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BudgIT is a civic organisation that uses creative technology to simplify public information, stimulating a community of active citizens and enabling their right to demand accountability, institutional reforms, efficient service delivery and an equitable society.

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About Resource Justice Network

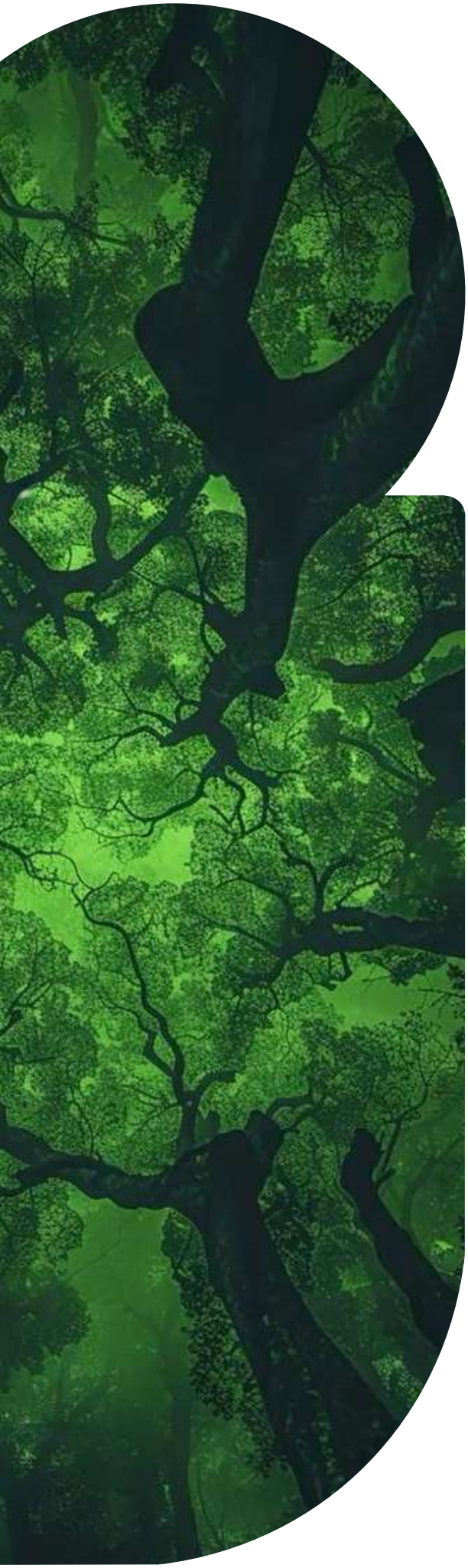
Resource Justice Network (formerly Publish What You Pay) is a global civil society movement of more than 1,000 member organizations in more than 50 countries around the world. RJN coalitions have contributed to legislative, policy, and corporate behaviour change at local, national, and international levels to advance the open, accountable, equitable, sustainable, and responsive governance of oil, gas, and minerals.

About the Community Champion's Climate Fellowship

As part of the social bonds programme in Nigeria, BudgIT's project "Energizing Sustainability" funded by the Resource Justice Network, incorporates a climate focused fellowship that builds the capacity of young leaders and fledgling organisations with the requisite skills and support to drive the campaign for a just energy transition and climate justice. The program not only empowers beneficiaries with the support and skill to engage but also promotes the inclusion of youths, marginalised and vulnerable segments of the society, in the decision making process of issues that significantly impacts their lives and future.

The BudgIT/RJN fellowship addresses the multifaceted challenges of energy transition and climate change, especially within the context of a petro-dependent, developing country like Nigeria, This is very important as issues such as the inclusion of gender and PWDs in Nigeria's ETP, fiscal sustainability in a post-fossil fuel world, the place of metals and minerals in the transition, environmental remediation in a transitioning developing country etc., need to be addressed.

Table of Content



Climate Health Surveillance and Energy Transition: Grassroots Insights from Climate Health Equity Africa (CHEA)

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About the Fellow

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Abstract

The global energy transition offers not only environmental benefits but also critical public health gains. In Nigeria, reliance on biomass and kerosene for cooking and limited electricity access drive respiratory illnesses, weaken healthcare delivery, and worsen vulnerabilities to climate shocks such as floods and heatwaves. This paper explores how Climate Health Equity Africa (CHEA) addresses these challenges through its Climate and Health Observatory and capacity-building initiatives. The Observatory enables communities, especially health workers, women, caregivers, and youth to report health issues linked to climate and energy, generating evidence that informs planning and advocacy. Training programs further equip residents to engage in policy dialogue and co-develop solutions. Findings emphasise that community-driven data strengthens equitable energy policies and interventions. The paper recommends policy integration, improved project tools, and deeper community engagement to ensure Nigeria's energy transition is health-responsive and inclusive.

1.0 Introduction

The global transition from fossil fuels to renewable energy sources is widely recognised as an environmental imperative, yet it also represents a major public health opportunity (World Health Organisation, 2021). Clean and affordable energy can significantly reduce greenhouse gas emissions; mitigate indoor air pollution, and lower health burdens caused by climate change (Intergovernmental Panel on Climate Change [IPCC], 2022). However, the success of this transition depends on inclusivity. Policies developed without community input risk overlooking daily realities such as reliance on biomass fuels for cooking, lack of reliable cooling during heatwaves, or electricity shortages in health facilities (International Energy Agency [IEA], 2020). Ensuring community participation is therefore critical to making energy solutions equitable, culturally relevant, and health-promoting.

In Nigeria, these challenges are particularly urgent. Millions of households still lack dependable electricity and rely on firewood, charcoal, or kerosene for cooking (IEA, 2022). Such reliance contributes significantly to household air pollution, a leading cause of respiratory illnesses (WHO, 2021). At the same time, persistent energy poverty undermines healthcare delivery, limiting the ability of clinics to store vaccines, operate diagnostic tools, or run life-saving equipment (Adelekan, 2016). These vulnerabilities are compounded by climate shocks such as heatwaves, floods, and water scarcity that further threaten health and well-being (IPCC, 2022). Addressing these intersecting challenges requires connecting energy transition policies to local health priorities.

Climate Health Equity Africa (CHEA) was established to address this nexus of climate, health, and gender equity. It's Climate and Health Observatory provides a community-based disease surveillance platform through which residents particularly women, caregivers, and youth document local health challenges linked to energy and climate. Complementary capacity-building programs train communities and health workers to engage in advocacy, data collection, and dialogue with policymakers. By transforming grassroots voices into actionable insights, CHEA advances equitable and health-responsive energy transition strategies.

This paper examines how CHEA Climate Health Observatory and capacity-building initiatives address the intersection of climate, health, and equity in Nigeria, and to explore how community-generated evidence can inform an inclusive and health-responsive energy transition. It provides answers to the following questions:

How does CHEA's Climate and Health Observatory capture community-level health challenges linked to climate and energy issues in Nigeria? In what ways do capacity-building initiatives empower communities particularly women, youth, and caregivers to participate in data collection, advocacy, and policy dialogue? How can grassroots evidence from the Observatory be integrated into national energy and health policies to ensure equity and sustainability? What lessons and recommendations emerge from CHEA's approach for strengthening the link between community engagement, health outcomes, and Nigeria's energy transition?

2.0 Methodology

This study adopted a community-based participatory approach to examine how the Climate Health Equity Africa (CHEA) Observatory and capacity-building initiatives address climate–health challenges within Nigeria's energy transition. Both primary and secondary sources of data were used to provide a balanced perspective.

Primary data was collected directly from communities through surveys, structured questionnaires, focus groups and observation checklists.

2.1 Data Collection

Three main methods were used:

1. Key Informant Interviews (KIIs): A total of 25 semi-structured interviews were conducted with health workers, community leaders, women's group representatives, and youth advocates in Nasarawa, Rivers and Benue States. These interviews explored perceptions of energy poverty, household fuel use, climate-related health risks, and engagement with CHEA's Observatory.

2. Household Surveys: 100 structured questionnaires were administered to households across three communities (urban, peri-urban, and rural) to capture data on cooking fuels, electricity reliability, exposure to climate shocks, and health outcomes such as malaria, diarrhea, respiratory symptoms or heat stress. Respondents were selected using stratified sampling to ensure gender and age representation, with 60% of respondents being women, reflecting their role in energy use and caregiving.

3. Focus Group Discussions (FGDs): Four FGDs were held, two with women caregivers and two with youth groups, to generate insights into barriers to adopting clean energy solutions and community priorities for health resilience.

Secondary data included CHEA's project records and relevant reports on energy and health in Nigeria, which provided additional context and helped validate field findings.

For analysis, data from surveys and questionnaires was compiled into Excel spreadsheets, which allowed for easy entry, categorisation, and visualisation of trends across groups, such as women, children, and different age categories. Observation notes were also organised in Excel to identify common patterns across sites. This simple but effective tool enabled both researchers and community members to interpret results clearly.

The Observatory itself functioned as a platform for organising, validating, and sharing findings, while capacity-building activities ensured that residents and health workers contributed actively to data collection and interpretation. This participatory element helped strengthen accuracy and built community ownership of the results.

By combining surveys, questionnaires, observation checklists, and Excel-based analysis, the methodology ensured that community voices were at the centre of evidence generation. This

approach not only supported academic inquiry but also produced actionable insights for health and energy planning in Nigeria's ongoing transition.

2.2 Case Study Description

- Benue, Nasarawa, and Rivers State represent three distinct regions in Nigeria that reflect the country's intersecting challenges of energy poverty, climate change, and public health. Benue, located in north-central Nigeria, is primarily agrarian and characterized by rural settlements. Nasarawa, also in north-central Nigeria, has experienced steady population growth due to its proximity to the Federal Capital Territory, Abuja (National Bureau of Statistics [NBS], 2020). In contrast, Port Harcourt, the capital of Rivers State in the Niger Delta, is a highly urbanized and industrial hub with a concentration of oil and gas activities (Olujobi, 2020).
-
- Despite these differences, all three regions face overlapping vulnerabilities. Rural communities in Benue and Nasarawa struggle with poor infrastructure, weak health systems, and limited energy access. Port Harcourt, while urbanized, is marked by informal settlements and significant environmental degradation linked to industrial activity (UN-Habitat, 2014). Across all three contexts, unreliable electricity, inadequate water systems, recurrent flooding, and widespread health risks such as malaria, respiratory infections, diarrheal diseases, and maternal health challenges are common. Climate change, air pollution, and rising heat stress exacerbate these vulnerabilities (Intergovernmental Panel on Climate Change [IPCC], 2022).
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- Energy poverty remains a critical barrier to health and development in Nigeria. Although some households are connected to the national grid, power supply is highly unreliable, characterized by frequent outages and voltage fluctuations. As a result, many families and businesses rely on petrol and diesel generators, which are costly, emit harmful fumes, and contribute to both noise and air pollution (Akinwale et al., 2014).
-
- Cooking practices illustrate further inequities. In Tarka LGA, Benue state and Lafia LGA, Nasarawa state, firewood and charcoal remain the dominant fuels, while in Port Harcourt, Rivers state, kerosene and charcoal are common. Liquefied Petroleum Gas (LPG) is available but remains unaffordable or inconsistently distributed for many households (International Energy Agency [IEA], 2022). Reliance on polluting fuels contributes to indoor air pollution, which is strongly associated with respiratory illness, eye irritation, and poor maternal and child health outcomes (World Health Organization [WHO], 2021).
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- Additionally, climate change has increased the frequency of heatwaves and extreme weather, intensifying demand for cooling. Yet, unreliable electricity prevents households, schools, and healthcare facilities from adequately coping with heat stress. Power outages compromise vaccine storage, maternal care, and laboratory services, forcing facilities to rely on expensive generators that raise the cost of healthcare (Adelekan, 2016).
- To address these intersecting challenges, Climate Health Equity Africa (CHEA) established the Climate and Health Observatory, a participatory platform designed to document community climate–health experiences and connect them to evidence-based advocacy. In Benue, Nasarawa, and Port Harcourt, CHEA's activities included:

- Community forums where residents discussed energy poverty, health risks, and climate exposures.

- Data collection tools such as surveys and reporting templates to capture household energy practices and climate-sensitive health symptoms.
- Awareness campaigns targeting women and caregivers on the dangers of polluting fuels and coping strategies for extreme heat.
- Integration with health systems, linking Observatory data with primary healthcare records to improve disease surveillance.
- Policy dialogues with local authorities, energy providers, and civil society to ensure community-generated evidence informs decision-making.

The Observatory relied on multi-sectoral collaboration. Primary Health Care Centers (PHCs) integrated Observatory data into patient monitoring. Community pharmacies used the insights to anticipate health demands and advocate for stable electricity for medicine storage. Hospitals validated community-level observations and provided referrals for severe cases. Community-based organizations including women's groups, youth associations, and faith-based networks mobilized households and advanced advocacy. Local government and energy actors engaged with CHEA to promote clean cooking, improve energy planning, and electrify health facilities.

This collaborative framework created a feedback loop that connected community realities with institutional responses, positioning the Observatory as both a data source and an advocacy tool for equitable energy transitions in Nigeria.

3.0 Community Voices

At the heart of the Climate Health Equity Africa (CHEA) Observatory lie the lived experiences and perspectives of local communities who are directly impacted by the intertwined challenges of climate change and health. Their voices reveal not only the urgency of the issues but also the knowledge, and adaptive strategies communities bring forward.

During an interview with a trader at Rumuokoro Market in P.H, Rivers State, who sources her goods from northern Nigeria, she shared how erratic weather patterns have disrupted both her livelihood and health. "Before, the rains came when we expected them. Now, they are either delayed or too heavy, and this has affected the cost and quantity of the goods I buy. My children also fall sick more often with fever and stomach problems from the bad water," she lamented. Her experience illustrates the growing connection between unpredictable rainfall, rising food insecurity, and waterborne diseases

For women, particularly those responsible for caregiving, the burden is even heavier. Miriam, a mother of four from Nasarawa, explained: "When my children fall sick from diarrhoea or heat rashes, it is me who runs around to find medicine or water. Climate change is not just about the farm it is about the stress on mothers." Her voice highlights the gendered dimensions of climate-health

impacts, where women often serve as the first responders within households but remain underrepresented in decision-making processes.

The establishment of a localised climate health observatory has already yielded visible benefits in pilot communities. Residents report that having their stories documented creates a sense of recognition and validation. As one elder in Benue State expressed: “They have been collecting our words and writing them down. It makes us feel that our suffering is seen, not forgotten.”

Yet, challenges remain. Many community members expressed skepticism about whether their voices will truly influence policy. This skepticism underscores the need to bridge the gap between community-level observations and actionable policy reforms.

Access to technology is another limitation. In rural areas where mobile phone ownership is uneven, particularly among women, digital data collection tools may inadvertently exclude those who are already marginalised. Social hierarchies also shape whose voices are heard. In some patriarchal communities, women’s perspectives risk being overshadowed by male leaders unless deliberate measures are taken to ensure inclusivity.

The cultural dimension of community voices reveals both barriers and opportunities. Community leaders, when engaged, play a significant role in legitimizing climate-health initiatives. For example, a village head in Benue state shared: “When we speak to our people about health and climate, they listen. But first, you must bring us into the process.” Such statements emphasise the importance of respecting cultural leadership structures in driving change.

Socially, communities are experiencing shifts in cohesion as climate pressures intensify. Migration from rural to urban areas due to climate-induced crop failure is straining family ties, while those left behind must adapt to worsening conditions. Within this, women often bear disproportionate burdens but also demonstrate resilience by organising informal support groups around water access, child health, and small-scale farming.

Gender dimensions remain deeply embedded in the climate-health discourse. Women, despite being key knowledge holders about household health and food systems, frequently lack decision-making power in community planning. The Observatory has therefore sought to create safe spaces where women can share their perspectives freely.

4.0 Outcome & Lessons Learnt

The CHEA Climate & Health Observatory has demonstrated important outcomes by embedding community perspectives into evidence generation for Nigeria’s energy transition. A key achievement has been the systematic documentation of locally reported health risks. During the pilot phase, households and health workers consistently identified respiratory symptoms linked to household air pollution, heat-related illnesses among children and older adults, and diarrhoea diseases following flooding events. These reports were collated, analysed, and presented through community dashboards and policy briefs, enabling decision-makers to better understand the direct health

impacts of energy poverty and climate extremes. In some communities, this evidence contributed to greater awareness and adoption of clean cooking solutions, with women's groups reporting reductions in smoke exposure and improvements in indoor air quality.

Another significant outcome was the strengthening of community engagement pathways. Through focus groups and participatory mapping sessions, the Observatory amplified the voices of women, caregivers, and youth in defining energy–health priorities. This approach facilitated policy responsiveness, with local authorities recognising issues such as heat stress and indoor air pollution, and community health workers integrating climate–health messaging into their routine household visits.

The process also revealed challenges. Data quality was initially inconsistent, as many community health workers were unfamiliar with structured reporting. CHEA addressed this by simplifying tools, offering training, and involving trusted local mediators. Sustaining women's participation, given heavy domestic responsibilities, required scheduling flexibility, childcare support, and the use of women facilitators to foster inclusive spaces. Connectivity gaps in rural areas were managed by combining digital and paper-based reporting options.

From these experiences, three lessons stand out: community trust is essential for data accuracy; linking evidence to visible local actions sustains participation; and disaggregated data is crucial for highlighting the disproportionate burdens faced by women and children. Ultimately, the Observatory has shown that grassroots evidence can powerfully shape equitable and health-responsive energy transition strategies in Nigeria

5.0 Discussion and Recommendations

The outcomes from CHEA's Climate and Health Observatory highlight the importance of grounding Nigeria's energy transition in community realities. The Observatory demonstrates that grassroots evidence such as reports on respiratory illness from smoke exposure, heat stress, or disease outbreaks after flooding provides critical insights often overlooked in top-down policy design. These findings underscore the need to connect national energy strategies with health priorities while ensuring that communities remain active participants in shaping solutions.

