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An Appraisal of Cooking Gas Refilling Spot in Owo Township, Ondo State

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***Abstract*: This study focuses on evaluating cooking gas refilling stations in Owo, considering their significance and potential risks due to the flammable nature of cooking gas. The research involved the distribution of 103 questionnaires using a simple random sampling technique in the study area. The results revealed that many people prefer cooking gas due to its cleanliness and efficiency, despite being aware of associated risks. Concerning the locations of these gas refilling stations, it was observed that numerous non-standard stations are situated within residential areas, lacking proper safety measures to prevent accidents and disasters. The study suggests that the Ondo State Ministry of Physical Planning should rigorously enforce planning standards and regulations for gas refilling stations and other developments in the area. Employers should provide safety training for employees, and relevant authorities should conduct awareness programs to educate the public about the environmental and health risks linked to gas refilling stations, among other recommendations.**

***Keywords*: cooking gas, gas refilling spot, liquefied petroleum gas.**

1. Introduction

The demand for liquefied petroleum gas (LPG), commonly referred to as cooking gas, has been on the rise in Nigeria, driven by its affordability, convenience, and environmental advantages compared to traditional cooking fuels such as firewood and kerosene [1]. It is a mixture primarily composed of butane and propane, along with trace amounts of other fractions like ethane and pentane. It is a highly flammable and colourless gas that easily evaporates into the atmosphere [2]. To enhance safety, LPG is infused with a sulfur-based odorant, giving it a distinctive and unpleasant smell, and facilitating the detection of gas leaks [3], [4].

To meet this growing demand, cooking gas refilling stations have become increasingly prevalent around the country, particularly in commercial areas such as markets and urban centres. These stations serve as vital sources of cooking energy for both households and businesses, contributing significantly to the nation's energy landscape. However, the safe handling and refilling of cooking gas, particularly in developing countries like Nigeria, poses challenges [2]. With the establishment of gas refill stations growing around the country, [5] there is concern about the risks involved in the activities including explosions, burns, cold injuries, arrhythmias, asphyxia, and even sudden death [6]-[8].

Given the potential hazards associated with LPG, there is a critical need to prioritize safety and risk management, especially in businesses handling these gases. Depending on factors like the nature of the business and the level of education, the risks of LPG handling can sometimes be underestimated, leading to severe consequences. Therefore, effective risk assessment and management systems are essential to minimize potential dangers. It is against this backdrop that this study appraises LPG refilling spots in Owo Township.

This research work aims to appraise the location of cooking gas refilling spots in Owo Township to suggest measures for effective siting of gas refilling spots. The objectives of the study are to:

(i) Identify the locations of the cooking gas refilling spots in Owo Township
(ii) Examine the hazards associated with the cooking gas refilling spot location.
(iii) Examine the safety measures put in place by these refilling stations to prevent these hazards in the locations.

A. Study Area

Owo Township is a significant part of the Owo Local Government Area, situated in Ondo State, Nigeria. Its geographical coordinates fall within the range of latitude 06°40’ to 07°33’ North and longitude 05°25’ to 05°59’ East of the Greenwich meridian. Owo Township is surrounded by Akoko South West and Akure North to the North, Ose Local Government Area to the East and South, and Idanre and Akure South Local Government Areas to the West.

This region experiences two primary seasons: the dry season, which typically spans from September to March, and the rainy season, occurring between April and August. The annual rainfall in this area varies from 1500mm to 2000mm, with a noticeable reduction in rainfall during the period between July and August. The presence of Rufus Giwa Polytechnic has had a notable impact on the town's economy. As a hub for higher education, the polytechnic has created employment opportunities for both skilled and unskilled workers, as well as professionals. The influence of the student population on the local economy cannot be overstated. This influence is evident in various aspects, including housing, commerce, markets, and

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transportation (utilizing modes such as motorcycles, taxis, and commercial buses).

