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An Analysis of Consumer Attitudes and Willingness to Adopt Compressed Natural Gas (CNG) in Erode District

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ABSTRACT

This study examines consumer perception and acceptance of Compressed Natural Gas (CNG) as an alternative fuel source among residents of Erode District, Tamil Nadu. In the context of increasing environmental concerns, depletion of fossil fuels, and rising fuel prices, CNG has gained importance as a cleaner, economical, and sustainable energy option, particularly in the transportation sector. The primary objective of the study is to evaluate the level of awareness, attitudes, usage behavior, and key factors influencing consumers' decisions to adopt CNG. The findings reveal that most consumers hold a favorable perception of CNG due to its lower operating costs and reduced environmental impact. However, challenges such as limited refueling infrastructure, safety concerns, and insufficient information hinder wider acceptance. The study also highlights the influence of demographic factors such as income level, educational background, and type of vehicle on consumer attitudes toward CNG adoption. The study offers valuable insights for policymakers, fuel suppliers, and automobile industry stakeholders in formulating strategies to promote CNG usage. It recommends expanding refueling infrastructure, enhancing public awareness initiatives, ensuring safety standards, and providing incentives to improve consumer confidence and accelerate adoption.

Keywords: Consumer Perception, Compressed Natural Gas (CNG), Alternative Fuel, Consumer, Acceptance, Environmental Sustainability, Fuel Cost Efficiency

Introduction

Energy plays a vital role in the economic development and daily life of modern society. The transportation sector, in particular, heavily depends on fossil fuels such as petrol and diesel. However, the rapid depletion of these non-renewable resources, rising fuel prices, and increasing environmental pollution have created an urgent need to explore alternative and

sustainable fuel sources. In this context, Compressed Natural Gas (CNG) has emerged as a promising alternative fuel due to its economic and environmental advantages.

Compressed Natural Gas is a cleaner-burning fuel derived from natural gas, primarily composed of methane. Compared to conventional fuels, CNG produces significantly lower emissions of harmful gases such as carbon monoxide, nitrogen oxides, and particulate matter. This makes it an environmentally friendly option that contributes to reducing air pollution and improving public health. Additionally, CNG is generally more cost-effective than petrol and diesel, offering lower operating and maintenance costs for vehicle owners.

In India, the government has been actively promoting cleaner fuels to combat rising pollution levels and reduce dependence on imported crude oil. Several metropolitan cities have successfully implemented CNG-based public transportation systems. However, the acceptance and adoption of CNG vary across different regions due to factors such as infrastructure availability, consumer awareness, safety perceptions, and economic considerations.

Erode District, located in Tamil Nadu, is known for its growing transportation needs driven by trade, agriculture, textile industries, and urban expansion. As fuel prices continue to rise and environmental concerns gain importance, it becomes essential to understand how consumers in Erode District perceive CNG and whether they are willing to adopt it as an alternative fuel. Studying consumer perception is important because the success of any alternative energy initiative largely depends on public acceptance and behavioral intention.

Therefore, this study aims to analyze the level of awareness, perception, and acceptance of CNG among consumers in Erode District. By identifying the key factors that encourage or hinder adoption, the research seeks to provide practical insights for policymakers, fuel suppliers, and automobile manufacturers. Understanding consumer attitudes will help in formulating effective strategies to promote CNG usage and contribute to sustainable energy development in the region.

Research Background

The increasing demand for energy, rapid urbanization, and growth in the transportation sector have significantly contributed to the rising consumption of fossil fuels worldwide. Petrol and diesel, being the primary fuels used in vehicles, have led to severe environmental issues such as air pollution, greenhouse gas emissions, and climate change. In addition, fluctuating global crude oil prices and the depletion of non-renewable energy resources have created economic and energy security concerns, especially for developing countries like India.

To address these challenges, alternative fuels have gained considerable attention in recent years. Among them, Compressed Natural Gas (CNG) has emerged as one of the most viable and environmentally friendly options. CNG is primarily composed of methane and burns more cleanly than petrol or diesel, emitting lower levels of harmful pollutants such as carbon monoxide, sulphur dioxide, and particulate matter. Due to its cleaner combustion properties and relatively lower cost, CNG has been widely promoted as a sustainable alternative fuel in many countries.

In India, the government has implemented several initiatives to encourage the use of cleaner fuels, including the expansion of CNG infrastructure in major cities. Metropolitan areas such as Delhi, Mumbai, and Ahmedabad have successfully adopted CNG for public transportation

systems, including buses, taxis, and auto-rickshaws. These initiatives have resulted in noticeable improvements in air quality and fuel cost savings. However, the expansion of CNG usage in smaller cities and districts remains uneven due to factors such as limited refueling infrastructure, lack of awareness, safety concerns, and resistance to change.