At the policy level, the evidence suggests the necessity of integrating climate–health surveillance into Nigeria's broader energy and health frameworks. Policies should apply a public health lens to energy transition by mandating clean cooking initiatives, ensuring reliable electrification of healthcare facilities, and investing in climate-resilient infrastructure. Furthermore, institutionalising participatory platforms that bring together government, civil society, and local communities will make policies more inclusive, while dedicated financing can sustain grassroots monitoring systems.

At the project level, CHEA's Observatory could be strengthened through improved tools and dissemination pathways. Incorporating mobile and SMS-based reporting systems would allow

real-time data collection, while translating findings into accessible formats such as policy briefs and infographics would improve their uptake by decision-makers and communities alike. Strategic partnerships with health facilities and energy providers would also enable pilot interventions, such as solar-powered vaccine cold chains or clean cooking hubs, guided by Observatory insights.

Finally, deepening community engagement is vital for long-term sustainability. Expanding participatory training modules, establishing community advisory boards, and recognising local champions, particularly women and youth, would enhance ownership and advocacy. Embedding cultural relevance, such as aligning clean energy technologies with local cooking practices, ensures that interventions are both acceptable and effective.

In summary, CHEA's work illustrates that when community-generated evidence is integrated into policy and practice, the energy transition can become not only environmentally sustainable but also health-responsive and socially equitable.

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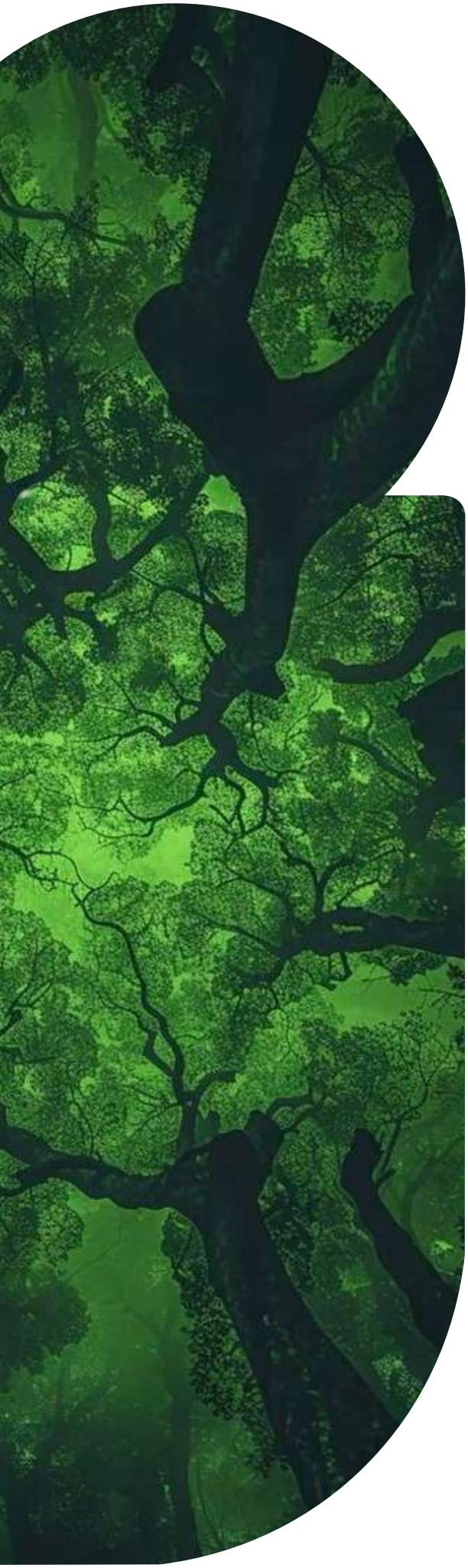
Appendix

Pictures from CHEA Climate Health Observatory and capacity-building initiatives



Community Voices in Africa's Clean Energy Transition: A Case Study of Afritekers Smart Digital Solutions

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About the Fellow

Moses Deshi is a social entrepreneur and CEO of Afritekers Smart Digital Solutions, committed to expanding clean energy and smart technology access in Africa. With over six years of leadership experience, he develops innovative solutions that empower households, businesses, and communities across Nigeria and beyond.

Abstract

This study explores community perspectives on Afritekers Smart Digital Solutions as an emerging model for Africa's clean energy transition. Using a mixed-methods approach—surveys, semi-structured interviews, and focus group discussions, the research examined households, small businesses, and prospective Afritekers staff in Badagry and nearby communities. Findings reveal widespread dependence on costly and unsafe energy sources, with households and businesses spending significant income on petrol generators and kerosene. Respondents expressed strong demand for affordable, flexible payment models, moderate trust in startups, and high value for after-sales support. Clean energy was consistently linked to improved health and wellbeing, while inclusivity of women and youth emerged as a critical adoption factor. The study concludes that Afritekers' success depends on flexible financing, community engagement, and sustainable support systems, offering insights for policymakers, startups, and development actors committed to equitable energy transitions in Africa.

1.0 Introduction

Nigeria loses an estimated $29 billion yearly due to Africa's pressing energy problem, where more than 600 million people lack consistent access to electricity (IEA, 2020). to electricity outages (World Bank, 2020). This deficiency forces communities to rely on harmful and unsustainable options like kerosene, firewood, and gasoline generators, which are costly, harmful to the environment and to human health (Adeshina. Ogunleye, Suleiman, 2024).

By moving towards renewable energy, the global energy transition offers a chance to tackle these issues.Communities all over Africa actively participate in determining the results of clean energy initiatives rather than merely receiving them.

Local cooperatives, community-based groups, and grassroots organizations that pool resources to invest in solar home systems, mini-grids, or clean cooking technologies are common ways to participate. (Ekpotu, Akintola, Obialor, et al., 2024). For instance, women's organizations in Nigeria have used current social networks to raise awareness and establish trust, making them key participants in the campaign to promote clean cookstoves. In the same way, youth-led businesses are pioneering mobile-pay solar distribution, which is fostering acceptance among their peers (Chukwuemeka et al., 2023).

However, in order for the transition to be successful, it must be equitable and inclusive, giving community voices a central role in influencing both technology acceptance and regulatory frameworks. Ignoring local realities in energy solutions runs the risk of exclusion, opposition, and inefficiency (Olajire, Gbadegesin &Gbadegesin, 2023).

The mismatch between national energy strategies and community-level demands has frequently hindered the uptake of renewable solutions in Nigeria. For example, despite the promotion of solar home systems and mini-grids, their expensive upfront costs and lack of after-sales support have limited their adoption among low-income families and small enterprises.

Furthermore, the growth of a strong renewable energy industry has been hampered by weak regulatory frameworks and contradictory policies, leaving disadvantaged groups to bear the brunt of energy poverty.

Afritekers Smart Digital Solutions represents an emerging initiative that seeks to respond to this challenge. Through its Liimbo platform, Afritekers envisions building Africa’s largest clean energy and smart solutions marketplace, connecting individuals, households, and businesses to affordable solar panels, batteries, inverters, and AI-enabled systems. While Afritekers has not fully launched, its mission, values, and early engagements provide a foundation for analyzing how grassroots perspectives can guide future interventions.

1.1 The goals of this project

1. To record local opinions and expectations about the clean energy and digital solutions that Afritekers has suggested.

2. To examine the possible benefits and difficulties that communities anticipate in connection with Afritekers' proposed activities.

3. To determine the potential social, economic, and environmental effects of Afritekers' project on regional communities.

4. To make practical suggestions for inclusive, scalable, and community-driven energy transition models that Afritekers and other firms may implement

This study adds to larger discussions about fair energy transitions and provides useful information for entrepreneurs, policymakers, and community stakeholders by looking at the rising role of Afritekers.

1.2 Methodology

This work will employ a mixed-method research design, combining both qualitative and quantitative approaches to provide a holistic understanding of community perspectives on Afritekers' proposed clean energy solutions. For the qualitative part, semi-structured interviews with households, small business owners, school administrators, and prospective Afritekers staff will be administered. Focus Group Discussions (FGDs) with youth entrepreneurs to capture group dynamics and shared perspectives. Scenario-based questions to explore how communities might use and adapt Afritekers' clean energy products under different conditions. Lastly, observation of existing energy practices (e.g., reliance on generators, kerosene, and solar products).

On the quantitative side, structured surveys using a five-point Likert scale to measure general perceptions, attitudes, and readiness towards clean energy solutions (e.g., affordability, trust in startups, willingness to adopt).

The population sample for this study comprises three categories: households, small business owners, and 5 Afritekers' prospective staff, drawn from Badagry communities in Lagos State. A purposive sampling strategy will ensure representation across gender, age brackets, and business sectors, with a minimum of 35 households, 20 small business owners, and 10 Afritekers staff targeted for participation. This sample size is considered sufficient to capture diverse perspectives while allowing for manageable analysis within the scope of this study.

1.3 Analytical framework

The work adopts 2 analytical Frameworks which include:

Diffusion of Innovation Theory to analyze how communities may adopt Afritekers' clean energy products, considering factors such as affordability, trust, and social influence and Triple Bottom Line (TBL) Framework to assess potential sustainability across three pillars, social (equity and inclusivity), environmental (emissions reduction), and economic (cost savings and job creation).
This combination allows the study to not only capture community perspectives but also situate them within broader theoretical and sustainability lenses.

2.0 Case Study Description

Badagry, a historic town in Lagos State, Nigeria, is one of the fastest-growing communities in the region, marked by rapid urbanization, a youthful population, and an increasing demand for reliable infrastructure and services (Sorensen-Gilmour, 1995).

Despite its strategic location as a border town and hub for trade and commerce, the community grapples with persistent electricity shortages that disrupt both household life and business activities. Like many parts of Lagos and Nigeria at large, Badagry residents face long hours of blackouts, leaving them heavily dependent on alternative energy sources.

With a dense population that continues to grow, the strain on the already weak electricity grid makes access to consistent power even more difficult, often forcing families and enterprises to resort to unsustainable alternatives (Aminu, 2020).

Figure 1: An aerial view of Badagry, Lagos State (Source: pmnewsnigeria.com)

The energy situation in Badagry has created multiple challenges for daily living. For many families, energy costs can consume up to 20–30% of monthly earnings, leaving little room for other essentials such as education and healthcare (Obafemi & Ifere, 2014). Small businesses also struggle, as unreliable electricity directly affects productivity and profitability, forcing many to shut down earlier than planned or incur extra expenses maintaining generators (Adamu & Ade., 2020). While solar products have begun to enter the market, their adoption remains slow due to high upfront costs, lack of consumer awareness, and skepticism about reliability. These realities highlight the urgent need for innovative, affordable, and accessible clean energy solutions tailored to the needs of the Badagry community.

Afritekers Smart Digital Solutions positions itself as an emerging enterprise committed to addressing these challenges through a bold vision of enabling a sustainable and smarter Africa. Its mission is to

build the continent's largest clean energy and tailored smart technology marketplace, ensuring that individuals, households, and businesses can easily access solutions that meet their energy needs within their budgets.

The company's flagship product, Liimbo, is designed as both an online and physical platform where communities can find a range of affordable clean energy products, including solar panels, batteries, inverters, and AI-enabled systems. By providing this marketplace, Afritekers seeks not only to improve access to clean energy but also to promote local innovation, productivity, and sustainability.

At the core of Afritekers' approach are values that reflect its aspirations: creativity in designing innovative solutions, connectedness in linking consumers with manufacturers and service providers, sustainability in promoting environmentally friendly alternatives, accessibility in ensuring affordability and reach, and innovation in integrating smart technologies with clean energy. Through these guiding principles, Afritekers aims to build trust within communities like Badagry, where energy poverty has long been normalized, and create a pathway toward a just energy transition.

The success of Afritekers' model, however, depends heavily on collaboration with diverse stakeholders. In particular, local manufacturers and distributors of solar panels and smart technology products in Badagry and its environs such as Sunking Solar Products, Qasa Solar Generator, D-Ultimate Solar Energy, and Kingken Solar Systems, are critical to ensuring that solutions are affordable and tailored to community needs.

International technology providers bring expertise and advanced systems that can complement local innovations. Community-based cooperatives, especially women's groups and youth associations, serve as essential partners in mobilizing grassroots adoption, building trust, and providing feedback that refines the solutions offered (Kaze, Balta-Ozkan, & Shrimpton, 2025). Government agencies and NGOs also play a pivotal role by creating enabling policies, offering subsidies or incentives, and supporting community education and awareness campaigns on clean energy. Together, these stakeholders form a network that can amplify Afritekers' efforts to deliver transformative impact in Badagry and beyond, making clean, reliable, and sustainable energy not just a dream but a lived reality for African communities.

3.0 Data Analysis and Findings

The findings from this study provide critical insights into the realities of energy access and the community's readiness to embrace Afritekers' clean energy solutions. Drawing on both qualitative interviews and quantitative survey data, the results highlight not only the economic and health burdens of current energy practices but also the opportunities and challenges for adoption of renewable alternatives. The analysis is organized around key themes, household energy use, business productivity, affordability, trust in startups, inclusivity, and adoption models, allowing for a nuanced understanding of how different groups perceive and engage with clean energy transitions.

From the data collected and analysed, households reported high energy costs, heavy reliance on generators, and the disruptive impact of blackouts on wellbeing. While trust in startups was modest

(mean = 3.92), there was strong interest in renewable energy (mean = 3.44) and a preference for affordable, flexible payment models (mean = 3.20).

Small businesses confirmed that energy is a major operational burden, with the highest support for clean energy's health benefits (mean = 3.67). They showed moderate interest in renewables (mean = 3.33) and stressed the importance of after-sales support such as repairs and training. Trust in startups was also moderate (mean = 3.73), though businesses were more positive about Afritekers' marketplace model.

The staff survey highlighted perceptions of affordability, trust in startups, and payment preferences. With a mean affordability score of 3.2 and trust at 3.4, respondents showed moderate concern and cautious optimism, stressing the need for consistent reliability. Installment or pay-as-you-go models (mean 4.0) were most preferred, aligning with household and SME data and underscoring financing as central to adoption. Staff also emphasized after-sales support, community sensitization, and partnerships with local distributors and technicians as critical to success, warning that inadequate training and technical support could hinder deployment in rural and semi-urban areas.

4.0 Community Voices (With Data Integration)

The voices of community members reveal the lived realities of energy poverty in Badagry and other surveyed locations, as well as their hopes and concerns regarding Afritekers' emerging clean energy solutions. These perspectives highlight not only the economic and environmental dimensions of energy use, but also the cultural, social, and gendered aspects of everyday life shaped by energy access.

Household respondents confirmed that energy is a costly necessity. On a five-point scale, households rated 3.20 on average when asked if they spend too much on energy. While this suggests varied levels of burden, qualitative feedback showed that the cost of fueling generators and buying kerosene is a significant strain. One respondent explained: "It is very costly and affects my ability to provide for other needs at home." Another added: "It makes me less focused and disrupts my children's studies."

The survey revealed that generator reliance was widespread, with most households experiencing between 6–15 hours of outages daily. This explains the high reliance on generators and kerosene lamps despite their hazards.

The health dimension of these practices was recognized, with households rating 3.28 on average in agreement that clean energy would improve wellbeing.
Households also showed strong openness to renewable alternatives, with a mean score of 3.44 for interest in solar or other clean energy solutions. While less than 35% express concern in startups, majority expressed hope in Afritekers building credibility. One respondent noted: "Many companies have promised solutions before but left us stranded. I believe that Afritekers has proven that it is different."

In terms of adoption models, affordability and payment flexibility were dominant themes. Households rated 3.43 in favor of installment or pay-as-you-go options. Scenario-based responses reinforced this: “I will adopt it immediately because installment makes it possible.” This demonstrates that financing models will be crucial to inclusion.

Small businesses reported almost same experience. When asked if they spend too much on energy, the average score was 3.67, indicating that some are considering strategies or interventions to cope with energy expenses. Their responses emphasized that energy costs remain a major productivity constraint. A trader explained: “Energy is our biggest cost. If Afritekers provides solutions on credit or pay-as-you-go, it will transform our productivity.”
Businesses showed strong recognition of health and wellbeing impacts, with the highest average score of 3.67 across all items, affirming that cleaner energy is not just an economic necessity but also a health intervention.

Their interest in renewable energy was positive (3.33), and trust in startups was moderate (3.33), aligning with household responses. Business owners also emphasized after-sales support and reliability as adoption drivers. When asked about Afritekers providing repairs and training, one entrepreneur responded: “Yes, because it will help give peace of mind and ensure the system lasts.” Another highlighted that maintenance is often the reason solar products fail: “The major problem is maintenance. If Afritekers can help with that, I will adopt.”

Cultural and gender dimensions were also strongly reflected in community voices. Women, who often bear the responsibility of household energy management, linked clean energy access to wellbeing and empowerment.

One woman’s cooperative leader shared: “Clean cooking and lighting will free us from the daily stress of buying kerosene and firewood, and improve our health.” This perspective illustrates how energy solutions directly intersect with gender roles, easing the domestic burden that disproportionately affects women.

For young people, particularly youth entrepreneurs, energy access was framed as a pathway to innovation and opportunity. A respondent explained: “We are ready to explore smart tools, but training and awareness are key to adoption.” Such voices highlight the role of youth not only as consumers but also as partners in advancing energy transition.
Cross-Cutting Themes

5.0 Outcomes & Lessons Learned

The survey and interviews with households and small businesses revealed important outcomes that demonstrate both the urgency of energy transition and the potential role Afritekers could play in driving change. While Afritekers has not yet fully launched, the data provides insights into measurable needs, anticipated impacts, and key lessons for shaping its model.

