

TRAINING REQUIRED OF MOTOR VEHICLE MECHANICS FOR MAINTENANCE AND REPAIRS OF COMPRESSED NATURAL GAS VEHICLES IN FEDERAL CAPITAL TERRITORY ABUJA.

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ABSTRACT

This study investigates the training required of motor vehicle mechanics for maintenance and repairs of compressed natural gas vehicles in FCT Abuja, Nigeria. Relevant literature related to the objectives were reviewed. The study employed explanatory sequential mixed method design. The population of the study comprised of 266 motor vehicle mechanics, which comprises of 260 respondents for qualitative while 6 for the quantitative. The sample size was obtained through simple random sampling and purposeful technique was used. The Instrument used for data gathering was a questionnaire titled TRMVMRCNGVAN and an interview guide which was developed by the researcher. The data were analysed using mean and standard deviation with the help of Statistical Package for Social Sciences (SPSS) version 25. The qualitative data obtained was analysed Thematically using NVIVO software. The findings of the study revealed that: motor vehicle mechanics in FCT Abuja, Nigeria required competencies in diagnosing CNG vehicles, motor vehicle mechanics in FCT Abuja, Nigeria and motor vehicle mechanics in FCT Abuja, Nigeria required safety skills related to maintenance and repairs of CNG vehicles. Based on the findings of the study, it was recommended that: The Federal Government should train motor vehicle mechanics on technical competencies in performing regular maintenance and repairs of CNG components/ system, technical competencies in diagnosing electrical issues related to CNG and the use of diagnostic tools for CNG vehicles in Abuja, and Nigeria at large, The Federal Government should train motor vehicle mechanics technical competencies in repairing problems in fuel injectors within the CNG system, technical competencies in troubleshooting CNG conversion kits in gasoline/diesel vehicles, technical competencies in conducting pressure test on CNG storage delivery system for maintenance and repairs of CNG vehicles in Abuja, and Nigeria at large.

INTRODUCTION

Compressed Natural Gas (CNG) vehicles present a strategic opportunity for Nigeria's economy, particularly in the context of the country's energy landscape and environmental goals. With Nigeria's vast natural gas reserves, adopting CNG as an alternative fuel can provide significant economic, ecological, and social benefits. This research explores the relevance of CNG vehicles to the Nigerian economy, highlighting key areas such as energy security, economic diversification, environmental sustainability, and public health: Energy Security and Utilization of Natural Gas Reserves. Nigeria is known for its significant natural gas reserves, estimated to be among the largest globally, with approximately 5.91 trillion cubic meters of proven natural gas reserves in 2022 (Olujobi, Yebisi, Patrick, & Ariremako, 2022). The country's natural gas reserves are substantial, with estimates indicating around 176 trillion cubic feet of proven natural gas reserves, positioning Nigeria as one of the top ten nations globally in terms of natural gas endowments and the largest in Africa (Bello & Nwaeke, 2023; Anoke, 2022). Additionally, Nigeria is reported to have about 188 trillion cubic feet of proven reserves, further highlighting its substantial natural gas wealth (Timitimi, 2022). Furthermore, Nigeria possesses the 9th largest non-associated and associated gas resources globally, surpassing its oil reserves (Gasu, Gasu, Olanrewaju, & Yakubu, 2022).

Despite Nigeria's abundant natural gas resources, challenges exist in effectively utilizing them. The country has faced issues such as gas flaring, which has negative environmental implications (Orji, 2014), he further stated that efforts have been made to transition from gas flaring to gas conservation and utilization, with a focus on the legal and policy framework to support this transition. Moreover, Nigeria has made strides in improving its gas utilization capacity through various projects, including liquefied natural gas (LNG) and compressed natural gas (CNG) initiatives (Ibeneme & Ighalo, 2020).

The economic significance of Nigeria's natural gas reserves cannot be understated. Natural gas plays a crucial role in Nigeria's energy sector, with approximately 80% of the country's electricity being derived from natural gas (Bello & Nwaeke, 2023). The utilization of natural gas has the potential to contribute significantly to Nigeria's economic growth, as evidenced by studies exploring the relationship between natural gas consumption and economic growth in the country (Galadima & Aminu, 2018). Additionally, the gas sub-sector, along with the electricity sector, has been identified as contributing to economic growth in Nigeria (Anoke, 2022). The increasing adoption of Compressed Natural Gas (CNG) vehicles in Nigeria, particularly in FCT Abuja, has indeed created a demand for motor vehicle mechanics to acquire specialized training in CNG vehicle maintenance and repair. As highlighted by (Trivedi., 2020), the current scenario of CNG vehicular pollution and the need for abatement technologies underscore the importance of ensuring that mechanics are well-equipped to handle the maintenance and repair of CNG vehicles. Additionally, (Ibeneme & Ighalo 2020) emphasize the benefits and recommendations for implementing CNG as an alternative fuel for automobiles, further supporting the necessity for specialized training for mechanics to effectively service CNG vehicles in Nigeria. This specialized training is crucial to ensure the safe and efficient operation of CNG vehicles, contributing to both environmental protection and the sustainability of the transportation sector in the region in Nigeria as a whole.

