# DEALING WITH SUTAINABILITY ISSUES AROUND THE NEWLY COMBINED NATURAL GAS INITIATIVE OF THE FEDERAL GOVERNMENT FOR AUTOMATED VEHICLES IN NIGERIA

**By**

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## Abstract

*The Federal Government of Nigeria recently introduced Combined Natural Gas for vehicular transport fuel as alternative to the conventional premium Motor spirit (PMS) and Diesel for automated Vehicles in Nigeria. The Objective is to provide alternative cheaper and more environmentally friendly fuel type for Nigerians, following the removal of petroleum products' subsidy and the ensuing price spikes for a unit pump _price of various petroleum products in Nigeria. This Initiative was not accompanied with the adverse environmental footprint for gas and the resultant air pollution that would result from the commercial application of CNG in Nigerian roads. With a population of over 250 Million people and above 50 percent either owners of cars and or using one form of vehicular transportation or the other, it is believed that this initiative should address or envisage the environmental and sustainability issues around any commercial application of CNG in Nigerian roads which are already despoiled by Second handed vehicles. The Authors will analyze the environmental and sustainability impacts of the Nigeria's application of CNG as alternative fuels for transport vehicles and make informed recommendations drawing from similar well established laws and regulations from the USA and UK.*

**Keywords**: *Environmental Sustainability, CNG, Transport Fuels*

## Introduction

For many decades, Nigeria's economy has been largely monocultural depending largely on petroleum. Nigeria is in dilemma in mitigating the devastating effect of climate change while ensuring the energy security of its ever growing population.[1] The nation being heavily dependent on fossil fuels has encountered several environmental defects, like degradation, pollution and economic setbacks as a result of the constantly fluctuating global oil prices thereby making the country spend billions of dollars annually on fuel importation.[2] The use of Compressed Natural Gas (CNG) offers a way out of this dilemma.

Nigeria is known to be abundantly blessed with natural gas reserves spread across the country. Thus switching to CNG will be more economical for Nigeria by shifting its interest from imported petroleum. This move will stabilize energy prices at this time where the country is facing a lot of challenges on petrol

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[1] D. M. Kutcha. 'What is CNG Fuel? Understanding Natural Gas Vehicles 20222. Treehugger Sustainability for all.<https://www.treehugger.com>accessed 27 August.

[2] K Imam. 'How Can Nigeria Leverage CNG to Combat Climate Change and Ensure Sustainable Energy?' 2024. Medium.<Https://www.medium.com<accessed 23, August 2024.

price and it will also boost the economy and create more jobs while reducing the effect of the air pollution caused by fossil fuel combustion.

Compressed Natural gas (CNG) is a bridge fuel gas composed mainly of methane, about 70%-90%.[3] It is the second most significant greenhouse gas contributing to climate change after Carbon dioxide.[4] Compressing natural gas reduces it to 1% of its volume that it occupies at standard atmospheric pressure, making it fit for use as a transportation fuel. CNG can be used in place of petrol, diesel fuel and liquefied petroleum gas (LPG) as it produces lesser undesirable gases compared to these.[5] CNG is lighter than air and hence provides little or no spills. It is non-renewable form of energy.[6] As a succor to complement the hardship occasioned by the removal of the fuel subsidy, the government has introduced the presidential CNG Initiative. This Initiative was not accompanied with the adverse environmental footprint for gas and the resultant air pollution that would result from the commercial application of CNG in Nigerian roads.[7] With a population of over 250 Million people and above 50 percent either owners of cars and or using one form of vehicular transportation or the other, it is believed that this initiative should address or envisage the environmental and sustainability issues around any commercial application of CNG in Nigerian roads which are already despoiled by Second handed vehicles. It is believed that the degradation of the environment would adversely affect the enjoyment of human rights within an affected community/region, hence the need for environmental sustainability. The shift to a cleaner and cheaper energy source is in line with the Sustainable Development Goals, especially Goal 7.[8]