One measurable outcome is the clear demand for affordable clean energy. On average, households and businesses expressed strong interest in renewable alternatives (mean = 3.44 and 3.33 respectively), with many respondents stating they would adopt Afritekers' products if offered through installment or pay-as-you-go models. This demonstrates that affordability is not just a preference but a prerequisite for adoption. In addition, the recognition of health benefits was particularly strong among small businesses (mean = 3.67), showing that clean energy is valued not only for economic savings but also for reducing health risks associated with generator fumes and kerosene use.

Another outcome is the community's emphasis on inclusivity and awareness. Both households and businesses agreed that women and youth should play an active role in clean energy program design (mean = 3.28 and 3.33 respectively). This suggests that Afritekers' success will depend on engaging these groups as stakeholders, not just consumers, thereby embedding community ownership in the adoption process.

Despite these positive signals, few challenges emerged. About 34.7% among households expressed concern in startups and moderate among businesses. Some respondents noted skepticism due to past experiences with unreliable providers.

This highlights the challenge of building credibility, which Afritekers must address through transparency, consistent service, and community demonstrations. Another challenge is the maintenance gap: respondents repeatedly emphasized that without after-sales support, renewable technologies often fail, discouraging long-term use.

From these findings, several lessons stand out for future work.
First, Afritekers must integrate flexible financing into its model to remove upfront cost barriers. Second, building community trust through pilots, testimonials, and local "energy ambassadors" is essential for credibility. Third, long-term sustainability requires after-sales service ecosystems that provide training, repair, and spare parts. Finally, inclusivity should be central: engaging women and youth will not only accelerate adoption but also ensure that solutions address the broader social dimensions of energy poverty.

6.0 Conclusion

The findings in this work show consistent trends across both groups:

- Both households and businesses expressed strong support for flexible payments (3.20 households; 3.33 businesses).

- Clean energy was widely associated with improved wellbeing (3.28 households; 3.67 businesses), largely because of the dangers of fumes and noise pollution.

- Cautious trust in startups (3.44 households; 3.33 businesses) indicates Afritekers will need strong community engagement, demonstrations, and peer testimonials as well to increase trust in start ups.

- Involving women and youth was seen as important (3.28 households; 3.33 businesses). A women's group leader explained: "Clean cooking and lighting will free us from the daily stress of buying kerosene and firewood, and improve our health." Youth voices added: "We are ready to explore smart tools, but training and awareness are key to adoption."

- Peer adoption was a strong driver, with several respondents saying they would adopt Afritekers' products if they saw neighbors or friends benefiting: *"Yes, if it's affordable and reliable, I will try it because others have benefited."*

7.0 Recommendations

The following recommendations were made for the study:

- Government and regulatory agencies should create enabling environments for startups like Afritekers by offering tax incentives, subsidies, and low-interest financing schemes that reduce the upfront cost of clean energy products. Policymakers should also integrate renewable energy into local development plans, prioritizing peri-urban and rural communities where reliance on generators and kerosene remains high.

- Afritekers should adopt flexible financing mechanisms such as pay-as-you-go and installment models to address affordability barriers. Pilot programs in communities like Badagry can serve as proof-of-concept demonstrations, allowing households and businesses to test the reliability of Afritekers' products.

- Afritekers should co-create solutions with households, businesses, women's cooperatives, and youth associations to ensure cultural and financial relevance.

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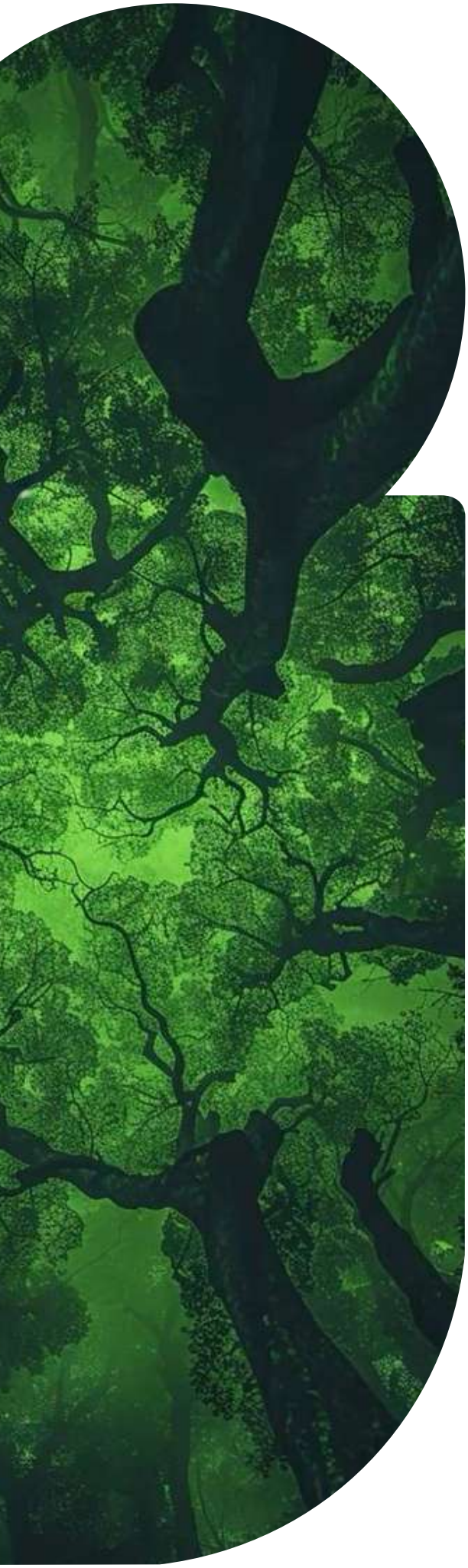

Community Perspective of Waste to Energy: Inclusion and Circular Economy in Enugu State

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About the Fellow

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Abstract

This study explores community perceptions of waste to energy (WtE) as a pathway to an inclusive and circular economy in Enugu State, Nigeria. Enugu is faced with two major problems: mounting waste from urban expansion and persistent energy poverty. Through surveys, interviews, and field observations, this research documents grassroots voices on the opportunities and challenges of adopting WtE solutions such as biogas, briquettes, and electricity generation. Findings reveal that while a majority of respondents express willingness to adopt WtE if it is affordable and safe, concerns remain around cost, safety, accessibility, and durability. Community members highlight potential benefits, including lower household expenses, job creation, cleaner environments, and reliable electricity. However, low awareness and mistrust of new technologies present significant barriers. The study concludes with policy and project-level recommendations for inclusive energy transitions in Enugu, emphasizing the significance of community education, pilot projects, and engagement of vulnerable groups such as youth, women, PWDs, and waste workers.

Keywords: Waste to Energy, Circular Economy, Inclusive Energy Transition, Community Perception, Waste Management, Enugu State

1.0 Introduction

1.1 Why Community Voices Matter in the Energy Transition

Nigeria struggles with waste management and energy poverty. Enugu State, being a rapidly growing urban hub in southeastern Nigeria, reflects this crisis acutely. Open dumping of waste clogs drainage, exacerbates flooding, and contributes to disease outbreaks such as cholera. Meanwhile, households face challenges with inconsistent electricity supply and increasing prices of cooking fuels like liquefied petroleum gas (LPG), kerosene, and charcoal. Many still rely on firewood, which exacerbates deforestation and indoor air pollution, posing a significant health risk, particularly to women and children.

Against this backdrop, Waste to Energy (WtE) emerges as a potential solution bridging two pressing needs: improved waste management and access to cleaner, affordable energy. WtE refers to technologies that convert waste into usable forms of energy, such as biogas from organic waste, briquettes from agricultural residues, and electricity from incineration or gasification. Globally, WtE has been integrated into circular economy strategies, but in Nigeria, it remains largely unexplored at the grassroots level.

A just energy transition guarantees that as the world moves away from fossil fuels and towards renewable energy, the process is fair and includes everyone, especially those most impacted by the change, by providing new opportunities for displaced workers, strengthening social support systems, and giving vulnerable communities a voice in the decision-making process for a sustainable future where "no one is left behind".

Community voices are central to the success of WtE. Too often, top-down projects overlook local knowledge, cultural practices, and the lived realities of marginalized groups. In Enugu, women (primary household energy decision-makers), youth (facing high unemployment), and waste workers (who handle much of the city's refuse) are critical stakeholders. Without their perspectives, projects risk exclusion, mistrust, or outright failure.

1.2 Overview of My Climate Initiative

Using surveys, interviews, and field observations, I have engaged directly with diverse community members for this research, from traders, food vendors, women,and persons with disabilities (PWDs) to waste workers, to understand their perceptions of waste to energy, concerns, and aspirations. These insights have helped amplify voices often excluded from climate conversations and contributed to the growing evidence base for inclusive, community-led climate solutions in African cities.

Although Ecocyclers has not yet ventured into clean energy, our experience in recycling and waste management positions us to explore sustainable energy opportunities. This work aligns with my capstone focus on waste to energy, which sits at the intersection of sustainability, innovation, and social equity.

1.3 Purpose of the Study

This research has three goals;

1. To capture community perceptions of waste to energy in Enugu.
2. To assess the barriers and opportunities for inclusive adoption.
3. To suggest policy and project recommendations for a just and sustainable energy transition.

By grounding the analysis in grassroots voices, this case study highlights not only the potential of WtE to solve interconnected waste and energy challenges but also the importance of designing solutions that are inclusive, culturally relevant, and community-owned. Overall, the study adds to the ongoing discussion on how African cities can achieve climate goals while ensuring that no community is left behind.

2.0 Methodology

2.1 Research Approach

This study adopted a mixed-methods approach combining quantitative surveys, qualitative interviews, and direct field observations.

Survey design: A structured questionnaire (Google Form) was distributed to residents across Enugu State, capturing demographics, energy use, waste management practices, awareness of waste to energy, willingness to adopt, concerns, perceived benefits, and accessibility challenges (see Appendix A for survey instrument and analysis).

Respondents: Participants included youth, women, traders, small food vendors, persons with disabilities (PWDs), and waste workers. These groups were selected because of their direct stake in energy use and waste management (see Appendix A for demographic breakdown).

Sampling: Purposive sampling was used to ensure representation across diverse socio-economic categories. Responses were collected from multiple local government areas, including Enugu South, Enugu East, Enugu North, and peri-urban settlements.

Interviews: Semi-structured interviews and voice notes were conducted with individuals willing to provide deeper reflections. Quotes included in this paper are drawn directly from these contributions (see Appendix B for interview transcripts).

Observation: Site visits to marketplaces, dumpsites, households, shops, and business areas provided contextual insights into current waste and energy practices (see Appendix C for observation photographs).

2.2 Tools and Ethics

- Data collection was conducted using Google Forms, voice recorders, and field notes.
- Analysis included descriptive statistics, thematic coding of qualitative data, and triangulation with observations (see Appendix D for charts and visualizations).
- Ethical considerations included informed consent, voluntary participation, and confidentiality. Respondents' identities remain anonymous except where explicit consent was granted.

This triangulated methodology ensures both breadth (quantitative trends) and depth (qualitative voices), allowing the study to reflect the complexity of community perspectives on waste to energy in Enugu.

3.0 Case Study Description

3.1 Community Background

Enugu State, located in southeastern Nigeria, has an estimated population of over 906,658 (Onyia & Amasiatu, 2024; World Population Review, 2025). Historically known as the "Coal City," Enugu was once a hub for fossil fuel extraction but now grapples with the paradox of energy poverty amidst urban growth. Despite urbanization and rising demand, energy access remains deeply unequal.

Nationally, Nigeria's electrification rate stands at about 57%, with rural access below 40% (Exploring sources of funding for off-grid rural electrification, 2021). Even in urban centers like Enugu, supply from the national grid (EEDC) is highly unreliable. Residents often receive fewer than 8–10 hours of electricity daily, forcing reliance on petrol and diesel generators. This imposes an economic burden on Nigerian households, and businesses spend over $14 billion annually on generators (Exploring sources of funding for off-grid rural electrification, 2021). For small traders, these costs erode fragile profits.

Cooking fuels reflect a similar challenge. About 67.8% of Nigerian households still depend on firewood, charcoal, or kerosene for cooking (Chibueze, 2024). In Enugu, many respondents reflected this reality: LPG adoption is rising but remains unaffordable due to high upfront cylinder costs and frequent price hikes. Small food vendors often use charcoal because it can be purchased in small, flexible quantities, aligning with irregular cash flows. Women, as household energy decision-makers, consistently emphasized the burden of fuel costs, smoke inhalation, and time spent sourcing cooking fuels.

3.2 Energy Needs and Challenges Before Intervention

The study revealed three pressing energy challenges:

- Affordability: Most households and businesses spend between ₦10,000 and ₦20,000 monthly on energy, with some reporting costs above ₦20,000. Given Nigeria's minimum wage of ₦70,000, energy expenses consume approximately 14–50% of household income, highlighting a significant affordability barrier (see Appendix D for supporting data).

- Reliability: Grid blackouts are routine. Some businessmen and women report difficulty running businesses without electricity, while traders lose perishable goods due to failed refrigeration. Generator dependence, while universal, exposes families to fluctuating fuel prices.

- Health and Environment: Indoor air pollution from firewood and charcoal contributes to an estimated 98,000 premature deaths annually in Nigeria (Odey, 2024). The demand for firewood drives deforestation in peri-urban forests, worsening erosion and biodiversity loss.

Waste challenges exacerbate these energy struggles. Nigeria generates approximately 32 million tonnes of solid waste annually, of which less than 30% is formally collected (Bakare, 2025). In Enugu, per capita waste generation is 0.48kg/capita/day, resulting in more than 420 tonnes per day (Nwoke et al., 2020). Informal practices, such as burning, open dumping, and scavenging, are widespread, clogging drainage channels and contributing to flooding. Dumpsites also emit methane, a potent greenhouse gas, making waste a local and global climate concern.

Waste workers, who are central to collection, face occupational hazards and lack protective equipment. Their exclusion from formal planning underscores the need for inclusive approaches that value them as partners in a circular economy.

4.0 Project Overview

Waste to Energy (WtE) is proposed as a dual solution to Enugu's crises of waste and energy. Its promise lies in transforming waste liabilities into energy assets:

Biogas: Organic waste from households, markets, and abattoirs could be processed into biogas, reducing reliance on LPG and firewood.

Briquettes: Agricultural residues and combustible waste can be converted into briquettes, cleaner alternatives to charcoal with reduced smoke and higher efficiency.

Electricity Generation: Large scale waste to energy plants could convert municipal solid waste into electricity via incineration or gasification, easing landfill pressure and strengthening the grid.

Community survey responses showed cautious optimism. As one respondent said:

"Waste to energy can solve two problems at once: our waste on the streets and the high cost of cooking."

Another added:
"If it is cheaper and safe, everyone will use it."

This reflects a readiness to embrace waste to energy if affordability, safety, and inclusivity are ensured.

Key Stakeholders and Partners

The ecosystem of WtE adoption in Enugu involves multiple interconnected actors:

Households & Traders: The largest group of end-users, they prioritize affordability, safety, and accessibility. Their acceptance is crucial for scaling waste to energy.

Waste Workers: Central actors in waste collection, often excluded from formal planning. Without their inclusion, WtE risks disrupting livelihoods; with inclusion, they become allies in material recovery.

ESWAMA: ESWAMA remains a statutory backbone for waste governance. Its cooperation is critical for waste feedstock supply.

NGOs & Community Groups: Organizations like Eco-Cyclers and SutyVibes are grassroots innovators, trusted within communities, and essential for building awareness and piloting projects.

Policymakers: The Enugu State government holds the power to enact enabling legislation, provide subsidies, and integrate WtE into broader energy and climate strategies.

Private Sector & Innovators: Entrepreneurs designing low-cost digesters, briquette machines, and off-grid solutions must be supported to connect innovation with community needs.

Together, these stakeholders form an interconnected network whose collaboration is essential to scale WtE into a community-driven, sustainable model for Enugu.

5.0 Community Voices

5.1 Quotes, Local Stories and Perspectives

The survey and interviews offered valuable insights into community views on Waste to Energy. These voices, grounded in daily experiences of high cost of energy bills, energy scarcity, unreliable power supply, and waste mismanagement, reflect both hope and hesitation.

Awareness of waste to energy was relatively high among respondents. Many had encountered the concept through schools, NGOs, TV, social media, and church discussions. As a youth and food vendor responded,

"I have heard about it. The first time was some years ago, over 10 years ago. I heard someone say they can use waste to generate light. I thought it was a joke."

But few had ever seen the technology applied locally. Some had not encountered it, as one woman responded,

"I'm just hearing it for the first time."

This illustrates the gap between theoretical knowledge and practical demonstration. Also, the need for more awareness, but also interest and openness to adoption, was notable. A majority of participants stated they would "definitely" consider waste to energy if it were safe, affordable, and reliable. Others expressed conditional willingness, emphasizing the need for real-life demonstrations:

"Maybe, I need to see it first."

This conditional optimism was strongly linked to frustration with existing systems. For many, waste to energy represents not just a new technology, but a chance to escape dependence on expensive and unreliable energy. A trader explained:

"If waste to energy will be cost-effective, we will buy into it."

These testimonies show that communities are not passive beneficiaries but active seekers of alternatives that address the structural problems in their daily lives.

5.2 Perceived Benefits, Challenge, and Changes

Community views on waste revealed both potential advantages and significant concerns, informed by their previous experiences.

Perceived Benefits

- Economic Relief: High energy costs dominate household budgets, making affordability the most immediate concern. Many believed waste to energy could reduce this burden:

"It will lessen the cost of energy and create more job opportunities."

Here, waste to energy was seen not only as an energy solution but also as a livelihood generator.

- **Cleaner Environment:** Residents consistently linked waste to energy to visible improvements in sanitation and drainage. The accumulation of refuse is a daily frustration, and waste to energy offered hope for a cleaner city:

"A cleaner environment means a healthier environment."

- **Health Gains:** Reduced reliance on firewood and charcoal was seen as particularly beneficial for women and children, and even charcoal users. One respondent noted:

"It will improve health, which means less smoke for charcoal users."