Objective of the study

The aim of this study is to identify the training needs required by motor vehicle mechanics for maintenance and repairs of compressed natural gas vehicles in Abuja, Nigeria. Specifically, the objectives of this study are:

1. Determine the technical competencies required by motor vehicle mechanics in the maintenance, and repairs of CNG vehicles in FCT Abuja, Nigeria.
2. Determine the safety protocols required by motor vehicle mechanics specific to servicing and handling CNG vehicles in FCT Abuja, Nigeria.

Research Questions

The following research questions guided the study:

1. What are the technical competencies required by motor vehicle mechanics in the maintenance, and repairs of CNG vehicles in FCT Abuja, Nigeria?
2. What are the safety protocols required by motor vehicle mechanics specific to servicing CNG vehicles in FCT Abuja, Nigeria?

Methodology

This study employs explanatory sequential mixed method design. The geographical area of the study is Abuja, Nigeria. The population consists of all 800 motor vehicle mechanics in Abuja central area. A sample size of 266 motor vehicle mechanics was selected using a simple random sampling and a purposive sampling technique was used respectively, ensuring representation from all workshop/garages. The data collection instruments was a structured questionnaire and an interview protocol, consisting of 41 and 48 items respectively, titled "Training Needs required by motor vehicle mechanics for maintenance and repairs of CNG vehicles in Abuja, Nigeria." The researcher, along with two research assistants, collected the quantitative data directly from the respondents while for the qualitative data the researcher collected the data alone considering the number of the respondents was manageable. The collected data was analyzed using descriptive statistics of mean and standard deviation with the help of SPSS version 25 for the quantitative data while NVIVO software was used for the qualitative data collected.

Results

Table 1 shows the Mean and Standard Deviation of the respondents on the technical competencies required by motor vehicle mechanics in the maintenance and repairs of CNG vehicles in FCT Abuja, Nigeria. Table showed the mean of the respondents ranging from 4.08 to 4.80 and the standard deviation also ranges from .482 to .851. The grand mean of the respondents is 4.42 which indicates that technical competencies such as Competency in repairing problems in fuel injectors within the CNG system, technical competency in troubleshooting CNG conversion kits in gasoline/diesel vehicles, competency in conducting

pressure tests on CNG storage delivery systems among others are required by motor vehicle mechanics in the maintenance and repairs of CNG vehicles in FCT Abuja, Nigeria.

Table 1: Mean and standard deviation of MVM on the technical competencies required by motor vehicle mechanics in the maintenance and repairs of CNG vehicles in FCT Abuja, Nigeria

S/N	Item Statement	N	X	SD	Remark
1.	Competency in repairing problems in fuel injectors within the CNG system.	241	4.08	.812	Highly Required
2.	Competency in repairing CNG cylinders for leaks.	241	4.12	.727	Highly Required
3.	Technical competency in troubleshooting CNG conversion kits in gasoline/diesel vehicles.	241	4.28	.634	Highly Required
4.	Competency in conducting pressure tests on CNG storage delivery systems.	241	4.56	.604	Very Highly Required
5.	Use specialized diagnostic software tools specific to CNG vehicle systems.	241	4.23	.737	Highly Required
6.	Technical competence in repairing CNG system components, such as fuel lines.	241	4.42	.655	Highly Required
7.	Technical competency in installing CNG conversion kits in gasoline/diesel vehicles.	241	4.57	.521	Very Highly Required
8.	Competency in performing routine maintenance task such as oil change.	241	4.72	.528	Very Highly Required
9.	Competency in performing routine maintenance task such as filter replacement.	241	4.27	.851	Highly Required
10.	Technical competence in repairing CNG system components, such as valves.	241	4.59	.534	Very Highly Required
11.	Technical competence in repairing CNG system components, such as pressure regulators.	241	4.80	.482	Very Highly Required
	Grand Mean	241	4.42		Highly Required

Source: Fieldwork, 2024

Table 2 shows the Mean and Standard Deviation of the respondents on the safety protocols required by motor vehicle mechanics specific to maintenance and repair of CNG vehicles in FCT Abuja, Nigeria. Table showed the mean of the respondents ranging from 3.53 to 4.83 and the standard deviation also ranges from .405 to 1.238. The grand mean of the respondents is 4.31 which indicates that safety protocols such as ensure the workshop is well-ventilated to

prevent the accumulation of gas, regularly use calibrated gas leak detectors to check for CNG leaks, adherence to the CNG equipment manufacturer's guidelines among others are required by motor vehicle mechanics specific to maintenance and repair of CNG vehicles in FCT Abuja, Nigeria.