## Conceptual Clarification

### Environmental Sustainability

Sustainability is one of the most important concepts when it comes to protecting the environment. It has been proven that global warming is caused by human activities that brings the plant closer to a catastrophic encounter with the forces of nature.[9] Most environmental problems – from overfishing to air pollution. Amelia[10] defined sustainability as meeting the needs of the present without compromising the ability of future generations to meet their own needs. Meadowcroft[11] also defined the concept as; 'sustainability is

[3] Kutcha (n 1).
[4] Imam (n 2)
[5] Ibid.
[6] Imam (n 2).
[7] 'Moving Nigeria Forword with the power of CNG' PCNGI 2023. <https:/www.presidential CNG initiative/ pci.gov.ng> accessed 25 August, 2024.
[8] A. Muhammed, D. Bernard, U. Emmanuel, E. Iroh & A. Rufai. 'Assessing the Viability of CNG Conversion as a Sustainable Alternative Fuel Source for Vehicles in Nigeria.' (2014). The National Centre for Technology Management. <https://www.nctm/viability of CNG pdf.>accessed 25 August, 2024.
[9] H. P. Faga, U. Uchechukwu. 'Environmental Degradation, Intergenerational Rights and the Challenges of Sustainable Development in the Oil-Rich Niger Delta Region of Nigeria.' *Laws on Oil and Gas Exploration and Production in Nigeria a Text in Honour of Austin Avuru.* (Princeton & Associates Publishing Co. Limited, 2012, Ikeja Lagos).
[10] B. Amelia, 'Explainer: What Is Sustainability and Why Is It Important?' 2022.
[11] J. Meadowcroft, 'Sustainability'. (2024) Encyclopaedia Britannica<.https://www.britannica.com/sustainability> accessed 25 August, 2024.

understood as a form of intergenerational ethics in which the environmental and economic actions taken by present persons do not diminish the opportunities of future persons to enjoy similar levels of wealth, utility, or welfare'

Environmental sustainability seeks to sustain global life-support systems indefinitely (this refers principally to those systems maintaining human life). Source capacities of the global ecosystem provide raw material inputs-food, water, air, energy; sink capacities assimilate outputs or wastes. These source and sink capacities are large but finite; sustainability requires that they be maintained rather than run down.[12]Also, environmental sustainability can be referred to as the charge to conserve natural resources and preserve global ecosystems to support health and wellbeing, in the present and in the future.[13]

The 2002 UN Plan of Implementation of the World Summit on Sustainable Development pledges that for global sustainable development, it is necessary to foster sustainable consumption and change unsustainable production patterns following the Rio principles. It urges countries to improve sustainability knowledge while exploiting resources and conducting production processes. It also prescribes a halt to environmental degradation in the name of unsustainable economic growth. Realizing the importance of ecosystems on human life and the economy and for sustainable development, the plan advocates for protecting and managing our natural resources in an integrated and sustainable manner. Simultaneously, it asks for adopting effective strategies with target settings to curb natural resource degradation and expand cooperation to minimize air pollution, acid deposition and ozone depletion at local, national, regional and global levels.

The second target of goal number eleven (11) of the United Nations Sustainable Development Goals (SDGs) laid particular emphasis on the need to provide sustainable transport systems for all.[14] However, current transport systems contribute to resource depletion and adverse environmental impacts. This can be attributed to the combustion of fossil fuels in transportation and the inefficiency of vehicle engines. Presently, the transport sector accounts for around 20% of global energy consumption and the sector is highly dependent on fossil fuels like gasoline and diesel.[15]

**Compressed Natural Gas CNG**

Compressed natural gas (CNG) is composed of about 70% to 90% methane, the second most significant greenhouse gas contributing to climate change, after carbon dioxide. Compressing natural gas reduces it to 1% of the original volume it occupies at standard atmospheric pressure, making it usable as a transportation fuel. It is stored and distributed in hard containers at a pressure of 20–25 mega pascals (2,900–3,600 psi; 200–250 atm), usually in cylindrical or spherical shapes.[16] CNG is an alternative to gasoline that's made by compressing natural gas to less than 1% of its volume at standard atmospheric pressure. Consisting mostly