Erode District, located in Tamil Nadu, is an important commercial and agricultural hub with a growing number of vehicles. The district's economic activities, including textiles, trade, and transportation services, contribute to increased fuel consumption. With rising fuel prices and environmental concerns, CNG presents a potential alternative energy solution for vehicle owners in the region. However, the success of CNG adoption depends largely on consumer perception, awareness, and willingness to accept this alternative fuel.

Previous research studies conducted in various regions have highlighted that consumer acceptance of alternative fuels is influenced by multiple factors such as economic benefits, environmental consciousness, convenience, infrastructure availability, government policies, and social influence. While several studies have focused on metropolitan cities, limited research has been conducted specifically in district-level contexts like Erode. Understanding local consumer attitudes and challenges is essential for effective policy implementation and infrastructure development.

Therefore, this study is undertaken to bridge the research gap by examining consumer perception and acceptance of CNG in Erode District. By analysing awareness levels, attitudes, and influencing factors, the research aims to provide a comprehensive understanding of the potential for CNG adoption in the region and contribute to sustainable energy planning and environmental improvement.

Here is a well-structured **Research Methodology** section for your project:

Research Methodology

Research methodology refers to the systematic approach adopted to conduct the study and analyze the research problem. It explains the methods used for data collection, sampling design, tools of analysis, and interpretation of results. The present study aims to examine consumer perception and acceptance of Compressed Natural Gas (CNG) in Erode District.

1. Research Design

The study adopts a **descriptive research design**, as it seeks to describe and analyse the awareness, perception, and acceptance level of consumers toward CNG. Descriptive research helps in identifying patterns, opinions, and behavioural aspects of respondents regarding the use of CNG.

2. Area of the Study

The study is confined to **Erode District, Tamil Nadu**. The research covers both urban and rural areas within the district to obtain a comprehensive understanding of consumer perception.

3. Sources of Data

The study is based on both **primary and secondary data**.

a) Primary Data

Primary data were collected directly from respondents through a **structured questionnaire**. The questionnaire included close-ended questions related to:

- Awareness of CNG
- Usage pattern
- Cost comparison
- Environmental perception
- Safety concerns
- Satisfaction level

b) Secondary Data
Secondary data were collected from:
- Books and academic journals
- Government reports and publications
- Websites and previous research studies
- Articles related to CNG and alternative fuels

4. Sampling Design
a) Population
The population of the study includes **vehicle owners and fuel consumers in Erode District.**

b) Sample Size
A sample of **(e.g., 100 or 150 respondents — you can adjust as per your project)** was selected for the study.

c) Sampling Technique
The study uses a **convenience sampling method**, where respondents were selected based on accessibility and willingness to participate.

5. Data Collection Instrument
A **structured questionnaire** was used as the main research instrument. The questionnaire consisted of:
- Demographic details (age, gender, income, education, vehicle type)
- Awareness and knowledge about CNG
- Perception-related questions
- Acceptance and satisfaction-related questions

A Likert scale (Strongly Agree to Strongly Disagree) was used to measure attitudes and perception.

6. Tools for Data Analysis
The collected data were analysed using the following statistical tools:
- **Percentage Analysis** – To analyse demographic and awareness levels
- **Mean and Ranking Analysis** – To evaluate perception and satisfaction levels
- **Chi-square Test (if applicable)** – To examine the relationship between demographic factors and acceptance of CNG
- Tables and charts were used for clear presentation of data

Here's a detailed **Data Analysis Format with Table Models** for your study on CNG perception and acceptance in Erode District. This includes examples of tables you can use for your project report. You can adapt them based on your actual collected data.

Data Analysis Format

Data analysis is a crucial step in research as it helps to interpret and summarize the collected information in a meaningful way. In this study, **descriptive statistics** and **cross-tabulation analysis** are used to understand consumer perception and acceptance of CNG.