Table 2: Mean and standard deviation of MVM on the safety protocols required by motor vehicle mechanics specific to maintenance and repair of CNG vehicles in FCT Abuja, Nigeria

S/N	Item Statement	N	X	SD	Remark
12.	Ensure the workshop is well-ventilated to prevent the accumulation of gas.	241	4.10	1.238	Highly Required
13.	Regularly use calibrated gas leak detectors to check for CNG leaks.	241	3.95	.943	Highly Required
14.	Specialized training in handling CNG vehicles.	241	4.34	.639	Highly Required
14.	specialized training on the use of Personal Protective Equipment (PPE).	241	4.74	.494	Very Highly Required
16.	labelling CNG cylinders to indicate their contents.	241	4.67	.581	Very Highly Required
17.	Emergency response procedures for dealing with CNG leaks.	241	3.87	.930	Highly Required
18.	Adherence to the CNG equipment manufacturer's guidelines	241	3.53	1.151	Highly Required
19.	Awareness of specific risks with their safety measures.	241	4.15	.749	Highly Required
20.	Use of appropriate signage to indicate CNG-related hazards in the workshop area.	241	4.45	.523	Highly Required
21.	Keep fire extinguishers/other emergency equipment accessible.	241	4.75	.521	Very Highly Required
22.	Use of fire suppression systems.	241	4.83	.405	Very Highly Required
	Grand Mean	241	4.31		Highly Required

Source: Fieldwork, 2024

Discussions

Technical competencies such as technical competency in performing regular maintenance on CNG systems/components, technical competency in diagnosing electrical issues related to CNG vehicle systems, technical Competency in the use of diagnostic tools for CNG vehicles among others are required by motor vehicle mechanics in diagnosing CNG vehicles in FCT Abuja, Nigeria. This finding agrees with that of Abdulkadir Et al., (2022). who opined that perspective is reinforced by the necessity of integrating diagnostics and maintenance data to enhance technician competencies, enabling them to manage the challenges presented by CNG vehicles.

Technical competencies such as Competency in repairing problems in fuel injectors within the CNG system, technical competency in troubleshooting CNG conversion kits in gasoline/diesel vehicles, competency in conducting pressure tests on CNG storage delivery systems among others are required by motor vehicle mechanics in the maintenance and repairs of CNG vehicles in FCT Abuja, Nigeria. Furthermore, this finding is in agreement with that of Patel & Brahmabhatt, 2019 who states that varying fuel injection timing is essential for optimizing engine performance in CNG applications, underscoring the mechanic's need to troubleshoot injection systems effectively.

Safety protocols such as ensuring the workshop is well-ventilated to prevent the accumulation of gas, regularly use calibrated gas leak detectors to check for CNG leaks, adherence to the CNG equipment manufacturer's guidelines among others are required by motor vehicle mechanics specific to maintenance and repair of CNG vehicles in FCT Abuja, Nigeria. This finding is in concord with the findings of Hamidieh & Ghanbari, 2023). which maintains that the importance of safety protocols within CNG stations, emphasizing the need for monitoring both external and internal safety parameters to minimize risks associated with gas management.

Conclusion

This study has systematically addressed the training needs required by motor vehicle mechanics for maintenance and repairs of compress natural gas vehicles in Abuja, Nigeria. Through a mixed-methods design using descriptive statistics and NVIVO analysis, the research results confirm that motor vehicle mechanics do require technical competencies in diagnosing, maintenance and repairs of CNG vehicles among others. However, the findings shows that there are differences in training needs among motor vehicle mechanics across different workshops/centers in FCT Abuja, Nigeria. Based on their differences in age and years of experience handling CNG vehicles.

Recommendations

Based on the findings of the study training needs required by motor vehicle mechanics for maintenance and repairs of compressed natural gas vehicles in Abuja, Nigeria. The following recommendations are proposed:

- i. The Federal Government should train motor vehicle mechanics technical competencies in repairing problems in fuel injectors within the CNG system, technical competencies

in troubleshooting CNG conversion kits in gasoline/diesel vehicles, technical competencies in conducting pressure test on CNG storage delivery system for maintenance and repairs of CNG vehicles in Abuja, and Nigeria at large.

- ii. The Federal Government should organize rigorous training/workshop/seminars directly focus on the safety protocols in handling CNG vehicles Maintenance and repairs in Abuja, and Nigeria at large.

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