[12] R. Good land 'Environmental sustainability', 1995. Annual reviews Incorporated System.26:1-6.
[13] Sphera Editorial Team, 'What Is Environmental Sustainability?,'( 2020), Sphera.
[14] M. O. Dioha, A Kumar. 'Sustainable energy pathways for land transport in Nigeria' (2020). Utility Policy Science Direct. 64(3)123-137.
[15] Ibid.
[16] Kutcha ( n 1).

of methane, CNG is odorless, colorless and tasteless. It's drawn from domestically drilled natural gas wells or in conjunction with crude oil production[17]

Natural gas is formed deep underground trapped between layers of rock and sand in reservoirs underneath the Earth, like other fossil fuels. Due to its lower density characteristic. It emits significantly lower levels of greenhouse gases and air pollutants compared to petrol and diesel, making it a cleaner fuel option. Moreover, CNG is abundant in Nigeria, with vast reserves spread across the country. This means that transitioning to CNG could reduce Nigeria's dependence on imported fuels, stabilize energy prices, and boost the local economy.[18] The number of vehicles in the world using CNG has grown steadily (30 percent per year).[19]Now, as a result of the industry's steady growth, the cost of such fuel storage cylinders has been brought down to a much more acceptable level. Especially, for the CNG Type 1 and Type 2 cylinders, many countries are able to make reliable and cost effective cylinders for conversion need.[20] NGVs fall into three categories:

a. **Dedicated**: Vehicles exclusively powered by natural gas.
b. **Bi-fuel**: Light or medium-duty vehicles capable of using both natural gas and petrol interchangeably.
c. **Dual fuel**: Heavy-duty vehicles that simultaneously use natural gas and diesel blends[21]

The first experiments with compressed gases took place in France in the 1850s. Natural gas first became a transport fuel during World War I. In the 1960s, Columbia Natural Gas of Ohio tested a CNG carrier. Worldwide, there were 14.8 million natural gas vehicles (NGVs) by 2011, with the largest numbers in Iran (4.07 million),[22]Any existing petrol vehicle can be converted to a dual-fuel petrol/CNG vehicle. Authorized shops can do the retrofitting, which involves installing a CNG cylinder, plumbing, a CNG injection system, and electronics. The cost of installing a CNG conversion kit can often reach $8,000 on passenger cars and light trucks, and is usually reserved for vehicles that travel many miles each year. CNG costs about 50% less than petrol, and emits up to[23] 90% fewer emissions than petrol[24]

**Transportation Fuels**

Transportation was derived from two Latin words '*trans'* which mean 'across' and '*portare'* which mean 'carry'.[25] According to Merriam Webster Dictionary, transportation is an act, process, or instance of

[17] S P Venkatesan, 'CNG' 2019. SAUX1025 automobile engineering unit 5 fuel feed system, alternate fuel & electrical system <https://www.saux1025<accessed 26 August, 2024.
[18] Venkatesan (n 17)
[19] K Imam. 'How Can Nigeria Leverage CNG to Combat Climate Change and Ensure Sustainable Energy?' 2024. Medium.<Https://www.medium.com<accessed 23, August 2024.
[20] (n 12).
[21] The National Centre for Technology Management, 'Assessing the Viability of CNG Conversion as a Sustainable Alternative Fuel Source for Vehicles in Nigeria'
[22] Ibid.
[23] Ibid.
[24] Ibid.
[25] A. O. Adeniran, T. B. Yusuf. 'Transportation and National Development: Emphasis to Nigeria' (2016), Developing Country Studies IISTE, 6(9).

transporting or being transported.[26] It also defines it as a means of conveyance or travel from one place to another or a public conveyance of passengers or goods especially as a commercial enterprise.[27] The term transportation was also defined by the Longman Contemporary English Dictionary as a process or business of taking goods from one place to another or a system for carrying passengers or goods from one place to another.[28]

Transportation is a vital part of human activity, and in several ways constitute the basis of all socio-economic interactions. Indeed, no two locations will interact effectively without a viable means of movement. A good transport system is important to support economic growth and development. The development of transport in the overall activities of a nation is the ability to deliver an enhanced, efficient, effective, affordable, accessible, safe, reliable and an integrated transport system which will prosper the economic, social and political segments of the nation. All these functions makes transportation a essential as the sector in itself is not productive but is responsive to forces generation in the production and consumption sectors.[29]

Transportation system has several elements without which it cannot function, the elements are;

1. **Infrastructure**, which includes the transportation network (that is roads, railways, airways, canals, pipelines, and others).