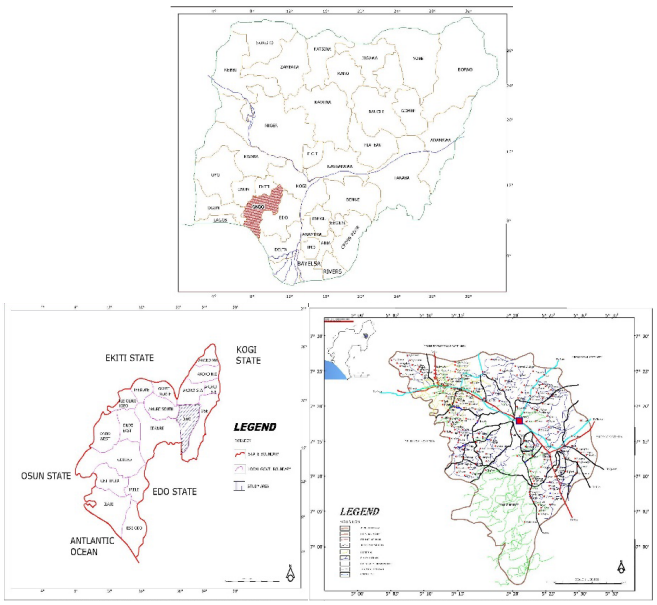

Fig. 1. Locational Map of Owo, Nigeria
Source: Modified from existing maps of the study area, 2023

Economic activities in Owo typically experience significant growth when the academic sessions are in progress. During this period, students engage in substantial shopping, and finding accommodation becomes a challenge due to the insufficient availability of housing relative to the student population's demand. Consequently, landlords often exploit the situation by increasing house rents, viewing it as an opportunity for profit. Given the lucrative nature of the housing sector, private investors have increasingly entered this market.

2. Literature Review

A. Facility Location Model

Facility location models play a significant role in understanding the placement and distribution of cooking gas refilling stations within the environment. The model explains why and how cooking gas refilling stations are located in specific areas [9]. Facility location models are essential in analyzing the strategic placement of cooking gas refilling stations to efficiently serve spatially dispersed demand [10]. In the study, we use similar principles to understand why A4 Gas Station and other refilling stations are located where they are to meet the demand for cooking gas in the commercial environment

B. Nature of Gas Filling Stations

Ihemtuge [11] highlighted that there is a prevalent sense of insecurity regarding the safety of LPG (liquefied petroleum gas), which leads to concerns about explosions and indoor air pollution. This perception has contributed to low LPG consumption rates, as many people view it as a highly risky energy source. Fire incidents related to LPG usage have occurred, with factors such as the use of sub-standard LPG accessories, over-pressurization of gas cylinders, and inadequate inspection and maintenance of equipment being responsible.

Marfo et al. [12] noted that the primary hazard associated with LPG is fire and explosion due to its high flammability, potentially leading to phenomena like BLEVE (boiling liquid expanding vapour explosion) under extreme conditions. There are also hazards related to the transportation and distribution of LPG. Additionally, inadequate ventilation at the point of use can result in carbon monoxide production, posing health risks. The intentional inhalation of LPG vapours, known as "sniffing," can lead to injuries or even death.

To mitigate these risks, there is a need for increased public awareness, especially in rural areas, and the elimination of substandard LPG accessories [11]. Risk assessment plays a crucial role in understanding and managing these hazards. It involves identifying potential risks, evaluating their severity and likelihood, implementing control measures, documenting assessment findings, and regularly reviewing and updating risk controls [13].

Ihemtuge [9] emphasizes the importance of managing LPG risks throughout its lifecycle, from production to end-use. Hazard identification, assessment, and control are essential steps in this process. Various risk control measures, such as leak detection devices, have been developed to enhance safety and prevent gas leaks and explosions. Additionally, safe handling practices for LPG storage tanks and cylinders have been widely documented in the literature [11].

3. Methodology

Data for the study were collected through a combination of methods, including the administration of 100 questionnaires to residents in Owo Township, and these data were subsequently analyzed using descriptive statistics. Additionally, personal observations were made to identify and record the locations of gas filling stations within the town.

4. Findings

A. Socioeconomic Characteristics of Residents

The respondents comprise a fairly balanced distribution of genders, with 54% being male and 46% female. In terms of age, the participants encompass a wide range, with the majority falling between the ages of 20 to 40, while smaller proportions are below 20 or above 50. In terms of their educational background, the respondents have diverse backgrounds, with the highest percentage having attained tertiary education (47%), followed by secondary education (39%). Regarding occupation, the sample includes a mix of employment statuses, with 40% being students, 26% being self-employed or engaged in trading, and smaller groups falling into categories like civil servants or artisans. The reason for the students' domineering residents in the area, is attributed to the influence of Rufus Giwa Polytechnic where most of the respondents are students. In terms of income, the study captures various income levels, with the largest group earning between N40,000 and N79,999 (30%). See Table 1.

