

Promoting Sustainable Energy Practices in Urban Environments: Understanding the Drivers of Transition from Fuelwood to Renewable Cooking Energy Sources - Insights from Maneah, Guinea.

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ABSTRACT

As Africa is experiencing rapid population growth, particularly in urban areas, it is highly noticeable that a significant number of this population still depend on biomass fuels such as firewood and charcoal as their primary energy for heating and cooking. While many clean cooking energy projects have targeted rural areas, the demand for woodfuel remains high and questionable in urban communities. Many studies have found that overreliance on biomass energy, such as firewood and charcoal, for cooking in developing countries contributes to high deforestation rates and indoor air pollution. Thus, the study analyzes the identified factors influencing urban households' transition from traditional fuelwood to renewable cooking energy sources. Energy transition is crucial for addressing environmental, health, and socioeconomic challenges associated with unsustainable energy practices. The findings indicate that 70.1% of respondents still primarily use fuelwood and charcoal for cooking, while 21.5% combine biomass with electricity. Only 7.5% and 0.9% rely solely on electricity and liquefied petroleum gas (LPG) respectively. The research highlights that factors that must be considered for transition in these urban households include affordability (33%), health advantages (25.9%), and ease of use (22.3%), with fewer respondents considering environmental benefits. To facilitate the energy transition and reduce dependence on traditional fuels, the study recommends creating an enabling environment for renewable energy adoption, improving accessibility and affordability of renewable energy technologies, conducting awareness campaigns and local-level training, and advocating for supportive policies and frameworks for urban energy needs.

RESEARCH QUESTIONS

1. What is the current level of urban household cooking energy consumption in the community of Coyah, Guinea? 2. What are the key factors hindering urban households from transitioning to renewable cooking energy sources? 3. What policy recommendations and solutions can be proposed to encourage a wider transition to renewable energy sources and reduce the high demand for traditional fuel in urban communities?

AREA OF STUDY

The research was conducted in the community of Maneah in Coyah, located in Guinea. Maneah is an urban area characterized by a diverse population and a mix of residential, commercial, and industrial activities. As a case study site for analyzing factors influencing urban households' transition from fuelwood to renewable cooking energy sources, Maneah presents a unique context for understanding the challenges and opportunities in adopting sustainable cooking practices. Through observation, most households rely completely on traditional cooking energy sources (fuelwood and charcoal). Therefore, Maneah is selected for its relevance as a representative community facing energy transition issues and the higher dependence of most households on traditional cooking energy sources. It is located in a region where fuelwood is commonly used for cooking, highlighting the need to explore factors hindering the transition toward renewable energy sources despite being an urban and industrial zone. The community's proximity to the capital city, Conakry and its accessibility makes it suitable for conducting research and engaging with various stakeholders.

POPULATION AND SAMPLE SIZE

Stakeholder	Population	Sample Size	Instrument	Total
Population A: Urban Households (Men and women above 18 years old)	Unknown (current statistic unknown)	150	Questionnaire	150
Population B: Companies or initiatives that are already providing clean cooking solutions or alternative energy sources in Guinea.	Unknown	2	Interview Questions	2
Population C: Government Agencies and Policy-makers at the Ministry of Environment	Unknown	2	Interview Questions	2
Total Sample Size				154

DISCUSSION OF FINDINGS

Introduction

This section presents the data analysis based on the objectives of the research study, which includes the presentation and interpretation of the results from the research study. It presents the findings of the study under the following: Demographic characteristics of the research respondents, energy choice and consumption level of the research respondents, and identified factors hindering the transition of research respondents in Maneah, Guinea. Additionally, this part interprets the presented research data and suggests recommendations based on the research primary findings and the secondary data.

Research Participants Response

The study required three main stakeholders as follow:

The first stakeholder (urban households) a printed questionnaires were shared with the research participants, and attracted 112 responses.

Interviews were conducted with the two other stakeholders (enterprise and government agency), which allowed to register the responses in audio recordings.

Demographic Information

This segment describes the demographic information of the research respondents. The research respondents' profiles include distribution by age range, level of education, and gender.