2. **Vehicles**, such as automobiles, trains, airplanes: This generally moves on the networks.

3. **Operations**, which deal with the control of the system such as traffic, signal and ramp meters, rail-road switches, air traffic control, as well as policies, such as how to finance the system, for instance, use of tolls or gasoline taxes in the case of highway transport. The design of networks are the domain of civil engineering and urban planning, the design of vehicles, of mechanical engineering and special subfields such as nautical engineering and aerospace engineering, and the operations are usually specialized, though might appropriately belong to operations research or systems engineering.[30]

4. **Nodes** or terminals such as airports, railway stations, bus stations and seaport.

An Automobile can be defined as a vehicle that is self-propelled and is primarily used for the transportation of passengers and goods. Automobiles are commonly propelled using an internal combustion engine which is powered by a volatile fuel. The fuels used are generally Petrol, Diesel, CNG or Electricity. Automobiles

[26] ' Transportation' Merriam Webster Online Dictionary. <https:/www.memerriamwebsterdictionary.com>accessed 23 August 2024.
[27] Ibid.
[28] Longman Dictionary of Contemporary English (2003). (4th edition). Pearson Education Limited.
[29] A. O. Adeniran, T. B. Yusuf (n 25).
[30] A. O Adeniran, T.B. Yusuf (n 25).

date back to 1672 with the invention of the steam-powered vehicle, which led to the creation of the first steam-powered automobile, built by Nicolas Cugnot in 1769.[31]

Samuel Brown first tested the industrially applied internal combustion engine in 1826. German inventor Carl Benz patented his Benz-Motorwagen in 1886. He developed a gasoline-powered vehicle and made several copies. The 1901 Mercedes designed by Wilhelm Maybach and Gottlieb Daimler for Daimler Motoren Gesellschaft, is the first complete modern car in all essentials

William Durant founded General Motors in 1908. This led to cars becoming widely available in the market by the early 20th century. Ford, General Motors, and Chrysler emerged as the leading companies by 1920.

During the aftermath of the world war, production in Europe and Asia soared to meet the growing demands. With the rise of Japan as the leading automaker by 1980, the industry became a shared global enterprise.[32]

**Classification of automobiles**

**Based on the purpose of the vehicle:**
Automobiles are classified on the use of the vehicle depending on whether the vehicle is used to carry passengers or used for transportation of goods or USD for any special use.

1. Passenger vehicle – Car, bus, taxi.

2. Commercial vehicle – Trucks, tempos, containers.
3. Special purpose vehicle- Ambulance, fire brigade, police vehicle.

**Based on the load-carrying capacity:**
This classification is done on the basis of the load-carrying capacity of the vehicle. Thisalso implies classifi cation based on the motor and body of the vehicle.
1. Light motor vehicle (LMV) – Car, Jeep, Minivan, etc.
2. Medium motor vehicle (MMV) – Tempo, bus, mini truck, etc.
3. Heavy motor vehicle (HMV) – Truck, trailer, container, tractor, multi-axle bus, etc.

**Based on the number of wheels:**
The number of wheels used in a vehicle is also classified.
1. Two-wheeler – Scooter, Motorcycle, etc.
2. Three-wheeler – Auto rickshaw.
3. Four Wheeler – Car, jeep, minivan, tractor, etc.
4. Six-wheeler – Bus, mini truck, etc.
5. More than six wheels – Truck, trailer, container, multi-axle bus, etc.