Table 1
Socio-economic characteristics of respondents

Sex of Respondent	**Respondents**	**Percentage**
Male	54	54%
Female	46	46%
Age of Respondent	**Respondents**	**Percentage**
Less than 20	10	10%
20 – 30	41	41%
31 – 40	33	33%
41 – 50	12	12%
Above 50	4	4%
Educational Status	**Respondents**	**Percentage**
No formal education	3	3%
Primary School	9	9%
Secondary School	39	39%
Tertiary institution	47	47%
Informal education	2	2%
Occupation	**Respondents**	**Percentage**
Unemployed	13	13%
Student	40	40%
Civil servant	17	17%
Self-employed/Trading	26	26%
Artisan	4	4%
Income of Respondents	**Respondents**	**Percentage**
Below N20,000	19	19%
N20,000 - N39,999	15	15%
N40,000 - N59,999	25	25%
N60,000 - N79,999	30	30%
N80,000 - N99,999	6	6%
N100,000 and above	5	5%

Source: Field survey, 2023

B. Gas Usage and Safety Issues

Table 2
Gas usage and safety issues

Use of cooking gas	**Respondents**	**Percentage**
Yes	94	94%
No	6	6%
Reasons for gas usage	**Respondents**	**Percentage**
Cheaper	21	21%
Cleaner cooking source	38	38%
Faster	27	27%
Less stressful to use	5	5%
More effective	9	9%
Closeness to a gas refilling station	**Respondents**	**Percentage**
Yes	52	52%
No	48	48%
Awareness of the negative effects	**Respondents**	**Percentage**
Yes	81	81%
No	19	19%
Perception of safety living close to a gas refilling station	**Respondents**	**Percentage**
Yes	63	63%
No	37	37%

Source: Field survey, 2023

The survey results indicate that the majority of respondents (94%) use cooking gas, with only a small minority (6%) not using it. Among those who use gas for cooking, several reasons were cited: 38% mentioned it as a cleaner source of cooking, 27% appreciated its speed, 21% considered it cheaper, 9% found it more effective, and 5% noted that it was less stressful to use. Additionally, over half of the respondents (52%) reported living close to a gas refilling station, while 48% did not. A significant portion of participants (81%) expressed awareness of the negative effects associated with gas refilling stations. When asked about their perception of safety living close to a gas refilling station, 63% responded affirmatively, while 37% indicated otherwise. These findings provide valuable insights into the respondents' usage of cooking gas, reasons behind their choices, proximity to gas refilling stations, awareness of potential negative effects, and perceptions of safety in such proximity. See Table 2.

C. Information on Gas Refilling Spots in Owo

95% of the gas refilling stations in the area are privately owned, except a few which are owned by different corporations. These gas refilling spots are within residential areas, these are mostly the smaller ones which are located within buildings, some are located in caravans and stores respectively; while some which are usually the bigger stations are strategically located along the express and a bit far from residential properties. Most of the gas refilling stations do not have open spaces within the locations making them susceptible to fire outbreaks when accidents occur. Only the bigger gas stations have open spaces within them where they also have office areas and parking lots different from the gas sales area. All of these stations have their various machines for measuring the sales of gas. The locations of the gas refilling spots in Owo are shown in Figure 2.

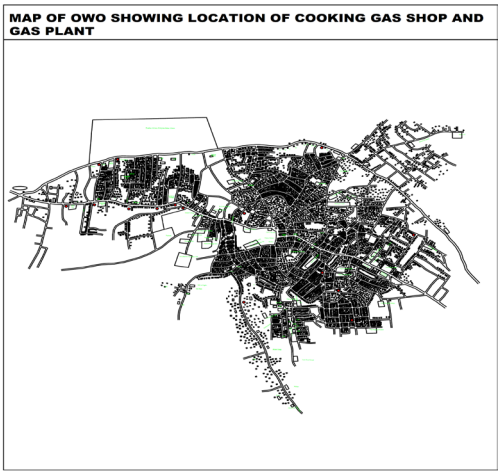

Fig. 2. Map of Owo showing the location of gas refilling spots in the area
Source: Field survey, 2023