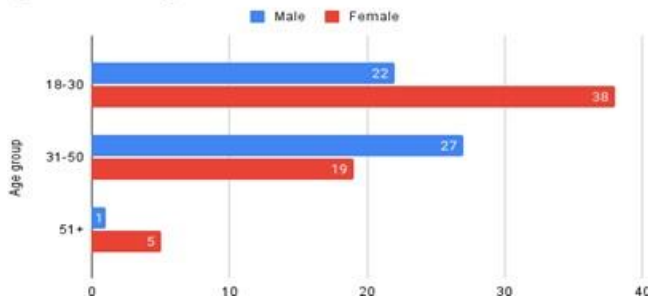
Research Respondent Distribution by Age and Gender

Table 1: Age and Gender of respondents

Age group	Male	Female	Totals	Percentage (%)
18-30	22	38	60	54%
31-50	27	19	46	41%
51+	1	5	6	5%
Totals	50	62	112	100%
Percentage	45%	55%		100%

The gender distribution table 1 indicates that 45% of the respondents were male, whereas 55% were female. This suggests that most of the research participants were male, constituting the majority. From Table 1, it is also observed that three age groups of respondents participated in this study, among which 54% of respondents were in an age range of 18-30, 41% of participants in between 31-50 years and 5% of respondents aged more than 50 years old.

Age and Gender of respondents

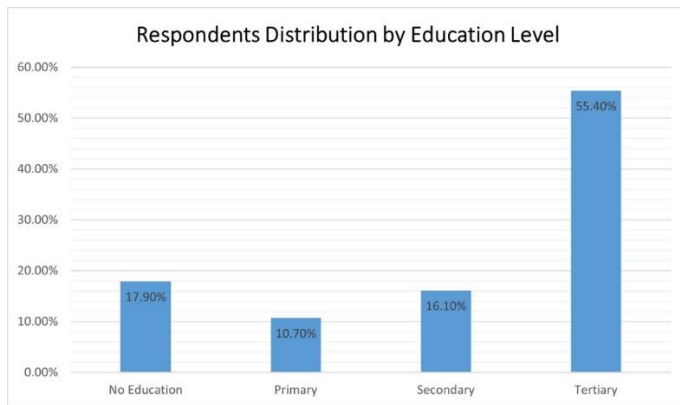


Graph 1: Distribution of research respondents by Gender and Age group

From Graph 1, it is evident that most of the respondents are female in two age groups (18-30 and 51+), which elucidates that gender perspectives on energy transition are crucial as women are the most affected and concerned in term of cooking in Guinea, like many other developing countries.

Research Respondents Distribution by Education Level

The research sought to establish the distribution of the research participants by education level.



Graph 2: Distribution of respondents by Education level

According to graph 4, the majority of the respondents (55.40%) had a tertiary level of education. Following that, 17.9% had no education or were illiterate, while 16.10% had completed secondary school. Respondents with primary education constituted 10.70%.

I. RESEARCH QUESTION ONE: What is the current level of urban household cooking energy consumption in the community of Maneah, Guinea?

To address this objective, the research seeks to identify the types of energy, and the respondents' monthly consumption.

Energy choice and consumption level

The research study aimed to assess the energy choice of urban households. It first identifies the current types of energy used by respondents in Maneah. The findings are shown in the following section:

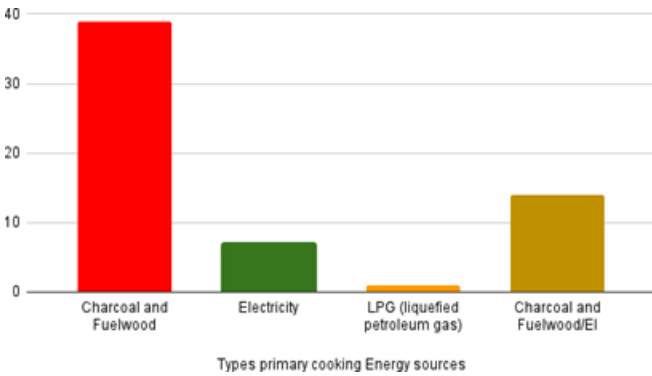
Respondents Types of primary energy sources

Table 2: Types of current primary Energy used in Urban Households

Types of Energy	Numbers of respondents	Percentage %
Fuelwood and Charcoal	75	70.10%
Electricity only	9	7.50%
LPG (Liquefied Petroleum Gas)	2	0.90%

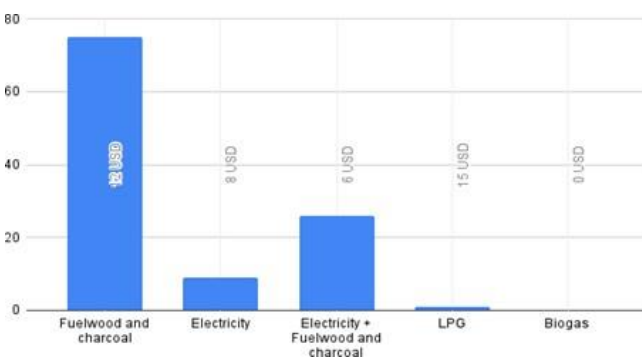
Mix Charcoal fuelwood and Electricity	26	21.50%
Biogas	0	0%