- **Employment Opportunities:** Waste workers, traders, and youth emphasized that waste to energy could transform waste into dignified employment:

"I believe many will see it as a job created for them, and it will reduce stealing and fraud."

These perceived benefits align closely with global literature on WtE, which identifies co-benefits in health, environment, and employment.

5.3 Concerns and Challenges

Safety: Most concern was about explosions, odors, and widespread contamination.

"I don't know if it will be safe."

Cost: Affordability was also a common worry. Several respondents feared waste to energy would benefit only the rich:

"If it will not be costly, why not?"

Durability and Reliability: Many referenced past disappointments with the grid and their current electricity source.

"If it will serve me, why not?"

Accessibility for PWDs: Persons with disabilities questioned whether they would be included in system design and showed concern for accessibility:

"It may not be accessible for persons with disabilities."

These concerns underline that technical innovation alone is not enough; trust, affordability, user-centered design, and accessibility for PWDs are essential.

5.4 Cultural, Social, and Gender Dimensions

Beyond technical and economic considerations, the study revealed how waste intersects with social roles, cultural practices, and inequalities:

Women: As primary household energy managers, women carry the heaviest burdens of rising fuel prices and health risks. Many reported alternating between LPG and charcoal depending on income flow and availability. For them, WtE represents both economic relief and health protection.

Youth: While frustrated by energy poverty, youth were also the most eager to see waste to energy as an innovation frontier. Many envisioned entrepreneurial roles in producing, distributing, or maintaining waste technologies. They perceived it as another business venture or source of income.

Persons with Disabilities (PWDs): They raised critical reminders that accessibility waste collection points, biogas systems, or payment models must be designed inclusively. Otherwise, WtE risks replicating existing inequalities. They commented that "if waste is converted to energy, it will be a good development in the country."

Waste Workers: Their perspectives combined fear and hope. Some worried about displacement if WtE became corporatized. An informal waste collector said that on some days:

"Sometimes we come out and work safely, other times we are arrested by the waste authority."

Others embraced it as a chance for formal employment and dignity if they were included in training and operations.

These voices demonstrate that WtE is not merely a technical intervention but a socially embedded process. Its success depends on affordability, transparency, and inclusive design that acknowledges the lived realities of women, youth, PWDs, and informal worker groups who bear the brunt of current energy and waste challenges.

6.0 Outcomes and Lesson Learned

6.1 Measurable Impacts

Although Waste to Energy (WtE) remains at the conceptual and advocacy stage in Enugu, this study revealed several measurable community perceptions:

- **High interest:** A majority of survey respondents expressed strong willingness to adopt WtE if it were affordable and safe. This shows readiness to embrace alternatives to firewood, charcoal, and unreliable grid supply.

- **Economic burden:** Many respondents reported spending between ₦5,000 and ₦20,000 and above monthly on energy, representing a significant share of income. This underscores the potential of waste to energy to relieve household financial pressure if it offers cheaper energy.

- **Environmental concern:** Residents consistently linked WtE adoption with benefits such as reduced waste, cleaner streets, and improved drainage systems. This reflects a grassroots understanding of the link between waste management and community well-being.

These impacts demonstrate that communities already view waste to energy as more than an energy solution; they see it as a pathway to improved health, cleaner environments, and job creation.

6.2 Challenges Faced and How They Were Addressed

Respondents identified several challenges that must be overcome for waste to energy adoption to succeed:

Affordability: The fear that WtE would be priced beyond reach was widespread. Flexible payment systems, subsidies, or community-based cooperative financing were suggested as ways to make it accessible.

Safety Concerns: Fears of explosions, odors, and contamination reflect mistrust of new technologies. These concerns could be addressed through pilot demonstrations, safety certifications, and awareness campaigns.

Durability & Reliability: Past experiences with faulty energy devices and the ordeal with the power supply from national grid is shaped skepticism. Respondents emphasized the importance of quality assurance, maintenance services, and technical training.

Exclusion of Vulnerable Groups: Women, youth, persons with disabilities (PWDs), and waste workers highlighted specific barriers. Addressing these requires inclusive planning, targeted training, and participatory decision-making.

6.3 Insights for Future Work

Several lessons emerge for advancing WtE in Enugu and beyond:

- **Pilot Projects First:** Communities want to see before they believe. Small-scale pilots in schools, markets, and neighborhoods would showcase safety, reliability, and affordability.

- **Economic Models Matter:** waste to energy must compete with firewood and charcoal in both cost and convenience. Pay-as-you-go and cooperative financing models could ensure adoption.

- **Community Ownership Is Key:** Long-term sustainability requires co-creation with local actors. By engaging women, youth, waste workers, and PWDs from the outset, projects will achieve stronger legitimacy and trust.

- **Framing waste to energy as multi-benefit:** Positioning waste to energy as a solution for both energy and waste resonates strongly with communities, who see both crises as intertwined.

The overarching lesson is that technical solutions must be embedded in social systems. Waste to energy in Enugu will only thrive if designed not just as an energy intervention, but as a community-owned, culturally relevant, and inclusive solution.

7.0 Recommendations

7.1 Policy Level Recommendations

For Waste to Energy (WtE) to scale meaningfully in Enugu, strong policy support and enabling frameworks are essential. The Enugu State government should formally integrate WtE into its energy and waste management strategies, aligning with Nigeria's national renewable energy and climate goals. This would create legitimacy, signal political will, and attract both domestic and international investors.
Key measures include:

- Providing tax incentives, subsidies, and favorable tariffs for companies and cooperatives investing in WtE.

- Establishing public-private partnerships (PPPs) to mobilize technical expertise, financing, and innovation from the private sector, NGOs, and academia. Notably, the idea of leveraging PPPs as proposed is also being implemented by the Enugu State Waste Management Authority, as stated by one of their staff.

- Introducing targeted subsidies for households and small businesses, ensuring WtE adoption does not become an elite-only solution but reaches low- and middle-income groups most affected by high energy costs.

7.2 Project Level Improvements

Pilot programs should serve as demonstration hubs to build community trust and prove viability. Priority sites include markets, schools, and neighborhood clusters, which generate concentrated waste streams and have clear energy needs.
To embed inclusivity:

- Training programs should specifically target women, youth, and waste workers, enabling them to become operators, technicians, and entrepreneurs within the WtE ecosystem.

- Financing models must reflect local income realities: pay-as-you-go systems, cooperative ownership models, and micro-financing schemes can ensure affordability and long-term uptake.

- Partnerships with local innovators can accelerate the production of low-cost digesters and briquette machines, reducing dependence on imports.

7.3 Ways to Deepen Community Engagement

At the grassroots level, adoption depends on awareness, accessibility, and usability. Awareness campaigns should leverage trusted channels such as churches, mosques, schools, radio, and town union meetings to reach a wide audience.

Technologies must be:

- Simple to operate and supported by strong after-sales services.
- Designed with universal accessibility in mind, ensuring persons with disabilities (PWDs) can benefit equally.
- Embedded in participatory models where communities co-design projects, strengthening ownership and long-term sustainability.

Together, these measures will ensure that WtE in Enugu evolves into a technically viable, socially inclusive, and community-driven model, with potential for replication across other Nigerian states.

8.0 Conclusion

This case study demonstrates that Enugu residents view WtE as both a solution to waste problems and a pathway to affordable, cleaner energy. While enthusiasm is high, adoption will hinge on addressing concerns of cost, safety, accessibility, and durability. Vulnerable groups, especially women, youth, PWDs, and waste workers, must be at the center of any initiative.

By listening to community voices, Enugu can pioneer an inclusive, circular energy economy that reduces environmental hazards, lowers household energy burdens, and creates new livelihoods. Waste in Enugu thus represents not just a technological shift but an opportunity to reimagine the energy transition as a truly community-led process.

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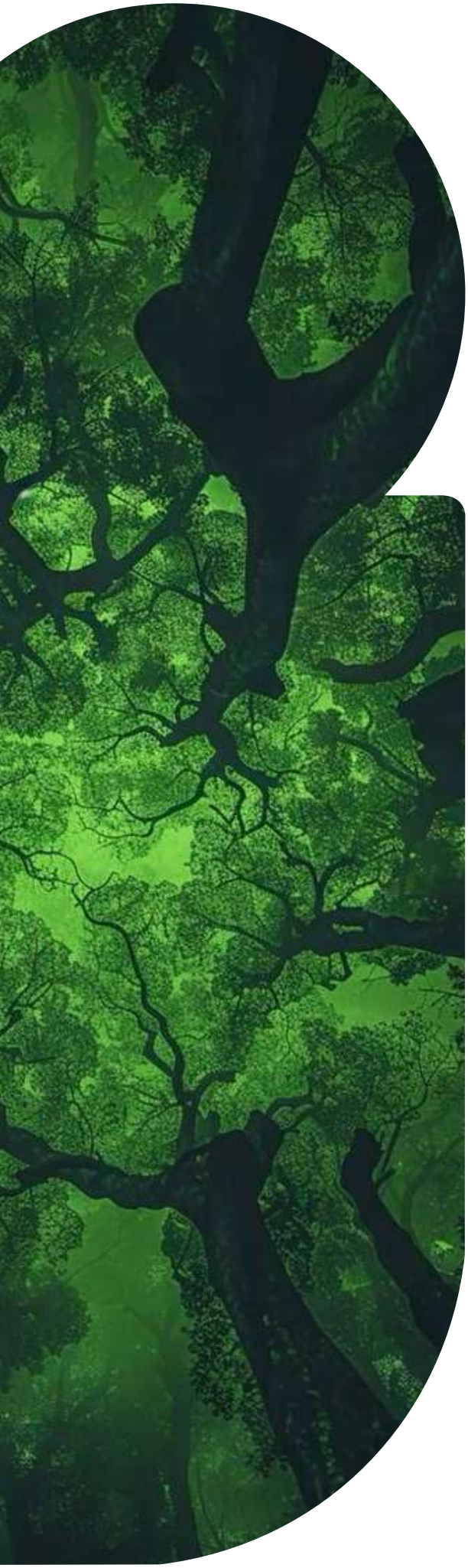
Appendix

Survey Questions and summary of findings

Community Perceptions of Waste-to-Energy: Inclusion and Circular Economy in Enugu State Survey

Table A-1. Summary Table of Key Findings

Aspect	Key Results
Demographics	Majority youth (26–35 yrs, 42.5%); more females (55%)
Cooking Fuels	80% use LPG; few use firewood/charcoal
Lighting	77.5% rely on EEDC; 15% lack regular electricity
Energy Spending	Split between ₦10,000–₦20,000 (30%) and ₦20,000+ (30%)
Waste Handling	37.5% collected by govt; 27.5% dumped openly
Inclusion	40% face energy challenges (cost, access, PWD issues)
Awareness of Waste to Energy	82.5% aware; schools & social media main sources
Adoption Willingness	72.5% “Yes, definitely”
Concerns	Safety, cost, accessibility most cited
Perceived Benefits	Lower costs, cleaner community, jobs most cited



Community Voices In The Energy Transition: Experience of women affected by oil pollution

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About the Fellow

Salwa Surajudeen is an advocate for women's empowerment and climate action. At 4Herfrika Climate Academy, she champions women-led climate solutions, amplifies women's voices, and drives inclusive sustainability. With experience working alongside the UN Liaison Office and Enactus, she's passionate about creating impact where gender equality meets climate justice.

Abstract

This research examines the gender responsiveness of climate policies and budgets in Rivers State, Nigeria, through the experience of women affected by oil pollution and intervention using 4Herfrika's climate education program as a case study. Despite Nigeria's commitments to gender equality in climate action, budget allocations and policy frameworks, these often fail to address the distinct needs of women and vulnerable groups, particularly in energy transition efforts.

Data were collected through policy and budget document reviews, interviews with women affected, focus group discussions and beneficiaries of 4Herfrika's training. Our findings reveal significant gaps between policy intent and budgetary implementation, with limited gender disaggregated and low representation of women in decision making and policy implementation. This paper recommends mandatory gender budget tagging, increased funding for women led climate initiative, stronger community participation mechanisms, education to ensure inclusivity, and sustainable energy transition.

1.0 Introduction

Communities are not just recipients of energy policies: they are people who live with the economic, social and environmental impact of the energy transition. They are also the direct beneficiaries of policy implementation necessitating the importance of carrying them along in decision making processes. When communities are engaged, policies are more likely to receive public support, result in measurable impacts and foster equity.

Policies such as the National Climate Change Policy (2021–2030) and the National Gender and Climate Change Action Plan (Federal Ministry of Environment, 2020, 2021) aim towards equity. This inclusion can help avoid resistance from individuals in the community, ensure fairness, build unity and improve the quality of policy implementation.

A shift to a sustainable future (energy transition) will not be successful without community inclusion. It is not just about technology or environmental targets but more about the people most especially affected by the impacts of climate change. So, community voices do matter in energy transition.

Overview of 4herfrika.

4herfrika Climate Academy is a women-led initiative dedicated to empowering vulnerable women with knowledge to participate in climate actions. In Rivers State, this initiative delivers climate education workshops in places with oil spillage, gas flaring & pollution Boni, Omoku, and Egi. Raising awareness about the effect, degradation and energy transition.

Aside from creating awareness, 4herfrika also focuses on introducing women to Nigeria climate policy & implementation,budget allocation and effective advocacy strategies. There by, empowering them to track climate spending and advocate for gender responsive allocation process.

Purpose of the Study

The purpose of this study is to examine how gender considerations are addressed within climate policies and budgets in Rivers State, using a first hand account from Omoku as the focal point. It explores the lived experiences and impacts of climate and environmental challenges of women, while assessing how current climate frameworks respond/overlook their needs. The study precisely investigates how climate funds are allocated, highlighting instances where gender priorities are ignored, and identifying the gaps between gender responsive policy and actual budget implementation. By grounding the analysis in a real life case study from Omoku, the research aims to reveal the disconnect between policy intent and lived reality, and to propose actionable steps for making climate action more inclusive and equitable.

2.0 Methodology

Data for this research were gathered through a qualitative and participatory research type. The primary source of gathering through this were interviews with community members, local leaders and women groups to capture household level impact and how they cope.

Participatory approaches have been recommended in Niger Delta research to capture grassroots perspectives on oil exploration and climate change (Okpara et al., 2016; Stakeholder Democracy Network [SDN], 2022).

The field work was conducted in Omoku, Obrikom and Egi communities in Rivers State, Nigeria. This area were specially selected due to their exposure to oil exploration activities and proximity to gas flaring, oil spillage and environmental degradation.

During community visits, the respondents engaged in open dialogue about how the pollution, gas flaring and oil spillage has affected their livelihoods, health and environment.

Special attention was paid to the women and vulnerable groups, documenting their challenges and how they cope. The interview was recorded with the consent of the respondents interviewed. The identity was anonymized to guarantee individual maximum protection. Community survey was applied to both the female and male respondents, ensuring gender degradation for comparative insights.

Based on the observations, women in these communities were disproportionately impacted by environmental degradation. Many reported smoke inhalation, which they linked to respiratory discomfort and other health issues. Their farmlands and crops had been extensively damaged, and several noted that once the land was contaminated by oil, it became unproductive and unsuitable for agriculture.

Gas flaring in Omoku, Rivers State, is a long-standing issue with significant negative impacts on both the environment and human health. Communities like Obrikom, and Omoku have been exposed to pollutants from gas flaring, pollution and oil spills for over 40 years, stemming from oil exploitation activities. These flares release harmful substances, contributing to respiratory illnesses, skin and eye problems, and other health issues among residents. The environmental consequences include acid rain, soil degradation, and potential damage to crops.

The experiences documented in Omoku, Obrikom, and Egi highlight the urgent need for an inclusive energy transition. The heavy reliance on fossil fuels in Rivers State has resulted in persistent gas flaring, oil spills, and land degradation, all of which disproportionately affect women whose livelihoods depend on farming and local ecosystems.

An effective energy transition strategy would reduce reliance on fossil fuels and their harmful byproducts, while creating opportunities for clean and renewable energy solutions.

However, unless these policies are gender-responsive, women will remain the most vulnerable to climate and energy shocks. By addressing the specific burdens faced by women in affected communities such as loss of farmland and health risks, energy transition in Rivers State can be both just and equitable, ensuring that no group is left behind as Nigeria moves towards sustainable alternatives.

2.1 Case study

Omoku is a town in Rivers State, Nigeria, known as the headquarters of the Ogba/Egbema/Ndoni Local Government Area. It is a major city of the Ogba people and is located in the northern part of Rivers State, near the boundaries with Delta and Imo State. The town is significant for its oil and gas industry with major companies like Shell, Total and Agip (now Oando) operating there, Rivers State is one of the communities situated within Nigeria's oil rich Niger Delta. The town has witnessed decades of oil exploration, gas flaring, and pipeline spillages that have degraded farmlands, polluted rivers, and worsened health outcomes. In addition to these long standing environmental challenges, Omoku faces frequent flooding and heat stress linked to climate change, leaving residents in cycles of poverty and vulnerability.

Geography and Environment
Omoku lies in the heart of the Niger Delta, a region characterized by dense vegetation, rivers, and wetlands. While these natural features make the land fertile and rich in biodiversity, Omoku's proximity to oil fields and pipelines has also exposed it to severe environmental degradation. (Nwankwoala, 2015; Amnesty International, 2018). Women in this community face disproportionate burdens, including poor health, declining farmlands, and limited participation in decision-making (Edeh, 2020). Decades of crude oil extraction, gas flaring, and frequent spills have polluted the soil, water, and air.

Economy and Livelihood
Traditionally, the people of Omoku engaged in farming, fishing, and petty trading as primary means of livelihood. However, oil exploration has disrupted these practices:

- Farmlands have been degraded by oil spills, making food production less viable.
- Rivers and creeks have been contaminated, destroying fish populations and limiting fishing activities.
- Many residents rely on casual labor within the oil sector, which offers income but exposes them to exploitation and unsafe conditions.