[31] A. Kumar 'Types or Classification of Automobile [Notes & PDF (2022). The Mechanical Engineering.com.<https:/www.mechanicalengineering.com>accessed 26August 2024.
[32] Ibid.

**Based on the fuel used in the vehicle:**

The fuel used is a very important component in terms of the classification of vehicles. Fuel plays a major role in the performance and efficiency standards of the vehicle.

Petrol – The system which uses petrol is called the Spark ignition system. The octane number of petrol decides the anti-knock, performance, and efficiency factor. Generally, the octane numbers available are 87, 89, and 91-93. Mostly used in passenger vehicles and two-wheelers.

Diesel – The system is called a Compression ignition system. The cetane number of diesel decides the compression and fuel needed for ignition. Generally, the cetane numbers range from 45 to 55. Mostly used in commercial and heavy vehicles.

CNG – Compressed natural gas in another form of fuel used as an alternative to petrol. The advantage is that it produces less toxic emissions from the vehicle and the disadvantage is that it reduces the performance of the vehicle as compared to that of petrol. These are mostly used in public transportation vehicles and passenger cars.

Electric – Electric vehicle is relatively a new technology used as an alternative to combustible fuels. These vehicles use electricity as fuel from the high-capacity battery.

Hydrogen – The hydrogen fuel cell is an upcoming invention in the automobile industry which is currently in full swing research. It is expected to provide a safer and more economical route for the automobile industry. There are several other classifications like based on transmission system, power source, and suspension system.[33]

**Advantages of CNG**

Today CNG is gradually being recognized as one of the most viable alternative fuel options available. Being a much cleaner fuel source, its increased portability and reduced cost has made it very popular as a transportation fuel. Presently, there is an increasing use of CNG in public transportation. It is mostly used for generating power and as fuel for vehicles. Natural Gas Vehicles (NGVs) drive on CNG stored in cylinders installed in the rear, roof or undercarriage of the vehicles. When needed to power the vehicle the natural gas leaves the cylinder to the engine combustion chamber through a specially designed system. These advantages includes

I. **Environmental Factor**

CNG is eco-friendlier than gasoline. Natural gas produces far fewer harmful emissions and hydrocarbons than gasoline. Using CNG makes the engine cleaner and more efficient. Unlike gasoline, CNG minimizes harmful carbon deposits when combusted. This results to a cleaner and

[33] Amelia (n 10).

more efficient engine as well as longer lasting spark plugs. In addition, oil changes are also minimized because of carbon deposits that contaminate the oil is eliminated. Another commonly cited major positive aspect of CNG use is that being a natural gas (methane content) its exhaust emissions contains just water vapour and minuscule quantity of carbon monoxide, no carbon or other particles. Being virtually pollution free CNG driven vehicles meet the most stringent of emission standards worldwide.

II. Natural gas vehicles have lower maintenance costs than other hydrocarbon-fuel-powered vehicles. CNG fuel systems are sealed, preventing fuel losses from spills or evaporation. Increased life of lubricating oils, as CNG does not contaminate and dilute the crankcase oil. Being a gaseous fuel, CNG mixes easily and evenly in air. CNG is less likely to ignite on hot surfaces, since it has a high auto-ignition temperature (540 °C), and a narrow range (5–15 percent) of flammability.[34] CNG-powered vehicles are considered to be safer than petrol-powered vehicles

III. **Efficiency of the Vehicle**

Several other factors contribute to the growing use of CNG such as its higher ignition temperature is higher compared to petrol. Secondly, CNG has a narrow combustion range when compared to petrol. The octane rating of natural gas is about 130 meaning that engines could operate at compression ratio of up to 16:1 without "knock" or detonation.[35]

IV. **Safety & Environment**

Natural gas is lighter than air and will disperse into the atmosphere if it leaks from its storage vessel – having a negative impact on greenhouse gas (GHG) emissions, but a positive impact on fuel safety. Diesel and other liquid fuels may leak and form pools, which is an environmental and safety concern. Overall, natural gas is less hazardous than diesel fuel.