From Table 2, it is well noticeable that about 70.1% of the respondents still use fuelwood and charcoal as primary sources of energy for cooking in their households, then 21.5% of the respondents often used this biomass (fuelwood and charcoal) and electricity. On the other hand, 7.5% and 0.9% of respondents often relied only on electricity and LPG (liquefied Petroleum Gas), respectively. Furthermore, almost none of the respondents use biogas as primary energy for cooking.



Graph 3: Types of Energy Choice and Consumption Level of the Research Respondents

The result from Graph 3 shows that three (3) types of Energy (electricity, LPG, Fuelwood and charcoal) are used for cooking in households in Maneah community, but the majority (75%) of households still rely on charcoal and fuelwood as the primary energy source for cooking.

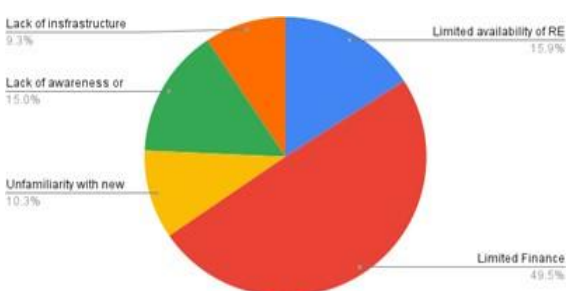


Graph 4: Types of energy and monthly average consumption by respondents

According to Graph 4, it is evident that most households(75.1%) still rely on charcoal and fuelwood only, but they claim is expensive(12 USD) after the Liquefied Petroleum Gas (cost about 15 USD), which is renewable energy.

II. RESEARCH QUESTION TWO: What key factors hinder urban households from transitioning to renewable cooking energy sources?

4.2 Distribution of Respondents and Identified Hindering Factors to Energy Transition



Graph 5: Factors Hindering Energy Transition by Respondents

From graph 5 below, it is evident that the majority (49.5%) of households point to their limited income level as a challenge for the transition to renewable energy for cooking. Then, about 15.9% of respondents find it difficult to transition because of the limited availability of renewable energy to sustain their households daily while 15% of households affirm not knowing other renewable energy (lack of awareness) besides electricity.

Furthermore, 10.3% of households find it difficult to get familiar with Renewable energy technologies challenging. Finally, 9.3% of households point to the lack of infrastructure that hinders their transition.

4.2.1 Level of Renewable Energy Affordability According to respondents

On the satisfaction of respondents about the current cost of renewable energy solutions, the results were obtained from a choice of response where Yes = Satisfied and No = Not satisfied.

Table 3: Respondents' satisfaction with the price of renewable energy

Question	Satisfaction	
	Yes	No
Are you satisfied with Price of the current RE?	20%	80%

From Table 3, It is observed that the majority of respondents(80%) find renewable energy solutions or technologies expensive, while only 20% of respondents are satisfied with the cost.

I. RESEARCH QUESTION THREE: What policy recommendations and solutions can be proposed to encourage a wider transition to renewable energy sources and reduce the high demand for traditional fuel in urban communities?

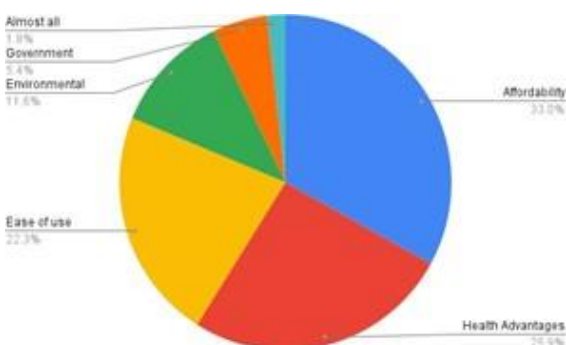
2. Factors considered to facilitate energy transition by respondents

From the primary data analysis, many factors explained urban households' high reliance on traditional energy sources (fuelwood and charcoal). Despite the high dependence on fuelwood and charcoal, many households are likely to transition to renewable sources for cooking if the factors (in Table 4) are addressed.