Energy Challenges
Despite being surrounded by oil wealth, Omoku faces energy poverty. Many households have limited access to reliable electricity and clean cooking energy. Instead, residents depend heavily on kerosene, firewood, and generators, which worsen both environmental and health risks.

Health and Social Impact
The environmental damage has led to significant health challenges, particularly for women and children:

- Respiratory illnesses from gas flaring.
- Waterborne diseases due to contaminated rivers and streams.
- Reduced agricultural yields, which worsen food insecurity and poverty.
- Women dying due to illegal mining of oil spillage.

Women are especially burdened, as they are responsible for household care, water collection, and food production, making them more vulnerable to these challenges.

Justification: Relevance to Climate Policy
Omoku is a critical case study for examining gender responsiveness in climate policies and budgets because,It sits at the intersection of oil wealth and climate vulnerability. Women and grassroots groups have historically been excluded from decision making about oil extraction, environmental management, and energy transition. Despite Nigeria's climate policies and international commitments, budget allocations rarely trickle down to address the lived realities of women in towns like Omoku.

One of the emerging insights from 4Herfrika's work in Omoku is the limited awareness among women regarding their role in climate advocacy. Many women initially did not recognize that they could actively participate in shaping policies or demanding accountability for the environmental and health challenges caused by oil-related activities.

Through ongoing grassroots climate education workshops, 4Herfrika is working to

- **Introduce Climate Awareness:** Women are beginning to understand how oil pollution, gas flaring, and flooding are connected to broader climate change challenges and policy decisions.
- **Highlight the Importance of Energy Transition:** The program emphasizes why a just energy transition is urgent for their community, helping women link the idea of clean energy to better health, livelihoods, and sustainable futures.
- **Build Advocacy Skills:** 4Herfrika is training women on the basics of Nigeria's climate policies and budget allocation processes, empowering them with tools to track spending and demand gender-responsive action.
- **Foster Inclusion:** By engaging women in discussions, the initiative is laying the foundation for stronger community voices in the energy transition process.

While still in progress, these efforts are gradually shifting perspectives. Women in Omoku are beginning to see themselves not just as affected bystanders but as emerging advocates for change.

Omoku is a critical case study for examining gender responsiveness in climate policies and budgets because it sits at the intersection of oil wealth and climate vulnerability. Women and grassroots groups have historically been excluded from decision-making about oil extraction, environmental management, and energy transition. Despite Nigeria's climate policies and international commitments, budget allocations rarely trickle down to address the lived realities of women in towns like Omoku.

3.0 Community Voices

The voices of local people in Omoku, Rivers State, reveal the realities that climate policies and budgets often overlook. These stories show how oil exploration, gas flaring, and environmental degradation have reshaped daily life, especially for women who shoulder the burden of food security, health, and household care. Listening to these voices is essential for building a just and inclusive energy transition.

3.1 Stories from the Ground

Women in Omoku describe how their environment, once fertile and reliable;

“Before, my cassava farm fed my family and I could sell in the market. Now the land is dark and weak. Oil spills have destroyed the soil. What I plant no longer grows well, and I must buy garri to feed my children.”

The rivers, once central to fishing and drinking water, have also been contaminated.

“Our water smells of oil. My children fall sick when they drink it.

Energy poverty, in a town surrounded by oil wealth, is another contradiction women emphasize. A young mother shared:

“Myself and children suffer from scratches (skin Irritation) due to gas flaring and eye scratches. Yet there’s no provision of hospital/ medication to help us”

A middle age woman leaving in Omoku explain how the exploration of these companies affect women more.

“ I fell sick and it got to a point I had to go to the hospital to treat my self, after several test and the doctor diagnosed me of having infection which according to him is caused by internal heat as a result of gas flaring and pollution affect the women"

These stories underline the irony of living in an oil rich state while lacking reliable access to clean energy.

Perceived Benefits of Engagement
Through 4Herfrika’s climate education workshops, women have begun to see themselves not just as victims of environmental degradation but as actors in shaping solutions.

One of the respondents reflected:

“I did not know I could talk about government budgets. I thought climate issues belonged to experts/ governments . Now, I know I can ask questions, and I have a right to demand that the money meant for us should reach us.”

The program has introduced women to Nigeria's climate policy framework, the basics of budget tracking, and the importance of energy transition. These sessions have planted the idea that women's experiences are valuable in shaping policies, and their advocacy can push for more gender responsive budgeting.

3.2 Challenges and Barriers

Despite these gains, community members continue to face structural and cultural barriers. Women often struggle with cultural restrictions that discourage them from speaking in public meetings. An elderly woman shared:

"Even if we know the truth, men will say this is not our place to talk. Sometimes, we keep quiet, even when it pains us."

This aligns with findings that cultural norms in the Niger Delta restrict women's participation in governance (ERA/FoEN, 2021; Okpara et al., 2016). However, after grassroots engagement, many women began to understand the links between gas flaring, health issues, and their right to demand accountability (SDN, 2022).

A woman said " Financial benefits if shared are given to the men not even we the women who are mostly affected"

Another challenge is the technical and inaccessible nature of policies. Government documents are written in formal English with technical terms that exclude grassroots women engagement.

Most importantly, communities perceive a consistent gap between what policies promise and what actually reaches them. Funds allocated for remediation, clean energy, or healthcare often fail to trickle down, reinforcing mistrust in government processes.

Cultural, Social, and Gender Dimensions
Women's stories reveal how gender roles make them more vulnerable to climate challenges. As primary caregivers, farmers, and water collectors, women directly experience the burden of degraded farmlands, polluted water, and rising health issues. When farms fail, it is women who must find alternatives to feed families. When children fall sick from polluted air or water, mothers shoulder the cost and care.

At the same time, cultural structures often marginalize women from decision-making spaces, deepening their exclusion from policies that affect them most. Yet, informal women's associations and cooperative groups have become safe spaces for solidarity and collective action. 4Herfrika's workshops tap into these networks, showing women that their collective voice is not just valid but powerful.

Emerging Shifts
In Omoku and other Niger Delta communities, women face a heavier burden from pollution, energy poverty, and food insecurity. If climate budgets are allocated equally, women still end up disadvantaged because their starting point is not the same as men's. Equity based policies ensure women's unique challenges are recognized like health risks from gas flaring, lack of access to farmland, and exclusion from decision-making.

While change is slow, the community is beginning to experience a shift in perspective. Women in Omoku are increasingly aware that they are not powerless bystanders but potential advocates for climate justice. They are learning to link their daily struggles with bigger policy frameworks and to recognize that demanding accountability is within their rights.

These emerging voices highlight the importance of inclusion in Nigeria's energy transition. Policies that exclude community perspectives risk deepening inequality and resistance. But when communities, especially women, are engaged, policies gain legitimacy, trust, and the potential for fairer implementation.

4.0 Outcomes & Lessons Learned

Although 4Herfrika's climate education program in Omoku is still ongoing, some early measurable impacts are evident. One of the most visible outcomes has been the shift in women's awareness of their role in climate advocacy. For example, before the workshops, many women believed that climate and budgetary discussions were reserved for government officials or never even existed. After participating, they began to recognize that their lived experiences of oil pollution, gas flaring, and flooding are valid forms of evidence and advocacy.

Through its sessions, 4Herfrika has gone around educating women on climate change, Nigeria's climate policy framework, budget allocation processes, and the urgent need for energy transition. Many reported a new sense of understanding, with one participant noting: "I did not know I could talk about government budgets. Now I know I can ask questions and demand accountability."

These groups have started tracking local discussions on environmental remediation funds and clean energy interventions. While not yet at the stage of influencing government policies directly, the creation of these groups marks an important first step toward community driven advocacy.

4.1 Challenges Faced and How They Were Addressed

The path to these outcomes has not been without difficulties. One persistent challenge is the cultural restriction on women's voices in public spaces. As one elderly participant explained: "Even if we know the truth, men will say this is not our place to talk." Or that of the woman who said "Financial Benefits are given to the men where women are mostly affected." To address this, 4Herfrika worked through informal women's associations as safe spaces for engagement, where women could build confidence before entering broader community dialogues.

Finally, mistrust in government processes remains a barrier, as funds for cleanup or clean energy often fail to reach communities. (Federal Ministry of Finance, Budget and National Planning, 2021). To address these, content was localized, linking climate jargon to lived realities such as coughs from gas flaring (IPCC, 2022). While this cannot be resolved locally, 4Herfrika encourages women to use education as a tool for accountability, monitoring spending and demanding transparency.

4.2 Insights for Future Work

Several insights have emerged. First, gender responsive climate action requires moving beyond equality to equity. Tailored education, safe spaces, and accessible information are essential to ensure women's inclusion.

Second, community voices add legitimacy to climate policies. Women's testimonies about farming losses, health impacts, and energy poverty ground abstract policies in lived realities.

Third, future work must emphasize multi-sector collaboration. Climate education alone cannot solve Omoku's challenges; partnerships with health providers, renewable energy organizations, and government are crucial for sustainable impact.

Lastly, the Omoku case shows that change is gradual. Early gains, such as increased awareness and women led advocacy groups, must be nurtured into long term strategies through cooperatives, schools, and community networks.

5.0 Recommendations

5.1 Policy-Level Recommendations

At the policy level, scaling grassroots climate education is critical. Simplifying Nigeria's climate and energy frameworks into accessible language should be institutionalized within local government climate action plans (Federal Ministry of Environment, 2021). Policies must also mandate gender responsive budgeting to prioritize women's health, given their disproportionate exposure to gas flaring, indoor air pollution, and contaminated water. A gender inclusive energy transition expanding access to clean cooking fuels and renewable energy would reduce respiratory illnesses among women and children while addressing environmental degradation (Okpara, 2020).

5.2 Project-Level Improvements

At the project level, 4Herfrika's model of integrating education into women's cooperatives can be replicated in other oil impacted communities. Improvements should include collaborations with health providers to document pollution related illnesses and with renewable energy actors to pilot small scale clean energy solutions. Embedding monitoring tools such as budget tracking templates will enable women's groups to follow climate and remediation funds, making advocacy more evidence-based.

5.3 Deepening Community Engagement

Sustainable impact requires deeper engagement. Safe spaces for women's dialogue should be scaled and supported with youth inclusion to foster intergenerational advocacy. Using storytelling and participatory mapping of pollution impacts can build community wide legitimacy for clean energy solutions. Most importantly, positioning women's testimonies as evidence in state level energy transition planning will bridge the gap between community realities and policy frameworks, ensuring that environmental recovery directly improves women's health and livelihoods (UNDP, 2022).

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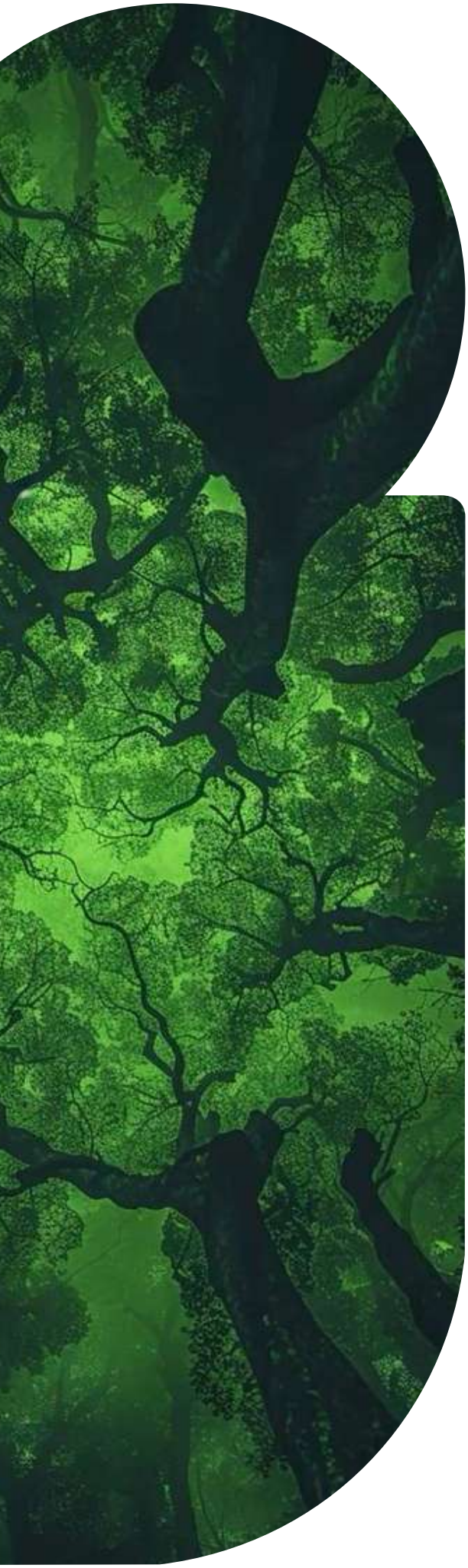

Community Voices in the Energy Transition: Awareness and Adoption of Solar and Kerosene/ Charcoal-powered Broiler Chicks Brooding in Nsukka, Enugu State

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Abstract

The use of solar or kerosene/charcoal-powered heat-generating sources during broiler chicks brooding was comparatively examined alongside its awareness and adoption in Nsukka, Enugu State, Nigeria. A structured questionnaire through a snowball sampling method was used to survey 30 broiler chicken brooding farmers' comparative perspectives on daily pen ambient temperature, relative humidity, observable occurrence factors during chicks brooding, awareness and adoption of solar or kerosene/charcoal; farmers' socioeconomic status as determinants of awareness and adoption levels among the respondents. Farmers' reported descriptive statistical evidences show that solar-powered chick brooding recorded comparatively less expenses, less pollution from heat source, steadier ambient temperature and relative humidity, ≤2% mortality, reduced greenhouse gases emissions and less climate vulnerability than the kerosene/charcoal-powered brooding.
Public-private-partnership funding/tax incentives for solar panels, batteries, inverters and solar-powered bulbs' manufacturing, concessionary loans to support access to renewable energy, periodic government-sponsored clean-energy sources' campaigns and farmer cooperative society-led incentivized carbon credits were recommended.

1.0 Introduction

Why community voices matter in the energy transition

Energy transition (ET) is the migration of energy production and consumption from unsustainable, non-renewable, non-ecofriendly and dirty fossil fuel-based sources to sustainable, renewable, ecofriendly and cleaner energy sources.

The need for community voices to be amplified towards the use of energy and the need for just energy transitions within the poultry subsector is critical because poultry plays a crucial role in providing a significant source of high-quality protein that is important for the good health of the population (Okpani, 2010). Raising poultry is seen as a key economic activity in most developing countries and is a major source of meat and eggs.

Therefore, energy generation and consumption in chicken brooding is not only critical to the chickens wellbeing and economic development, it is also inextricably linked to the challenges of sustainable development (e.g poverty alleviation, climate change, responsible consumption) (Goldemberg et al., 1988).

The 2002 World Summit for Sustainable Development (WSSD) highlighted the essential role of energy transitions in social, environmental and economic domains (UNDP, 2002). The need for community voices and participation in energy use in poultry production as a major small-scaled agribusiness enterprise in Nsukka, Enugu State.

Nigeria hinges on the link between energy use human health (e.g. indoor pollution due to inefficient energy technologies like use of kerosene stove and charcoal pots during broiler chick brooding); energy use and biodiversity (e.g. the impact of climate change due to greenhouse gas emissions); energy use and agriculture (e.g. bioenergy as replacement for fuels); and energy use and water (e,g, the environmental and social impacts of hydropower) (Hollande, 1992; Johanson et al., 2002; Bradbrook et al., 2005).

Justification of the Research

This research focuses on highlighting the comparative implications of adopting solar-powered heat-generation during broiler chicks brooding as effective energy transition strategy in a typical kerosene/charcoal-dependent chick brooding poultry farming subsector in Nsukka, Enugu State Nigeria and farmers' socioeconomic characteristics that significantly determine the awareness and adoption of this energy transition strategy.

The study intends to fill the gap by examining the level of awareness and adoption of climate-smart energy transition from fossil fuel (kerosene/charcoal) to solar-powered heat-generating electric bulbs as climate-smart mitigation and adaptation strategies in humid tropical environments.

Purpose of the case study

Specifically, it assesses how the Nsukka broiler chicken farming community participates in energy transition through:

1. Assessing Local Farmers-Reported Experiences on the comparative production occurrence factors of kerosene/charcoal-powered and solar-powered chick brooding.

2. Assessing Reported Percentage Distribution of Local Farmers Socioeconomic characteristics that could influence awareness-and-adoption of energy transition from kerosene/charcoal-powered to solar-powered heat-generation during chick brooding

3. Determining Farmers' Responses on the levels of awareness-and-adoption of energy transition from kerosene/charcoal-powered to solar-powered heat-generation during chick brooding.

2.0 Methodology

2.1 Case study design, data collection instrument, validation, data collection and analysis

The research adopted a Descriptive Survey Study design.

A snow-ball sampling method was used for the selection of 30 broiler chicken farmers within the Nsukka community of Nsukka Local Government Area of Enugu State. Research instrument used to interview the respondents to generate primary data was a well-structured questionnaire based on the specific objectives of the study. According to Anyaoha (2009), descriptive survey research design uses questionnaires, interviews and observations to determine the opinions of people.

The survey research design was considered appropriate as it elicits information from the respondents concerning their awareness and adoption of either solar-powered or kerosene/charcoal-powered broiler chick brooding.

The face validation of the instrument was established by three experts from the Departments of Animal Sciences, Measurement and Evaluation; and Agricultural Economics, Rural Sociology and Extension, University of Nigeria, Nsukka, Nigeria. Reliability of the questionnaire was established using Cronbach alpha method and reliability coefficient of 0.78 was obtained, showing high consistency of the test items.

The respondents were visited in their farms to obtain their stories, experiences and opinions. 30 copies of the questionnaire were administered to the farmers by the researcher. Their responses were then ticked in the questionnaire accordingly. All the 30 (100%) copies of the questionnaires were correctly filled out and returned.