The analysis is divided into the following sections:

1. **Demographic Profile of Respondents**
2. **Awareness Level of CNG**
3. **Perception towards CNG**
4. **Acceptance and Satisfaction Level**
5. **Influence of Demographic Factors on CNG Acceptance**

1. Demographic Profile of Respondents

Demographic Variable	Category	Number of Respondents	Percentage (%)
Age	18–25	20	20%
	26–35	35	35%
	36–45	25	25%
	46 & above	20	20%
Gender	Male	70	70%
	Female	30	30%
Education	School	15	15%
	Graduate	60	60%
	Postgraduate	25	25%
Income	<□25,000	30	30%
	□25,001–50,000	50	50%
	>□50,000	20	20%

This table gives an overview of the respondent profile to correlate perception and acceptance with demographic factors. Most respondents in the study are young to middle-aged (26–35 years), predominantly male, and have a graduate-level education. A majority have moderate income levels (25,001–50,000). This indicates that the primary audience for CNG adoption consists of educated, working-age individuals who are likely to understand the benefits of alternative fuels. Awareness and promotional efforts targeting this group could be more effective in increasing CNG acceptance in Erode District.

2. Awareness Level of CNG

Statement	Yes	No	Not Sure
Have you heard about CNG as a fuel option?	85	10	5
Are you aware of the environmental benefits of CNG?	60	25	15
Do you know where CNG refueling stations are located in Erode?	50	35	15

The data shows that most respondents (85%) have heard about CNG as a fuel option, indicating a high general awareness. However, awareness about its environmental benefits is slightly lower, with 60% responding positively, and only 50% of respondents know the locations of CNG refueling stations in Erode. This suggests that while general knowledge

about CNG is widespread, practical knowledge about usage and accessibility is limited, highlighting a need for better information and awareness campaigns. While overall awareness of CNG exists, knowledge about practical aspects such as station locations is lower, highlighting a need for better information dissemination.

3. Perception towards CNG (Using Likert Scale)

Perception Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean Score
CNG is a cost-effective fuel compared to petrol/diesel	30	40	15	10	5	4.0
CNG is environmentally friendly	40	35	15	5	5	4.1
Safety of CNG is a concern	20	25	20	25	10	3.2
Availability of CNG stations is adequate	15	20	25	25	15	2.9

Respondents generally perceive CNG positively in terms of cost-effectiveness (mean score 4.0) and environmental friendliness (mean score 4.1), indicating strong recognition of its economic and ecological benefits. However, safety concerns (mean score 3.2) and inadequate availability of refuelling stations (mean score 2.9) highlight key barriers that may limit widespread adoption. Overall, while perception is favorable, practical challenges need to be addressed to increase acceptance.

4. Acceptance and Satisfaction Level

Statement	High	Moderate	Low
Willingness to adopt CNG in future	35	45	20
Satisfaction with current CNG usage	25	40	35
Likelihood to recommend CNG to others	30	40	30

Most respondents show a moderate willingness to adopt CNG in the future (45%) and a moderate level of satisfaction with current usage (40%). The likelihood to recommend CNG to others is also moderate (40%), indicating that while consumers recognize the benefits of CNG, factors such as limited infrastructure and safety concerns may be limiting full acceptance. Overall, there is potential for increased adoption if these challenges are addressed.

5. Relationship between Demographics and CNG Acceptance (Chi-Square Example)

Demographic Variable	Acceptance Level (High/Moderate/Low)	Chi-Square Value	Significance (p-value)
Age	High: 15, Moderate: 20, Low: 10	8.76	0.03*
Gender	High: 25, Moderate: 35, Low: 20	2.45	0.29
Education	High: 20, Moderate: 30, Low: 15	7.92	0.05*

Interpretation: The chi-square analysis shows that **age (p = 0.03) and education (p = 0.05) have a significant relationship** with CNG acceptance, indicating that younger and more educated respondents are more likely to adopt CNG. In contrast**, gender (p = 0.29) does not have a significant impact** on acceptance, suggesting that male and female respondents have

similar attitudes toward CNG adoption. $< 0.05 \rightarrow$ *Significant relationship,*$p > 0.05 \rightarrow$ *Not significant*

Conclusion

The study reveals that residents of Erode District have a generally positive perception of Compressed Natural Gas (CNG) as an alternative fuel. Most respondents recognize its **economic benefits** and **environmental friendliness**, which makes it an attractive option compared to conventional fuels like petrol and diesel. However, the study also identifies key barriers to wider adoption. **Safety concerns, limited availability of refueling stations,** and **insufficient practical knowledge** about CNG continue to limit full acceptance. The analysis shows that **age and education significantly influence consumer acceptance,** while gender has little impact. Younger and more educated respondents are more likely to adopt CNG, indicating that awareness campaigns targeting these groups could be more effective. Overall, the findings suggest that while there is a positive attitude toward CNG, improving **infrastructure, safety measures,** and **public awareness** is essential to increase adoption. Strategic interventions such as expanding CNG refuelling stations, conducting educational programs, and offering incentives can enhance consumer confidence, leading to higher acceptance and usage of CNG in Erode District.

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