Table 4: Factors considered for the transition by respondents

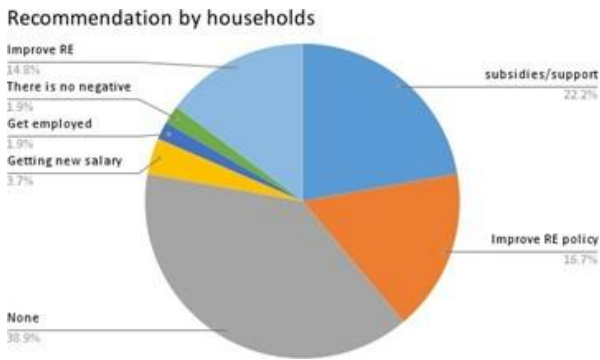
Factors	Numbers of respondents	Percentage %
Affordability	37	33%
Health Advantages	29	25.90%
Ease of use	25	22.30%
Environmental concerns	13	11%
Government incentives	6	5.40%
Almost all	2	1.80%

As per Graph 4, about five factors (affordability, health advantages, Ease of use, environmental concerns, and government incentives) are considered for the transition to renewable cooking energy by respondents.



Graph 6: Distribution of Factors that might facilitate transition according to respondents

From graph 6, about 33% of households consider the affordability of renewable energy, then 25.9% of households prefer the health or safety advantages of renewable energy, 22.3% consider the ease of use of the renewable energy or solution. Furthermore, only 11.6% of respondents consider the environmental benefit of renewable energy, while 1.8% mentioned considering all five factors.



Graph 7: Other specific recommendations from households

Graph 7 highlights some recommendations provided by respondents. From the graph, it is evident that 38.9% of households have no solution or recommendation, about 22.2% of households suggest that the government should subsidize households to facilitate their transition to renewable energy for cooking. Then, 16.7% request that the government should improve the renewable energy policy, while 14.8% of households recommend reliable and sustainable renewable energy solutions from the government. Furthermore, 3.7% of respondents are likely to transition if they only have a reliable income level through jobs or increased salary and 1.9% of respondents have interests in getting more information(need for awareness) and training about renewable energy solutions and technologies.

INTERVIEWS DISCUSSION

Insight from Stakeholder 2 (Enterprise) and Insight from Stakeholder 3 (Government Agency) provide valuable perspectives on the challenges and opportunities in transitioning to renewable energy solutions for cooking. While they come from different vantage points, several commonalities and differences can be observed. Both stakeholders highlight the significant role of financial constraints in hindering the adoption of renewable energy solutions. While stakeholder 2 emphasizes the cost of implementation as a deterrent and the financial instability of most households, Stakeholder 3 acknowledges the need for legal frameworks to attract investor interest without compromising their business growth. Therefore, the economic aspect is pivotal in the transition process of urban households.

Then, the lack of awareness regarding the benefits of renewable energy solutions is a shared challenge. They both highlight that the lack of awareness exacerbates the adoption barrier for urban and rural households, revealing the importance of raising awareness to drive change.

The alignment of these core challenges suggests the need for a holistic approach that combines economic strategies with educational initiatives.

The insights also reflect a collaborative opportunity. Enterprises can collaborate with government agencies to address financial barriers and promote awareness through shared objectives. Moreover, the call for legal frameworks highlights the crucial role of policy in supporting the renewable energy sector's growth while attracting investments.

In general, a successful transition requires a multi-dimensional effort, involving various stakeholders to address financial, awareness, and regulatory aspects collectively.

SECONDARY RESEARCH FINDINGS

The literature review reveals the rapidly growing demography with a set of interconnected challenges influencing the adoption of renewable cooking energy sources in developing countries, including Guinea.

Predominantly, financial limitations emerge as a major hindrance for households due to their financial capacity, and limited stability, among others, hinders their investment in such technologies.

A second obstacle revolves around a lack of awareness. As indicated in a study by Das, Jeuland, & Plutshack (2022), insufficient knowledge of renewable technology benefits discourages transition. This necessitates awareness campaigns and community engagement to enhance understanding. Cultural norms are also influential, as seen in studies by Broto & Arthur (2020), and Ishengoma and Igangula (2021), which identify factors such as social status and community dynamics shaping energy choices.

Furthermore, the literature highlights the significance of strong policy frameworks, like feed-in tariffs and tax incentives; as illegal and unregulated policy frameworks result in inadequate access to affordable renewable energy options (Bhattacharyya et al., 2022).