A verbal consent was obtained from the respondents before the study commenced. The purpose of the study, the voluntary nature of participation and confidentially of data were duly explained to them, after which they gave their consent. Descriptive statistics such as percentage and means were used to analyze data.

2.2 Background of the community:

The study area is Nsukka delineated as a town and a Local Government Area. It is also home to the University of Nigeria. Nsukka shares a common border with Edem, Opi, Ede-Oballa and Obimo. The study area is situated at coordinates 6o30'N and 7o30'E, located on an elevation of about 232 m (732 feet) above sea level (Enugu State Agricultural Development Program, ENADP, 2021). Nsukka falls within the rainforest zone of Nigeria which is characterized by hot and humid climate. The climate is characterized by two distinct seasons; rainy and dry season. The mean annual rainfall is between 2,500 mm to 3,000 mm and that of temperature is 22oC to 36oC (ENADP, 2021).

The influence of climate change on poultry production and food security is evident in the study area (Annual Flood Outlook AFO, 2021). The presence of the Registered Poultry Farmers Association of Nigeria (PAN), Enugu State Chapter, and the preponderance of poultry production make Nsukka appropriate for the study. Nsukka was chosen for its high prevalence of small scale poultry farming among its residents and its status as a university community with a semblance of urban and peri-urban status. (Ekwe, 2019).

2.3 Energy needs and challenges before intervention.

Okonkwo (2000) and Okonkwo and Akubuo (2007) had submitted that fossil fuel based energy source such as the kerosene-powered stoves, charcoal pots are commonly used in humid tropical environments are not only non-renewable but pollute the poultry pen, emit greenhouse gases like carbon dioxide (CO2) and carbon monoxide (CO) and with a possibility of fire outbreak.

This results to low production and high mortality rate ranging from 60-70% in poultry enterprises in these regions. In most humid tropical environments like Nsukka, Enugu State Nigeria; most poultry farmers often use kerosene bush lamps/stoves or the combination of both to generate the heating requirements in day-old chicks brooding houses (Okonkwo and Akubuo, 2007).

This generated heat is sometimes supported with hoovers for efficient distribution of the generated heat in the brooding pens. This kerosene or charcoal-powered heat sources and in addition to other energy sources, are used in many ways in a typical deep-litter pen or battery-caged poultry production systems for lighting and heating (Byrne et al., 2005).

Typically, to brood 1000 day-old chicks, about 40 litres of kerosene is burnt per day which presently estimates at monetary value of about N2,700,000.00 (two million and seven hundred thousand naira) per annum at stock market price of N1,500.00 per dollar. This is a huge challenge to rural poultry farmers in resource-poor humid tropical environments like Nsukka. This challenge is exacerbated by the unavailability of the national grid supply, making electricity-powered brooding so expensive. Researchers have looked into various areas of renewable energy sources as a means to conserve energy in the prevailing population rise. Geothermal, wind, solar and biomass energy sources have been considered for energy transitioning to meet the energy needs in the poultry industry (Zanaty, 2019).

The answer to this problem is to transition the energy source during chick brooding to a renewable energy source such as the solar energy sources like the use of the sunlight-dependent solar panels. The energy from the sun is renewable, affordable and good for the environment, making it perfect for chick brooding which is the most delicate stage of their development.

Overview of this Research Project

The overview assesses the level of awareness and adoption which altogether will help to fully define how community engagement strategies will be incorporated into the Energy Transition Plan ETP.

There is a need to use the data derived from this study to deeply engage with wider stakeholders at community levels on the critical needs that intersect with Nigeria's transition plans. It is centered on affordable and sustainable access to clean energy while also considering support for communities that have faced significant lack of awareness and adoption.

Key Stakeholders and Partners

1. Poultry Association of Nigeria
2. Nigeria Institute of Animal Science
3. Federal/State Ministries of Agriculture and Rural Development
4. National Council on Climate Change
5. BudgIT Foundation
6. Intergovernmental Panel on Climate Change
7. United Nations Environmental Program
8. World Climate Research Program
9. United Nations Framework Convention on Climate Change

3.0 Experiences From Local Broiler Farmers In Nsukka

Table 1: Local Farmers-Reported Experiences on the comparative production occurrence factors of kerosene/charcoal-powered and solar-powered chick brooding.

S/N	Occurrence Factor	Kerosene/charcoal	Solar
1.	Greenhouse gases Emissions	Higher amount of GHG	Less amount of GHG
2.	Temperature Control	Less consistent	Ranged 28-35^{0}C
3.	Relative humidity	Less consistent	Ranged 56-82%
4.	Kerosene/charcoal cost	N168,000.00	Nil
5.	Mortality rate	≥10%	≤2%
6.	Fire outbreak	High possibility of fire outbreak	Low or no possibility of fire outbreak
7.	Cause of mortality	Incidence of cold, pollution and emission of Greenhouse Gases leading to Chronic respiratory Disease Coccidiosis etc.	Only happens when there is a accidental foot match by the attendant of incidence of cold during transit
8.	Disease-resistance	Low resistance & vulnerability to diseases.	High disease resistance and low vulnerability
9.	General health status during brooding	Persistently sick leading to mortality	Mostly very lively and healthy
10.	Average ambient temperature	Low & fluctuating with high relative humidity	High & steady enough with average relative humidity
11.	Financial expenses	High expenses	Lower expenses
12.	Pollution from heat source	High level of pollution from heat sources	no pollution from heat source
13.	Waste generation from heat source	High level of waste generation from heat source	No waste generation from heat source

Summary of observed occurrence:
Kerosene/charcoal-powered brooding Is expensive, pollutes poultry pen and wasteful while Solar-powered chick brooding is comparatively less expensive, zero pollution from heat source and not wasteful

Table 2: Reported Percentage Distribution of Local Farmers' Socioeconomic characteristics that could influence awareness-and-adoption of energy transition from kerosene/charcoal-powered to solar-powered heat-generation during chick brooding

Variable	Percentage
Age class:	
Youths	11
Young-adults	48
Middle-aged-adults	22
Aged-people	19
Gender:	
Male	11
Female	89
Marital-status:	
Married	74
Single	14
Divorced	6
Widowed	6
Educational-level:	
No formal education	15
Primary education	32
Secondary education	45
Tertiary education	8
Household-size:	
2-4	39
5-6	52
7-8	9
Farm-size:	
Small-scale	93
Medium-scale	5
Large-scale	2
Poultry-farming-experience (years):	
1-3	56
4-5	29
6-8	4
9-10	4
Above 10	3
Cooperative-membership:	
Non-member	96
Member	4
Estimated Annual income from broiler chicken farming (Naira):	
<600,000.00	33
601,000.00-700,000.00	42
701,000.00-800,000.00	17
Above 800,000.00	8

Table 3: Farmers' Responses on the levels of awareness-and-adoption of energy transition from kerosene/charcoal-powered to solar-powered heat-generation during chick brooding.

Variable	Percentage
What is your current energy source for chick brooding?	
-Kerosene stove	48
-Solar power	11
-Electricity	19
-Charcoal	22
Have you considered transitioning to a different energy source for chick brooding?	
-Yes	88
-No	12
Factors influencing decision to adapt a renewable energy source for chick brooding like solar energy?	
-Cost	55
-Environmental concerns	2
-Energy efficiency	29
-Reliability	14
Have you ever used or presently use solar-powered chick brooding in your poultry farm?	
-Yes	19
-No	81
I'm aware of the benefits of solar-powered chick brooding compared to kerosene stove brooding?	
-Yes	26
-No	74
Rate the effectiveness of solar-powered chick brooding compared to kerosene/ charcoal (Scale: 1-5, where 1 is "not-effective-at-all" and 5 is "very-effective"	
-1	9
-2	12
-3	13
-4	15
-5	51
Major challenges you face in adopting solar-powered chick brooding?	
-High initial-cost	40
-Lack of knowledge	30
-Limited access to solar-panels	30

Variable	Percentage
Importance of reducing energy costs when considering transition to a new energy source for chick brooding? (Scale: 1-5, where 1 is "not-important-at-all" and 5 is "very-important")	
-1	4
-2	4
-3	4
-4	5
-5	84
Are you interested in participating in training on energy-efficient chick brooding practices like transition to solar-power use?	
-Yes	98
-No	2
Are you willing to invest in solar-powered chick brooding if you had access to affordable financing options?	
-Yes	98
-No	2

3.1 Perceived Benefits, challenges and changes

Chicken meat and egg production constitutes an important component of the agricultural economy in developing countries and also constitutes an instrument of socioeconomic change, improved income and quality of rural life in Nigeria (Olaniyi, et al., 2010). Poultry farming is important to the biological needs, economic and social development of the people in any nation (Oladeebo and Ambe-Lamidi, 2007).

Faced with the complex problems of a growing population and unemployment with increasing urbanization that will create an even faster growing demand for food (FAO, 2014), harnessing of the enormous solar energy in the tropics should be utilized in the brooding process of poultry birds as its profitable and less expensive than the conventional kerosene and charcoal.

Nigeria needs a more comprehensive energy transition document as available documents do not situate the energy challenges in poultry production, and different interventions in energy do not provide energy transition details in the poultry production subsector which will mitigate the challenges.

Cultural, social and gender dimensions

The socioeconomic characteristics of the respondents reflect cultural, social and gender dimensions to the energy transitions in the community.

4.0 Outcomes & Lessons Learned

Measurable Impacts

- 98% of the respondents indicated interest in being trained in solar-powered chick brooding if there are affordable financial resources.

- 98% of the respondents indicated interest in willingness to invest in solar-powered chick brooding if there are affordable financial resources.

- 98% of the respondents became aware of the production occurrence factors of kerosene/charcoal-powered brooding to record comparatively higher expensive, polluted poultry pens and waste.

- 98% of the respondents became aware of the production occurrence factors of solar-powered chick brooding to record comparatively less expenses, zero pollution from heat source and not wasteful.

Challenges faced and how they were addressed.

- The challenge of sampling a higher number of broiler chicken farmers due to limited financial and time resources was addressed by using a snowball sampling method to sample a manageable sample size of 30 broiler chicken farmers within the study area.

- The challenge of collecting real-time primary data from the respondents was addressed by first obtaining a verbal consent from the respondents before the study commenced. This was done by duly explaining the purpose of the study, the voluntary nature of participation and confidentiality of data after which the respondents gave their consent.

Insights For Future Work

- Exploring community-led initiatives on the use of wind and biogas as alternative energy sources.

- Designing and implementing energy-efficient brooding systems like heat pumps to minimize energy consumption and costs.

- Designing community-led incentivized carbon crediting to broiler chicken farmers to encourage adoption of renewable energy sources.

5.0 Recommendations

5.1 Policy-level recommendations

This research makes the following policy-level recommendations:

1. Public-private-partnership funding for solar panels, batteries, inverters and solar-powered energy-saving bulbs' manufacturing.

2. Tax incentives for solar panels, batteries, inverters and solar-powered energy-saving bulbs' manufacturing.

3. Establishing concessionary loans to support poultry farmers' access to renewable energy.

4. Periodic government-sponsored clean-energy sources' campaigns.

5. Institutionalizing farmer cooperative society-led incentivized carbon credits.

5.2 Project-level recommendations

This research makes the following project-level recommendations:

1. Expanded multi-disciplinary research to develop a broadened localized database for a bottom-top policy approach to community-led energy transitions.

2. Periodic government-sponsored trainings and workshops to increase the technical knowledge of solar-panel manufacturing, installation, maintenance and usage.

5.3 Project-level recommendations

1. Establishing demonstration projects that showcase the effectiveness and efficiency of renewable energy systems in broiler farming.

2. Provide technical and capacity-building programs for farmers, local technicians and artisans to develop the skills needed to install, maintain and repair renewable energy systems

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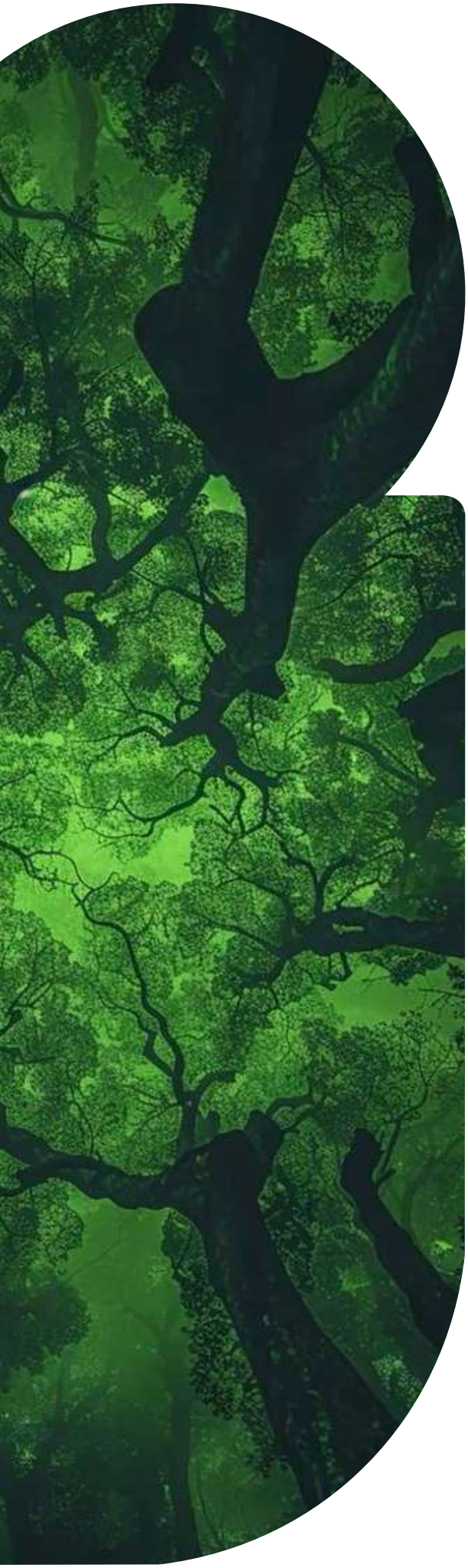
Appendix

Some poultry farmers' brooding pens in the study area

Image 1: Solar-powered energy-saving bulbs generating heat in a brooding pen.

Image 2: Kerosene lamp-powered generating heat in a brooding pen.

Image 3: Charcoal pot-powered generating heat in a brooding pen



From Crisis to Climate Action: How 'Make Yobe Green and Safe' is Creating Green Jobs and Promoting Clean Energy in the Face of Regional Instability

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About the Fellow

Abubakar Abdulmusawwir is an environmentalist and climate advocate with a Master's in Green Chemistry from the University of York. His research focuses on transforming plastic waste into clean fuel, and he founded "Make Yobe Green & Safe" to promote sustainability, youth engagement, and plastic recycling in communities.

Abstract

This research paper discusses how Make Yobe Green and Safe (MYGS), a locally-led environmental sustainability and climate-focused NGO, founded by Abubakar Abdulmusawwir is tackling the challenges of climate change, promoting plastic recycling, clean energy, and empowering conflict-affected communities through sustainable livelihoods in Yobe State, Nigeria, a state in a region grappling with insecurity, poverty, energy crisis and environmental degradation. Despite challenges posed by instability and the severity of the climate issues, the organization has emerged as a catalyst for change and transformation, championing sustainability amid insecurity and poverty, transforming communities through advocacy, mobilizing students and locals towards green energy to combat climate change and promote environmental stewardship.

Through field observations and qualitative interviews, the research highlights how the MYGS's sustainable energy initiatives like solar adaptation, plastic waste-to-product programs, and community awareness campaigns is creating green jobs, fostering peace building in post-conflict settings, empowering individuals, and building climate resilience.

1.0 Introduction

As climate change becomes central and efforts to shift toward sustainable energy garner global support, the voices of local communities and vulnerable population are becoming more critical than ever, energy transitions that lack inclusive and meaningful local engagement risk escalating ongoing inequalities and further marginalize the communities most severely affected3. Despite consensus that inclusiveness and local participation is vital to fair and equitable energy transitions, MYGS observes that the voices of local communities in the energy transition remain largely absent, particularly the economically disadvantaged groups and vulnerable population in internally displaced persons camps (IDP camps). Although the discussion about climate change and energy transition is a major focus and dominates national policy, local communities are often overlooked.

The reality is that local communities and vulnerable population are at the frontlines of both the energy transition and the climate crisis. Their experiences and perspectives are essential for creating solutions that are sustainable and inclusive.

In Yobe State, the combined challenges of climate change and violent extremism have jointly wreaked havoc on communities and economies. For more than ten years, the region has endured the devastating impact of the Boko Haram insurgency, millions have been displaced and livelihoods shattered, At the same time, the effects of climate change have further strained already fragile communities, the region's natural resources are rapidly declining due to deforestation, desertification and rising temperatures. Meanwhile, economic hardship and joblessness have made many youth easy targets and vulnerable to recruitment by insurgents groups like Boko Haram who exploit these conditions with promises of not just money, but a place to belong.

In response to these challenges, Make Yobe Green and Safe State (MYGS) was founded on the belief that addressing climate change and advancing the energy transition must go hand in hand with tackling the underlying drivers of conflict, such as lack of education, unemployment and environmental injustice. MYGS focuses on tackling climate change, reducing plastic waste, promoting clean energy, and creating green jobs especially for disadvantaged groups. By opening plastic waste collection center in Potiskum, the largest city in Yobe State, the organization did not only addresses environmental issues but also provides income-generating jobs for vulnerable population, particularly those at risk of being drawn into violent extremism by armed radical groups. Through environmental initiatives, MYGS is fostering peace and supporting the reintegration of marginalized groups.

This case study documents MYGS's work as a model of grassroots climate action in a fragile context. It highlights how conflict-affected communities are participating and benefiting in the clean energy transition. It also shows how plastic recycling and green jobs can help prevent youth radicalization and promote sustainable development.