The presence of safety measures in gas refilling stations varies significantly between larger filling stations and smaller gas spots. Larger filling stations, which are presumably more established and well-equipped, have several safety measures in place to mitigate the risks associated with their operations. These measures include the presence of fire extinguishers, exit signs, and emergency exit routes to address fire outbreaks and disasters. They also display warning signs such as 'No smoking,' 'Switch off your engine,' 'No naked light,' 'Inflammable,' 'No use of cell phones within the premises,' and 'Emergency Exit' in various areas of the stations. Moreover, they reported that their staff undergo training and are cautioned about safety measures during gas sales to prevent fire outbreaks and explosions. Additionally, some of these larger stations are engaged in the sale and repair of cooking gas cylinders and related accessories.

In contrast, smaller gas spots often lack essential safety measures such as fire extinguishers and signs warning of

potential dangers. Some of these smaller operations may operate without these safety precautions, claiming expertise and self-assuredness in avoiding risks. However, their profit-driven approach might lead to a higher level of risk-taking behaviour, potentially endangering the lives and properties of those in their vicinity due to the volatile nature of the gas. This discrepancy in safety measures between larger filling stations and smaller gas spots underscores the need for consistent safety standards and regulatory oversight to ensure public safety in all gas refilling establishments.

5. Recommendations

Based on the findings of this study, several recommendations are put forward to ensure the safe and responsible operation of gas refilling stations and to protect the well-being of residents in proximity to these facilities:

1. *Strict Enforcement of Planning Standards:* The Ondo State Ministry of Physical Planning should rigorously enforce planning standards and regulations for gas refilling stations' development, as well as other physical developments in the area. This will help ensure that new stations adhere to safety and environmental standards from the planning stage.
2. *Promote Personal Protective Equipment (PPE) Usage:* Gas stations should cultivate the habit of using Personal Protective Equipment (PPE) as a fundamental safety measure for their staff and customers. This includes providing safety gear like fire extinguishers, gas leakage detectors, and appropriate signage.
3. *Safety Induction for Employees:* Employers should ensure that employees, especially those working in gas refilling stations, receive comprehensive safety induction and training concerning occupational hazards. This training should cover emergency response procedures and safe handling of gas to prevent accidents.
4. *Discourage Gas Refilling Stations in Residential Areas:* Gas refilling plants should be discouraged from being located within residential areas to reduce the potential risks to residents and properties. This zoning can be achieved through urban planning regulations.
5. *Employee Safety:* Employers must ensure the health, safety, and welfare of all employees. This includes providing adequate safety equipment, and training, and maintaining a safe working environment to prevent accidents.
6. *Public Sensitization Programs:* Relevant authorities should conduct public sensitization programs to educate residents about the environmental and health risks associated with gas refilling stations. These programs can be carried out through mass media campaigns and partnerships with traditional rulers and community associations.
7. *Environmental Impact Assessments (EIAs):* Planners should mandate that any development, including gas refilling stations, must undergo a proper Environmental Impact Assessment (EIA) before approval. This assessment will help ascertain the potential effects on the environment and public health.

6. Conclusion

The research aimed to assess the location of cooking gas refilling spots in Owo Township, with a focus on identifying potential hazards associated with their locations and examining the safety measures implemented by these stations. The study revealed that respondents had significant concerns about various negative effects of gas refilling stations, with fire outbreaks, gas leakage, explosions, and potential harm to lives and properties topping the list of apprehensions. The research also highlighted differences in safety measures between larger filling stations and smaller gas spots, with the former generally demonstrating more comprehensive safety precautions. Given the widespread apprehension about potential risks associated with gas refilling stations and the varying safety measures in place, this study underscores the importance of regulatory oversight and enforcement of consistent safety standards across all gas refilling establishments. The study concludes that there is a need for proper monitoring of the locations of gas filling stations, to avoid unwarranted incidents in the future. Additionally, public sensitization programs and proper Environmental Impact Assessment (EIA) reports are essential to raise awareness about the environmental and health implications of these facilities and ensure safer urban development in the study area. Ultimately, safeguarding public health and well-being should be a paramount consideration in the siting and operation of gas refilling stations.

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