical experts, labors as well as business man.

4. Environmental Benefits

The main causes of air pollutions are exhaust gases from vehicles and industrial exhaust gases. Vehicle emissions contain a number of gases which contribute to one or more types of air pollution, of which the most important are acid rain, smog formation, lead pollution and the greenhouse effect. Vehicles are the major sources of CO, NOX, HC and also particulates matter. Use of CNG can reduce the harmful emissions and produces less amount of CO and organic methane component. The United States Environmental Protection Agency has predicted that future advanced technology CNG vehicle will reduce 90% CO.[5]. Natural gas is a less carbon intensive fuel compared to petrol or diesel so CO₂ emission from CNG vehicle is lower than the conventional vehicles. Diesel contains Sulfur component and produces SO₂ which cause acid rain, but the processed natural gas in Bangladesh is Sulfur free.

Table-1 and Table-2 show that an emission from CNG vehicles are significantly lower than those of gasoline and diesel vehicle and reduces the particulate matter, CO and NOX emission which is a major health concern.

Table 1: Emission data reported by Gas Association of New Zealand [8].

Pollutant	Gasoline (g/km)	Diesel (g/km)	CNG (g/km)
CO	6.34	1.06	0.22
HC	0.85	0.21	0.06
NOX	0.78	1.08	0.26
PM	0.011	0.125	0.003
CO ₂	220	210	163
SOX	0.08	0.21	0.0015

Table 2: Emission benefits replacing conventional diesel buses with CNG buses [9].

Fuel	CO (g/km)	NOX (g/km)	PM (g/km)
Diesel	2.4	21	0.38
CNG	0.4	8.9	0.012
% reduction	84	58	97

Improvements are in air quality in Dhaka through the increased use of CNG operated vehicles. The Department of Environment has measured decreases in the amount of particulate matter (PM₁₀) following the implementation of the CNG project. Research had shown that CNG operated cars for instance emit around 10-20% less carbon di oxide up to 25% less nitrous oxide and 80% or less Carbon mono oxide, non-methane hydrocarbons and other smog forming emissions in comparison gasoline car used in Bangladesh.

5. Economic Benefits

Bangladesh imports liquids fuel but for the maximizing the use of natural gas to decrease the import of liquid fuel, the Government of Bangladesh has undertaken the business of CNG in transport sector. In Bangladesh cost of CNG is much more cheaper compared to petrol octane. The comparison can be seen from the following calculations.

Cost comparison between CNG and Octane

1 liter of Octane=0.81 m³ of CNG

Price of 1 liter of Octane= Tk.77.00

Price of 1m³ of CNG= Tk. 16.75

Price of 1 liter Octane equivalent of CNG= $16.75 \times 0.81 = \text{Tk. } 13.56$

Hence savings of per liter of Octane is $(\text{Tk. } 77 - \text{Tk. } 13.56) = \text{Tk. } 63.45$

Monthly Savings for the using of CNG is Tk. 968.45 Crore in Bangladesh. [7]

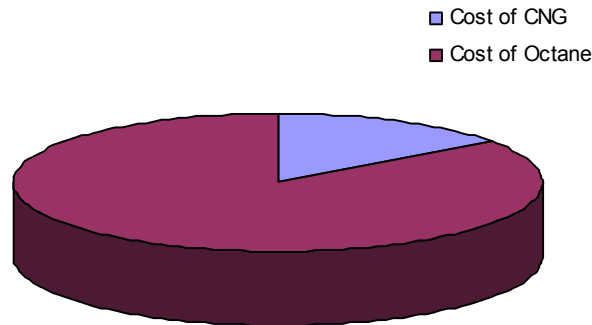


Fig.6: Comparative cost of CNG and Octane

6. Conclusions

Bangladesh has significant natural gas reserve and out of 1800 mmscfd of being marketed over the country, approximately 72 mmscfd is being used in the CNG sector. The projected demand of gas in CNG sector in the next 5 years will be around 130-150 mmscfd. The creation of new job opportunities as a result of the large number of CNG conversion stations because a large number of vehicles are using CNG as a transport fuel. For the using of CNG a positive impact on the country's balance on payment with a substantial reduction of the annual import bills of liquid petroleum as well as reducing the environmental pollution.

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