1.1 Background of the Community/Region

temperatures, and erratic rainfall, the region faces acute challenges in waste management, energy access, and youth unemployment. These challenges have fueled a cycle of vulnerability, where terrorist groups take advantage of economic hardship to recruit jobless youth.

Once known for its agriculture and livestock, Yobe state is now often associated with insecurity and humanitarian crises. Floods and droughts occur in irregular and unpredictable cycles, eroding food security and livelihoods. In urban areas like Potiskum and Nguru, growing populations have outpaced basic services. Meanwhile, plastic pollution has become a persistent hazard, fostering unsafe living conditions and accelerating climate change.

In the face of these complex challenges, MYGS is crafting a new narrative, rooted in resilience, clean energy, environmental stewardship, and community empowerment.

2.0 Methodology

To explore and document the community-based climate response and clean energy initiatives of Make Yobe Green and Safe (MYGS), this research adopted a grounded, community-based approach combining interviews and document analysis, primary data was gathered through a combination of interviews, field visits and community surveys. A total of 25 interviews were conducted in Hausa and Kanuri to capture diverse opinions on the MYGS's interventions in climate action, clean energy promotion and green job creation. To ensure inclusiveness, interviews were conducted with the aid of interpreters.

In addition to interviews, a well-structured survey was administered to 120 students and residents across selected schools and communities, the survey was designed to assess how MYGS's interventions influenced their behavior, particularly around energy and plastic use, their awareness of climate change and access to clean energy solutions were assessed, respondents represented various age groups, genders, and income levels. A field visits to plastic waste collection hubs in Potiskum and solar-powered demonstration sites were also made to allow for direct observation of program activities and community engagement. The goal was to capture how the MYGS's climate-related programs, particularly in clean energy promotion, plastic recycling, and green job creation are engaging communities affected by insecurity and poverty, and how these initiatives may offer viable alternatives to extremist group recruitment.

Secondary data was obtained through the review of internal project documents such as reports, training manuals, funding proposals, and monitoring and evaluation (M&E) documents provided by the MYGS. These were complemented by the analysis of regional and national policies on renewable energy and climate resilience to understand how MYGS's work aligns with broader policy objectives.

Given the conflict-sensitive nature of the research environment, ethical considerations were strictly observed throughout the study; participants were informed of the research objectives and gave their consent freely. Interviews and surveys were conducted with assurances of confidentiality, and care was taken not to disclose information that could place participants at risk. All photos included in this research paper were used with the informed consent of the students and community members featured. Permission was granted for their publication, and some of the images (not the research) have already been shared on our official social media platforms.

3.0 Energy Needs And Challenges Before Intervention

At various times, large parts of Yobe state have been without power for many months; Boko Haram regularly blows up power lines from the national electricity grid, the power pylons were repeatedly attacked, the communities were plunged into darkness and cut off from the national grid. The blackout had been hard for everyone, and had a devastating effect on businesses, it remained a major challenge for hospitals, schools and hotels, which were also struggling to keep the lights on. Each time the government try to restore the power, Boko Haram and its splinter groups would bomb the power pylons again and plunged the state back into darkness. The lack of energy and high cost of fuel was not sustainable and it was killing the economy.

Before the intervention of MYGS and other NGOs, energy poverty defined daily life for most residents; households in Yobe depended on charcoal, firewood and kerosene for cooking and lighting. For internally displaced persons (IDPs) living in temporary camps, access to electricity, clean cooking solutions, or even basic lighting is almost nonexistent.

Traditional cooking methods using firewood or charcoal are not only inefficient but contribute to deforestation and respiratory diseases. The burden falls heaviest on women and children, who spend hours looking for firewoods, risking assault in conflict zones, and inhaling toxic smoke at home.

The lack of clean energy not only deepened poverty but also contributed to environmental degradation, including deforestation and air pollution.

4.0 Overview Of The Initiative/Project

In response to these challenges, MYGS was established as a grassroots, youth-led environmental and climate-focused NGO, with a mission to promote clean energy, advance environmental sustainability, foster green job creation, and contribute to peace building in Yobe state.
MYGS Designed a comprehensive program structured around three core pillars:

4.1 Plastic Waste Collection and Social Reintegration

MYGS established two plastic waste collection centers in Potiskum, Yobe State, these centers serve a dual function, they recruit local youth, especially those at risk of radicalization, train and equipped them with protective gear to become scavengers, they learn how to collect and sort waste plastics. By providing salary and skill development, the NGO offers a tangible alternative to violent extremist recruitment that capitalizes on financial hardship and insecurity to its benefit.

4.2 Green Job Creation and Vocational Training

MYGS runs green job training programs that focus on solar panel installation, maintenance of clean cook stoves, and sustainable agriculture. Trainees many of them young women are equipped with marketable skills and connected to micro-finance opportunities to start their own eco-enterprises. The project prioritizes the inclusion of women, internally displaced persons, and unemployed youth. The training not only boosts employment but also builds a local market for clean energy solutions. Many trainees become ambassadors for clean cooking and solar power, spreading these technologies within their communities.

4.3 Community Awareness and Environmental Education

MYGS invests heavily in community awareness and advocacy, it conducts regular environmental awareness campaigns through radio programs, workshops in schools, town hall meetings, and mosque-based discussions to spread messages about climate change, clean energy, and waste management. They emphasize the links between environmental stewardship and local security, helping people see themselves as ambassadors and agents of change.

4.4 Key Stakeholders and Partners

The success of the MYGS initiative relies on collaboration among multiple stakeholders:

Traditional rulers and Local Volunteers: pastors, imams, youth and women's groups play a crucial role in mobilizing participation and spreading awareness.

Local and State Governments: Collaboration with Local Education Authority (LEA), Ministries of Environment, Youth Empowerment, and Humanitarian Affairs has enabled access to schools, public spaces and alignment with policy goals.

Private Sector: MYGS collaborates with local businesses and renewable energy companies to scale up access to clean technologies and offer employment opportunities for trained beneficiaries.

5.0 Community Voices

Quotes, stories and experiences from local people

A quiet transformation is taking root in Yobe State, a region where climate crisis, energy poverty and insecurity continue to shape daily life, With the threat of violent extremism still looming large, especially for jobless and uneducated youth, a local grassroots organization, MYGS offers a bold alternative rooted in dignity and sustainability. The NGO is bringing new life to vulnerable population through climate action, clean energy, and green job creation.

The success of MYGS's initiatives lies in their deeply participatory approach. Rather than imposing solutions, the NGO began with open forums in local mosques, churches, town halls, and IDP camps, spaces where community members could share their perspectives on the region's

environmental and economic challenges.

"We don't just start awareness campaign," says Abubakar Abdulmusawwir, Founder/CEO of Make Yobe Green and Safe, MYGS. "We first asked people: what are the greatest needs in your community, what are your challenges, and how do you think we can fix it together?"

In July, 2025, MYGS members visited a community where members raised serious concerns about a refuse dumping site located in the midst of their residential area. They complained that despite repeated appeals, the owners have refused to relocate the dump away from the community, after listening to their complain, MYGS members organized a campaign and protest that led to the evacuation of 4 dumping sites which were believed to be threat to public health of the locals, they drew the attention of the owners and residents to the adverse health outcomes in individuals living close to such dumping sites, their efforts resulted in saving the residents and the area from further pollution and diseases.

Sample quotes from beneficiaries/ Voices from the Community

In Potiskum, a 25-year-old Khadija Lawan who was employed at one of MYGS's plastic waste collection centers and taught how to sort and collect waste plastics. For her, the work is not just about the money—it's about making the community a better place for all.

"Now I earn money unlike before, but the important thing is I'm learning about plastic recycling, and I'm not afraid to campaign against non-recyclable plastics. We are not just cleaning plastic; we are cleaning our environment."

One of MYGS's key interventions is awareness cam as paigns in schools and communities.

"I have been in school for many years but before this workshop by Make Yobe Green and Safe members, I don't know anything about clean energy or plastic recycling, Now I am informed and pledge to teach others, thank you Mr. Abubakar Abdulmusawwir," says 19-year-old Maryam Bello, a final year student at Nasra Academy, Potiskum.

5.1 Challenges and Observed Changes

Funding, security risks, resistance to change and gender barriers are some of the obstacles or challenges that MYGS faces and also based on the community feedback and observations from the field, the initiative observe shifts in behavior and attitudes, that have resulted from the program, the observed changes are: growing respect for women's roles, shift in youth aspirations, increased community engagement and improved public health & environment.

5.2 Cultural and Gender Dimensions

Cultural sensitivity has been crucial to the success of MYGS, there was initial resistance to women participating in awareness campaign and waste collection. To break these barriers, MYGS created women-only spaces for training and ensured that female facilitators led sessions. These changes made a big difference today; almost half of MYGS's trainees are women.

MYGS partnership with women-led cooperatives through women-only workshops to promote clean cooking and climate education is transforming households and helping them to save money and reduce health risks.

"After knowing about the health hazard, I bought solar stoves," said Jamila, a participant from Mamudo. "I cook cleaner, and even teach our children."

5.3 Women at the Forefront

One of the most profound transformations has been the empowerment of women in these traditionally conservative societies. Initially, participation was low—due to social norms, fears about safety, and skepticism from male community members but now 48% of the trainees are women.

"When they first start there advocacy, my husband was against women's participation," says Uwani, a housewife and mother of two in Nangere. "But when they sensitized them through our imam and district head, he later changed his mind."

In a region where women's voices are often silenced, this shift is not just environmental, it is social and cultural.

6.0 Outcomes & Lessons Learned

From the onset, MYGS understands that locals and traditional leaders are central to both the design and implementation of any successful initiative and to ensure interventions are culturally and socially aligned, youth groups, local government representatives and religious leaders must be consulted and included before taking major decisions. This collective approach foster ownership, innovation and trust, especially in communities who have had disappointing experiences with prior development interventions from other NGOs.

6.1 Measurable impacts

Since its establishment, MYGS has recorded measurable successes such that include:

Job Creation: MYGS established two waste collection centers in Potiskum, 25 people were hired and trained to work as plastic waste collectors. This reduces poverty and vulnerability to extremist recruitment.

Environmental Benefits: The plastic waste centers have collected over 10 tons of plastic waste in two years, reducing environmental hazards and improving cleanliness.

Violence Prevention: Communities involved in the project report improved trust, social cohesion, and reduced vulnerability to extremist recruitment.

Climate Awareness: 2,320 students and volunteers were trained; Environmental knowledge among residents, especially youth, has grown significantly, with new community groups forming to advocate for greener practices.

Tree Planting: 1,200 trees were planted

6.2 Challenges Faced and How They Were Addressed

Operating and movement across communities in a state plagued by insurgency and mistrust remained the most serious obstacle because there is always a security concern, intervention and any awareness campaign had to be carefully coordinated due to the threat of violence. At some point, movement was restricted. To navigate this, MYGS worked with traditional leaders, youth leaders and vigilante groups to ensure safe access to target areas. Another big challenge was funding, financial constraints threatened some of the MYGS's projects, especially on plastics collection and sorting; however, strategic partnerships with local recyclers and small businesses enabled cost-sharing and market access for collected plastic.

6.3 Insights for Future Work

One of the most powerful insights that the project highlights is that environmental sustainability and peace building can be pursued together when solutions are community-driven, in fact, they are deeply intertwined. The success of MYGS's approaches also suggests it could be replicated in other conflict-affected regions across in Nigeria and Africa at large.

For future interventions, it will be critical to build longer-term capacity such as offering advanced skills training in clean energy technology or empowering small businesses that transform recycled plastic into sellable products.

7.0 Recommendations

To enhance the effectiveness of community-led climate initiatives and build a more inclusive community-driven energy transition in conflict-affected state like Yobe, the following recommendations are proposed at both the policy and project levels:

7.1 Policy-Level Recommendations

Governments at all levels must recognize grassroots initiatives as key partners in the just energy transition and fight against climate change. Policies should prioritize funding and technical support for local NGOs working on climate resilience and green job creation.

National frameworks should prioritize solar technologies, and allocate dedicated funds for locally-led recycling and employment programs that counter extremist recruitment narratives.

To enhance project sustainability, the NGOs must create structured pathways for beneficiaries to transition from short-term engagement into long-term employment or enterprise development. And also to scale green job training programs the NGOs should formalize partnerships with renewable energy providers and vocational training centers. Furthermore, establishing many more plastic waste collection centers in different areas will also widen participation and help create more green jobs.

7.2 Deepening Community Engagement

Community engagement must be continuous and multi-dimensional, having community forums will improve project ownership, especially when marginalized groups are given special attention and also appointing community leaders as ambassadors can boost outreach and combat misinformation spread by terrorist groups.

In this capstone project, MYGS has clearly demonstrated how community-led climate action can simultaneously address unemployment, environmental degradation, and insecurity in a region suffering from the climate crisis and violent extremism, the NGO has also shown how it made significant strides and took a locally grounded approach to promote clean energy, plastic recycling, and encourage green jobs creation.

Most importantly, the initiative shows that the energy transition in Africa must be inclusive. When vulnerable groups are meaningfully engaged, and when solutions reflect real local needs, climate action becomes a tool for hope, stability, and transformation.

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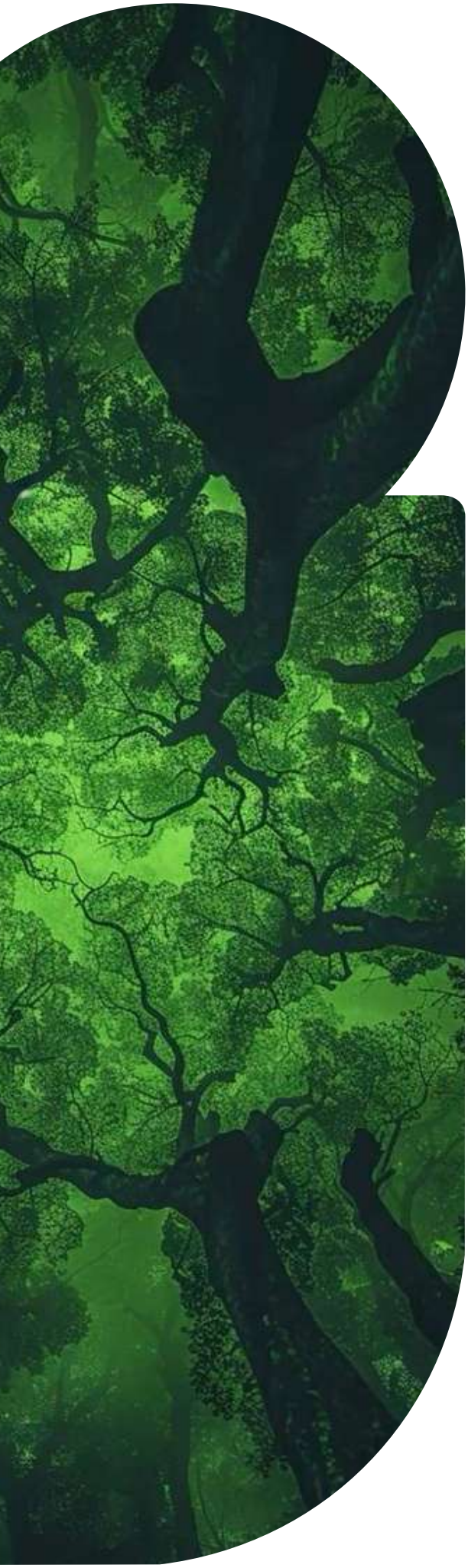
Appendix

MYGS's climate awareness campaigns focused on clean energy promotion, tree planting and plastic recycling



Trash2Cook Initiative via COOKBLU to Enhance Sustainable Access to Clean Cooking

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About the Fellow

Princess Odiaka, Founder of Trifinity Intelligence Consult Ltd and COOKBLU, is Vice-Chair of the LPG Nigeria Alliance for Clean Cooking. She is a climate consultant, carbon market expert, and advisor on Nigeria's national clean energy policies

Abstract

This case study explores the waste-energy nexus aligning socio-cultural dimensions of clean cooking within Nigeria's energy transition. Mixed-methods approach—including household surveys, focus group discussions, interviews with women and youth, and field observations—were used in the study to assess community needs, adoption patterns, and impacts of sustainable cooking solutions. Guided by frameworks such as the World Bank's Multi-Tier Framework for Energy Access, the ENERGIA Gender and Energy Framework, and participatory rural appraisal, the initiative revealed significant outcomes. Clean cooking improved health by reducing smoke-related illnesses, redirected household savings toward education, and empowered women as both beneficiaries and entrepreneurs. Environmentally, it contributed to deforestation reduction and lower carbon emissions. However, barriers such as upfront costs, cultural resistance, and limited infrastructure persist. The study recommends policy-level support through subsidies, inclusive financing models, and gender-sensitive programming, while emphasizing community-driven approaches to ensure long-term adoption and scale-up of clean cooking solutions.

Keywords: Clean cooking, cookblu, sustainable cooking

1.0 Introduction

According to the World Economic Forum (2024), the "Just Energy Transition" is anchored on three pillars: innovation, access to energy, and community engagement. Of these, community engagement is foundational, as no transition can succeed without the active participation of the people it is designed to serve. UNESCO (2017) defines a community as a group of individuals bound by geography, shared interests, or common characteristics, and within such groups, community voices are essential in shaping energy, health, and social development outcomes.

The transition to clean energy is not merely a technical shift from fossil fuels to renewables; it is a systemic transformation in how societies live, work, and thrive. While finance, technology, and policy are critical enablers, scholars emphasize that community engagement ensures transitions are fair, inclusive, and sustainable (Sovacool, 2021).

Several dimensions highlight the importance of engagement:

Equity and fairness: marginalized groups—rural households, women, and low-income families—face the greatest barriers to affordable and reliable energy (IEA, 2022). Engagement ensures that benefits such as cleaner air, lower costs, and job creation are more widely shared.

Trust and acceptance: large-scale energy projects often meet resistance when communities feel excluded (Ahlborg & Nightingale, 2018). Early involvement fosters transparency, prevents conflict, and builds legitimacy.