In general, these findings underscore the multidimensional barriers to energy transition, which the current study is trying to address in the local context. Financial constraints, awareness gaps, cultural norms, and policy weaknesses collectively affect the transition to renewable energy for cooking.

CONCLUSION

In summary, this research answers pressing questions surrounding the transition to renewable cooking energy sources in the urban community of Coyah, Guinea. The investigation shed light on the current energy consumption levels, the hindrances to adopting renewable solutions, and proposed policy recommendations.

Insights from Stakeholder 2 (Enterprise) and Stakeholder 3 (Government Agency) revealed the common challenges of financial constraints and lack of awareness. These challenges were further substantiated by secondary research findings highlighting financial limitations, a lack of awareness, and policy gaps as interconnected barriers.

The alignment of these findings with the research questions underscores the complexity of the energy transition landscape. It emphasizes that addressing energy challenges requires a comprehensive approach integrating economic strategies, awareness campaigns, policy adjustments, and cultural considerations. Collaborative efforts between enterprises, government agencies, and communities hold promise in overcoming these multifaceted obstacles. Moreover, strong policy frameworks, incentives, and education campaigns are necessary.

Comparing these findings with broader trends, it is clear that the challenges faced by the community of Maneah in Coyah are not unique. According to the International Energy Agency report (2023), without support, 50% of households in sub-Saharan Africa could not afford clean cooking at today's prices. Across developing nations, financial limitations and awareness gaps hinder the adoption of renewable energy sources for cooking. The importance of aligning policies and regulatory frameworks with local needs and contexts also emerges as a common thread. Additionally, the emphasis on cultural norms and gender dynamics reflects a universal need to tailor solutions to societal contexts. In conclusion, this research demonstrates that the journey toward sustainable cooking energy in urban communities demands collaborative, multidimensional strategies encompassing economic, social, and policy dimensions in a local context.

RECOMMENDATIONS

Although factors related to energy transition seem more complex, the results from primary data give light or room to valuable recommendations focused on various aspects to facilitate urban as well as rural households' energy transition and reduce their high dependence on traditional energy (fuelwood and charcoal):

1. Investment and Market Development:

Encouraging and promoting investment in making renewable energy solutions more adaptable and attractive to most households. Create an efficient environment that helps renewable energy promoters (especially the private sector) to thrive in the market.

2. Accessibility and Affordability:

Make renewable energy technologies like LPG, biogas, solar panels, electric or improved stoves, and electricity more accessible, safe, and affordable for urban households.

Accessibility and affordability are pivotal for driving adoption. Making renewable energy technologies accessible, safe, and affordable addresses one of the primary barriers to entry. This can lead to increased utilization of renewable energy solutions for cooking, as households are more likely to switch if the alternatives are convenient and economical.

3. Community-Level Strategy and Education:

Provide strategies to support renewable energy technologies' acquisition at the community level.

Constantly provide massive awareness and training at the local level to help households understand the benefits of using renewable energy and be familiar with renewable energy technologies (biogas, LPG, etc.). Developing strategies at the community level for adopting renewable energy provides tailored solutions that consider local contexts and preferences. Simultaneously, constant awareness and training efforts are essential to combat misinformation and misconceptions about renewable energy. Educated households can make informed choices, understanding the benefits and positive impacts on their energy consumption patterns.

4. Collaboration and Policy Involvement:

Collaborate and be involved in the subregional politics of Renewable Energy.

Collaborating in subregional renewable energy policies promotes knowledge sharing and resource pooling. It enables the implementation of consistent regulations and incentives that can accelerate the transition to renewable energy. Active involvement in policy discussions ensures that urban energy needs are represented and conducive frameworks are developed to support renewable energy integration.

By addressing these aspects, a comprehensive approach is taken to reduce urban households' reliance on traditional energy sources for cooking and promote the adoption of renewable alternatives.

FURTHER STUDIES

The research conducted establishes a fundamental platform for comprehending the intricacies of transitioning urban households to renewable cooking energy sources. However, there exists a realm of unexplored dimensions that beckon further investigation, aiming to enrich our comprehension of the multifaceted energy transition landscape. Delving deeper into the aforementioned factors, we can foster a holistic and nuanced understanding that will undoubtedly refine strategies and tactics, thus steering the trajectory towards sustainable energy practices within urban communities. The pursuit of additional studies is essential to unlock fresh perspectives, optimize existing approaches, and ultimately pave the path toward a future where sustainable energy practices thrive within urban contexts in Guinea.

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