**V. Promoting Sustainable Development**

The shift to CNG supports sustainable development goals by reducing environmental pollution and fostering the use of cleaner energy sources. This contributes to a healthier environment and improved public health outcomes.

**VI. Enhancing Energy Security**

Utilizing Nigeria's abundant natural gas reserves enhances the country's energy security by reducing dependence on imported fuels. This not only stabilizes fuel prices but also ensures a more reliable and sustainable energy supply.

VII. **Low Operation and Maintenance Costs**

CNG vehicles are normally gasoline vehicles with added components to store and feed CNG to the engine. Long-term maintenance costs can actually be lower, due to the fact that

CNG is a cleaner-burning fuel and generates less wear-and tear on some engine components. In addition, due to the absence of additives like lead and benzene in CNG, lead fouling of spark plugs is reduced to barest minimum. There is an increase in the life of lubricating oils, as CNG does not contaminate and dilute the crankcase oil. This is mainly because it enters the engine as gas while

[34] C. Ubani, I. S. Ubong,' Use of CNG as Autofuel in Nigeria' 2018.European Journal of Engineering and Technology Research.3(10)66-69.

35 CNG-ONE. CNG-ONE, LLc. CNG-ONE website. [Online] ] www.cng-one/info/beenefits.asp.

petrol comes in as spray or mist which washes down the lubricating oil from the piston ring area to raise the rate of engine depreciation.[36]

**Challenges of CNG**

Despite its potential, several challenges hinder the widespread adoption of CNG in Nigeria. One of the major hurdles is the lack of adequate infrastructure. A widespread network of CNG refueling stations and pipelines is essential for ensuring the convenience and accessibility of CNG for consumers. Financial barriers also pose a challenge, as the initial investment costs for CNG vehicles and infrastructure can be high, particularly for individuals and small businesses.[37]

Another significant obstacle is the lack of public awareness and acceptance. Many Nigerians are unfamiliar with CNG and its benefits, leading to hesitancy in adopting this alternative fuel. Addressing these challenges requires a multi-faceted approach involving government intervention, private-sector investment, and public awareness campaigns.[38] Furthermore, other challenges includes;

1. **Less Fuel Efficient**

Compressed natural gas is 3.5 times less energy-dense than gasoline, meaning it requires that many times more volume to produce the same amount of energy. CNG fuel tanks thus need to be larger than gasoline or diesel fuel tanks, cutting into available storage or cabin space and increasing the vehicle weight. In "bi-fuel" vehicles, two fuel tanks are required, limiting storage or cabin space even further. Lower energy density and increased weight make CNG vehicles less fuel-efficient.[39]

2. **Vehicle** cost: Compressed Natural Gas vehicles cost more than comparable gasoline or diesel models because of its low-production volumes and the greater cost of fuel storage tanks.
3. **Driving range**: Compared to a volumetric gallon of gasoline or diesel fuel, there is less energy in an energy gallon equivalent of CNG. Therefore, the driving range of vehicles operating on NG is less. Natural gas vehicles need pressurized fuel storage tanks. The present storage capacity has a range of about 150 km.[40] On-board NG fuel tanks are larger than comparable gasoline or diesel fuel tanks. There are inconsistent NG fuel properties around the world.
4. **Few Refueling Stations**Public CNG refueling stations are rare, with only 865 CNG refueling stations existing in North America, according to the U.S. Department of Energy, including 821 in the U.S[41] In Nigeria there are very few .
5. **Lack of awareness:** the use of CNG as an alternative means of transport fuel has very little popularity in Nigeria as most citizens are not aware of its existence nor its benefits.

[36] Dioha (n 14).
[37] Kutcha (n 1).
[38] Kutcha (n 1).
[39] Kutcha (n 1).
[40] Ibid.
[41] Kutcha, (n 1).

**Comparison between CNG and PMS/ Diesel Cars**

A vehicle that runs on CNG can prove more cost-efficient than its diesel or gasoline equivalent, depending on the price of fuel, the number of kilometres covered annually, and prevailing tax laws. Even if a CNG vehicle is more expensive to purchase. The engine technology for natural gas reduces noise levels in CNG vehicles quite substantially compared to Diesel vehicles. This is a real advantage for urban or night transport. CNG trucks have a range of up to 570 km, so they are mainly used in urban and regional areas. Passenger cars are always equipped with a second fuel tank, which gives them very comfortable autonomies (between 600 km and 1,000 km).

**Strategies for Promoting CNG Adoption in Nigeria**

The Nigerian government has taken a major step by launching the Presidential Compressed Natural Gas Initiative (PCNGI), aimed at promoting CNG adoption across the country. The initiative includes plans to deploy thousands of CNG-enabled vehicles, provide conversion kits for existing vehicles, and establish a nationwide network of CNG refueling stations. Government policies and incentives play a crucial role in driving CNG adoption. Subsidies for CNG vehicles and refueling infrastructure, tax breaks for businesses that switch to CNG, and favorable regulations can create a conducive environment for investment and adoption. Public-private partnerships can also be instrumental in leveraging resources and expertise to accelerate infrastructure development

**Insights from USA and UK**

The adoption of CNG as an alternative fuel is not exclusive to Nigeria; it has evolved into a global catalyst for sustainable energy and economic development. Countries worldwide are increasingly recognising the multifaceted benefits of transitioning to CNG, sparking a transformative wave in the global energy landscape.

Developed countries have already established regulations to govern CNG conversion processes. These regulations include standards for safety, emissions, and technical specifications. Additionally, certification and licensing of conversion centers or technicians are part of these regulations to ensure compliance.[42] In the United States, CNG adoption has gained momentum, particularly in the transportation sector. The country boasts an extensive network of CNG filling stations, and government incentives encourage the use of CNG-powered vehicles, reducing emissions and fostering energy independence. In UK, the road use of vehicles propelled by compressed natural gas (CNG) is permitted by an order made under section 44 of the act – The Road Vehicles (Authorisation of Special Types) (General) Order 2003. It can be deduced that these nations have setup legislations that supports and promotes the use of CNG. There is also a private-public partnership on the production of CNG fueled vehicles.

**Conclusion**

Fossil combustion is the chief driver of global warming, and the Nigerian transport sector has being solely dependent on fossil fuels to meeting its energy demands. The initiative of the Federal government of Nigeria

[42] The National Centre For Technology Management. 'Assessing the Viability of CNG Conversion as a Sustainable Alternative Fuel Source for Vehicles in Nigeria' (2023).

to adopt the use of Compressed Natural Gas'(CNG) as an eco-friendly alternative to Premium Motor Spirit (PMS) is a laudable development. CNG has proven over the years in countries where it is used to be a better alternative to diesel and PMS because of its less cost and low gas emission, thereby reducing the levels of environmental pollution and its health consequences. This is a way of fostering environmental sustainability.

**Recommendations**

The study therefore suggests the following recommendations

1. The Nigerian government should create an avenue that would encourage the use of CNG vehicles, by establishing policy for subsidizing the importation of CNG vehicles to augment the high cost of CNG vehicles and encourage many private sector to invest in the business. This will also reduce the burden of conversion cost.
2. Enactment of laws that will regulate the production processes and use of CNG in Nigeria just like what is obtainable in U.S.A and UK. This will help to curtail the hazards encountered during the production process. It will also assist in the development of the nation's economy and increase GDP.
3. The government should partner with private bodies to establish more CNG fueling stations across the nation. This way, the product will be more readily available to consumers.
4. The government through its relevant agencies in conjunction with the media, the private sector and non-governmental agencies, as part of national orientation should create more awareness by engaging the public and educating the citizens in all levels from the federal, to state and local governments, cities and villages on the benefits of the use of CNG powered vehicles over PMS and Diesel.
5. The government should through its relevant agencies should reduce foreign exchange rates in order to stabilize and mitigate the fluctuating currency exchange rate affecting the purchase of CNG conversion kits and processes.