Local knowledge and innovation: communities bring lived expertise, enabling solutions—such as clean cooking technologies—to be tailored to cultural practices (Oparaocha & Dutta, 2011). Accountability and resilience: participatory processes create feedback loops, strengthening safety and adaptability (World Bank, 2020).

Ownership and long-term change: when communities see themselves as partners rather than recipients, they are more likely to embrace behavioral change and entrepreneurship (UNDP, 2021).

A practical example is COOKBLU, a Nigerian initiative delivering LPG as a service through smart composite canisters. COOKBLU combines affordability, convenience, and safety with IoT-enabled devices for real-time monitoring, refill alerts, pay-as-you-go payments, and carbon credit tracking.

Its complementary Trash2Cook scheme innovatively tackles both waste pollution and dependence on dirty fuels by enabling households to trade recyclable waste for clean cooking solutions such as LPG and e-cooking.

This model reduces reliance on firewood and charcoal, curbing deforestation and lowering emissions. Women and children benefit directly by avoiding the burdens and risks of firewood collection and exposure to indoor air pollution. Beyond health and environmental gains, the scheme generates green jobs in recycling and clean energy distribution, with a focus on youth and women.

The purpose of documenting this case is to demonstrate how clean cooking initiatives can be culturally appropriate, socially inclusive, and gender-responsive. By amplifying community voices, it highlights challenges and opportunities in advancing grassroots solutions, while providing replicable models for policymakers and practitioners. Ultimately, COOKBLU illustrates that equity, trust, innovation, accountability, and ownership must be co-created with communities living the transition daily.

2.0 Methodology

To capture a comprehensive picture of community needs, behaviours, and outcomes, a combination of qualitative and quantitative research methods were employed. Household surveys were conducted to document cooking patterns, energy preferences, and affordability challenges.

These were complemented by in-depth interviews with women and youth, which provided lived experiences and highlighted gendered dimensions of energy access. Focus group discussions with community leaders offered broader insights into local priorities, cultural norms, and perceptions of new technologies.

In parallel, field observations during cooking demonstrations allowed us to directly assess how households interacted with clean cooking solutions in real time, identifying both opportunities and barriers to adoption. Secondary data sources—including project reports, national energy statistics, and health impact assessments—were also reviewed to triangulate findings and strengthen overall reliability.

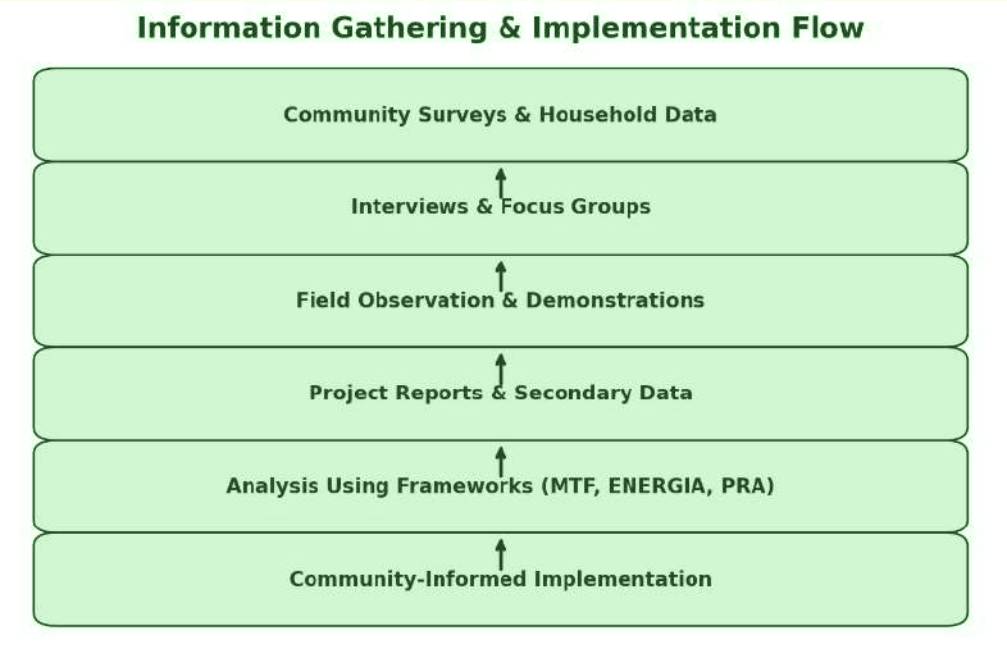
The study was guided by internationally recognized frameworks in energy access and participatory development.

The World Bank's Multi-Tier Framework for Energy Access was adapted to evaluate the reliability, affordability, and sustainability of cooking solutions within the local context.

Gender dynamics were systematically analysed using the ENERGIA Gender and Energy Framework, ensuring that women's voices and contributions were not only captured but also integrated into solution design. To deepen community participation, we applied a Participatory Rural Appraisal (PRA) approach, which emphasizes bottom-up decision-making and inclusive dialogue. By combining these methods and frameworks, the study balanced quantitative rigor with qualitative depth, while embedding community ownership at every stage.

The approach ensured that the initiative was aligned with sustainable development goals, global best practices while responsive to the unique realities, aspirations, and challenges of Chika Satellite Town, Abuja.

Table 1: Information Gathering and Implementation Flow



2.1 Case Study Description - Energy Access and Environmental Challenges in Chika Community, Abuja.

Community Context

Chika community, located along Airport Road in Abuja (Lat. -8.991371587123526, Long. -7.405336956126408), lies within the middle-belt woodlands of Nigeria. With an estimated population exceeding 850,000, the community reflects a mix of rural and peri-urban dynamics, where farming coexists with small businesses and corporate jobs (Chika Community Environmental Services [CCES], 2023). Demographic data reveal that 65% of residents fall within the youthful age group of 20–50 years, forming a productive labour force. However, income distribution highlights inequality: 10% are high-income earners (₦300,000+ monthly), 15% belong to the middle-income group (₦80,000–₦299,999), and a vast majority (75%) live below ₦79,999 per month, often surviving on $2–$5 daily (World Bank, 2022).

Environmental Degradation

Chika once boasted rich forest reserves, however, records from CCES indicate that about 90% of the forest cover and one natural park have been lost to deforestation, primarily for firewood. The situation is compounded by heavy littering of non-biodegradable solid waste, including plastics and electronic waste, which block waterways and farmlands. During rainy seasons, this results in waterlogging and stagnant pools that foster mosquito and tsetse fly breeding, increasing risks of vector-borne diseases (Federal Ministry of Environment [FME], 2021).

2.2 Household and Commercial Energy Use

Energy assessments indicate that approximately 70% of households rely on firewood, coal, and kerosene, while only 10% use a mix of electricity and LPG (CCES, 2023). In the commercial sector, about 80% of food vendors depend on traditional fuels, while just 20% employ LPG or electric stoves.

This pattern mirrors national statistics, where more than 70% of Nigerians continue to rely on biomass for cooking (International Energy Agency [IEA], 2021).

3.0 Gender Dimensions Of Energy Access

Women and children disproportionately bear the burden of fuel collection. Many travel three to eight hours to unsafe forest areas, exposing them to gender-based violence (GBV), kidnapping, and exploitation (Global Alliance for Clean Cookstoves, 2018). Firewood use also reinforces economic dependency, as some families engage in firewood trading to supplement income.

Health risks from inefficient cooking are severe. Indoor air pollution (IAP) from smoke, carbon monoxide (CO), nitrogen oxides (NOx), and fine particulate matter (PM2.5) contributes significantly to respiratory diseases.

The National Clean Cooking Policy (2023) estimates that 95,300 premature deaths in Nigeria are linked to IAP annually, with 52,000 of these deaths occurring among women and children. Observations in Chika revealed additional reliance on burning plastics as fuel, which releases dioxins and other carcinogenic pollutants (World Health Organization [WHO], 2021).

Prolonged exposure has been linked to cardiovascular and pulmonary diseases, vision impairment, skin disorders, and chronic fatigue (WHO, 2018).

Public Health Implications
Poor energy access intersects with inadequate sanitation to worsen health burdens. Data from Aleyita Primary Health Centre (PHC) in a neighbouring community indicate a 60% increase in malaria incidence, largely attributable to waterlogged drainages and mosquito proliferation.
This reflects findings from national studies that link poor waste management and unclean cooking environments with high disease prevalence (Nigeria Centre for Disease Control [NCDC], 2020).

4.0 The Cookblu Initiative

The COOKBLU project offers an integrated solution to these challenges through smart clean cooking technologies. It provides LPG as a service using composite canisters embedded with IoT devices for real-time monitoring, refill alerts, and pay-as-you-go functionality.

Additionally, the project promotes efficient cookstoves, e-cooking solutions, and a Monitoring, Reporting, and Verification (MRV) system to support carbon credit sales.

A central feature of the initiative is the Trash2Cook scheme, which allows households to exchange recyclable waste for clean cooking fuel.

This innovation reduces plastic pollution while facilitating an affordable transition from firewood to LPG. Complementary activities, such as tree planting around micro-distribution outlets, promote biodiversity restoration and climate resilience.

4.1 Partnerships and Future Outlook

The COOKBLU project operates in collaboration with government agencies, academia, industry actors, and NGOs, aligning with Nigeria's clean cooking and climate policies. By transitioning women from traditional fuels to LPG, the initiative reduces health risks, empowers women economically, and frees time for education and productive work. Its scalable model holds promise for replication across other Nigerian communities facing similar challenges.

4.2 Community Voices

A mother once told me: "Since I started cooking with your solution, my children no longer cough from smoke." That simple statement captured the health benefits more powerfully than any statistic.

In another community, a woman explained how the money she once spent on firewood was now directed toward her children's school fees. For her, clean cooking meant not just cleaner air, but also opportunity and dignity. During a follow-up visit, several community members expressed pride in being part of the clean energy transition. Adopting our solution was not merely about food preparation—it symbolized progress, resilience, and belonging to a bigger change.

4.3 The Vision and Targets

Our initiative seeks to transform energy use in households and businesses by making clean cooking accessible, affordable, and culturally acceptable. By 2026, we aim to transition 60% of homes and 40% of businesses to sustainable cooking solutions.

This transformation is projected to mitigate deforestation, reduce waste-related pollution, and improve access to low-carbon energy sources. By 2027, we intend to:

- De-risk the cost of clean cooking by lowering the initial price of LPG stoves by 70%.
- Ensure household safety, targeting 99% risk-free adoption through modern canisters and smart monitoring.
- Eliminate up to 95% of environmental pollution linked to firewood and plastic burning.
- Switch 200,000 homes and 50 businesses to sustainable clean cooking practices.
- Restore biodiversity through reforestation and waste-to-fuel schemes.
- Contribute at least 20% progress to eight Sustainable Development Goals (SDGs) and achieve 5% contribution toward Net Zero Emissions by 2027.

These targets are ambitious, but they reflect the urgency of the problem and the scale of change required.

4.4 Cultural Dimensions of Clean Cooking

Cooking is more than a functional activity—it is central to cultural identity, traditions, and family life. Across Nigeria and much of the Global South, recipes and cooking methods are passed down through generations. This cultural link often influences whether households accept or reject new technologies. As the World Bank (2020) notes, adoption rates for clean cooking are higher when solutions are designed to accommodate local cuisines and traditional practices.

Our initiative therefore integrates community feedback to ensure that stoves and fuels align with local cooking styles, thereby increasing acceptance and long-term use.

4.5 Social Benefits

The social impacts of clean cooking extend far beyond the kitchen. The World Health Organization (WHO, 2021) estimates that household air pollution from solid fuels causes more than 3.2 million premature deaths annually, with women and children disproportionately affected. Transitioning to clean fuels drastically reduces this burden, leading to better respiratory health and reduced medical expenses.

Clean cooking also saves time. In many rural and peri-urban communities, women spend three to six hours a day collecting firewood or tending inefficient stoves. By switching to clean cooking, this time can instead be invested in education, small-scale businesses, or community leadership roles.

According to the International Energy Agency (IEA, 2022), widespread adoption of clean cooking solutions has the potential to free up millions of productive hours globally, boosting both education and livelihoods.

At a community level, the shift also supports environmental sustainability. By reducing firewood dependence, clean cooking contributes to forest preservation and lowers greenhouse gas emissions. This aligns with the United Nations Development Programme (UNDP, 2023) emphasis on integrating clean cooking into broader climate action frameworks.

4.6 Gender at the Heart of Clean Energy

Gender is not a side issue—it is central to the clean cooking agenda. In most households, women are the primary cooks, making them the most exposed to indoor air pollution and the health consequences that follow. Clean cooking technologies directly address these health risks while also offering economic and social opportunities.

Studies show that when women are engaged as entrepreneurs, distributors, or decision-makers, the adoption of clean cooking solutions increases significantly (ENERGIA, 2019).

In our project, women are not only end-users but also champions and leaders in the clean energy transition. By reducing their exposure to smoke and freeing up time, women gain new opportunities to participate in education, small business ventures, and community governance.

This positions clean cooking as a pathway not only to health but also to gender equity, dignity, and resilience.

Looking Forward

The clean energy transition cannot succeed without addressing cooking, a daily practice at the heart of household life. Our project demonstrates that clean cooking is not merely a technological shift but a holistic solution that touches on health, environment, culture, and gender equity. By 2027,

Our vision is to see Chika and similar communities thrive with healthier households, restored forests, empowered women, and reduced carbon footprints. What began as a mother's relief over her children's coughs has grown into a broader story of transformation—one where clean cooking fuels dignity, progress, and sustainable futures.

5.0 Outcomes & Lessons Learned

The initiative has enabled over 300 households to transition from traditional cooking fuels to LPG and other clean alternatives.

This shift has reduced household air pollution, cutting smoke-related health risks, and is estimated to have saved 7.5 million tonnes of CO_2 equivalent in emissions. Families also report significant cost savings on fuel and improved household wellbeing, particularly in terms of time freed from collecting firewood.

A key challenge was affordability, as the upfront cost of clean cooking technologies is often a barrier. We addressed this by piloting pay-as-you-go models and reducing stove and cylinder costs through partnerships.

Cultural preferences also slowed adoption, as some households felt clean cooking altered the taste of traditional dishes.

To address this, we conducted community demonstrations and allowed households to test solutions in real settings. Finally, supply chain disruptions were mitigated by training local distributors and creating community-based refill networks.

The experience shows that clean cooking transitions succeed when solutions are co-created with communities, not imposed. Affordability and accessibility remain central, meaning innovative financing and subsidies are critical for scale. Gender inclusion is also a powerful driver: when women and youth are engaged as entrepreneurs, adoption grows faster and deeper.

Future work should focus on replicating community-led distribution models and strengthening policy support to mainstream clean cooking in national energy strategies.

6.0 Recommendations

6.1 Policy-level recommendations

- Integrate clean cooking into national energy strategies as a core priority.
- Provide targeted subsidies and incentives for low-income households.
- Support innovative financing models such as pay-as-you-go and micro-credit.
- Develop gender-responsive energy policies that empower women as entrepreneurs.
- Strengthen supply chain infrastructure to ensure consistent access in rural and peri-urban areas.

6.2 Project-Level Improvements

- Expand local distribution networks by training women and youth as last-mile distributors.
- Enhance monitoring and evaluation systems using digital tools to track adoption and impacts.
- Refine product design to align with cultural cooking practices.
- Build stronger partnerships with government, NGOs, and private investors for scaling.

6.3 Ways to Deepen Community Engagement

- Conduct participatory design workshops to co-create solutions with households.
- Train community ambassadors to champion clean cooking adoption.
- Establish continuous feedback loops through surveys, forums, and digital tools.
- Launch awareness campaigns using storytelling and peer-to-peer learning.
- Engage youth as advocates through schools, social media, and community events.

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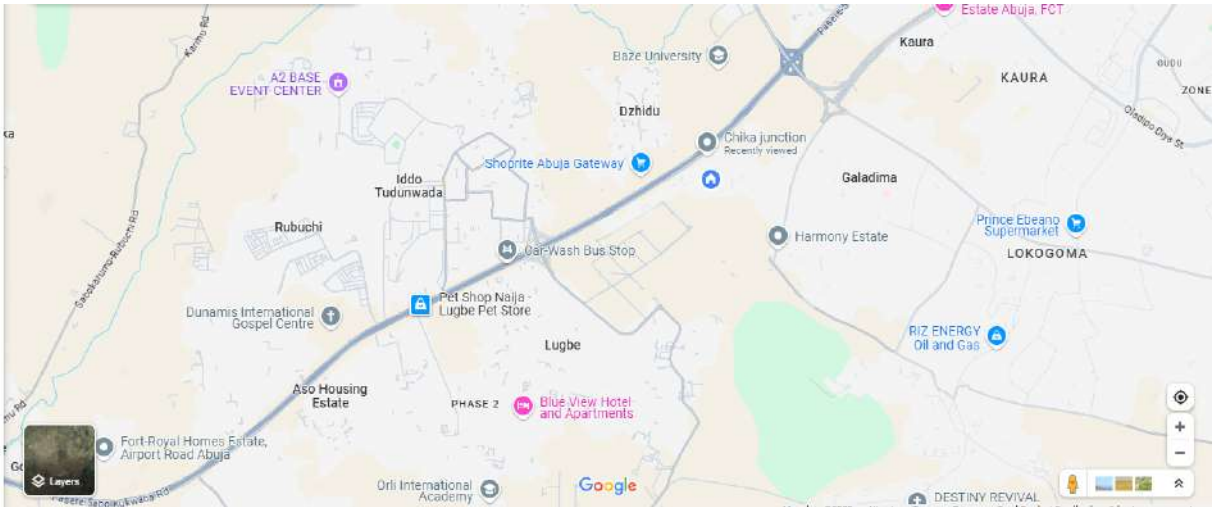
Appendix 1

Project Location Map

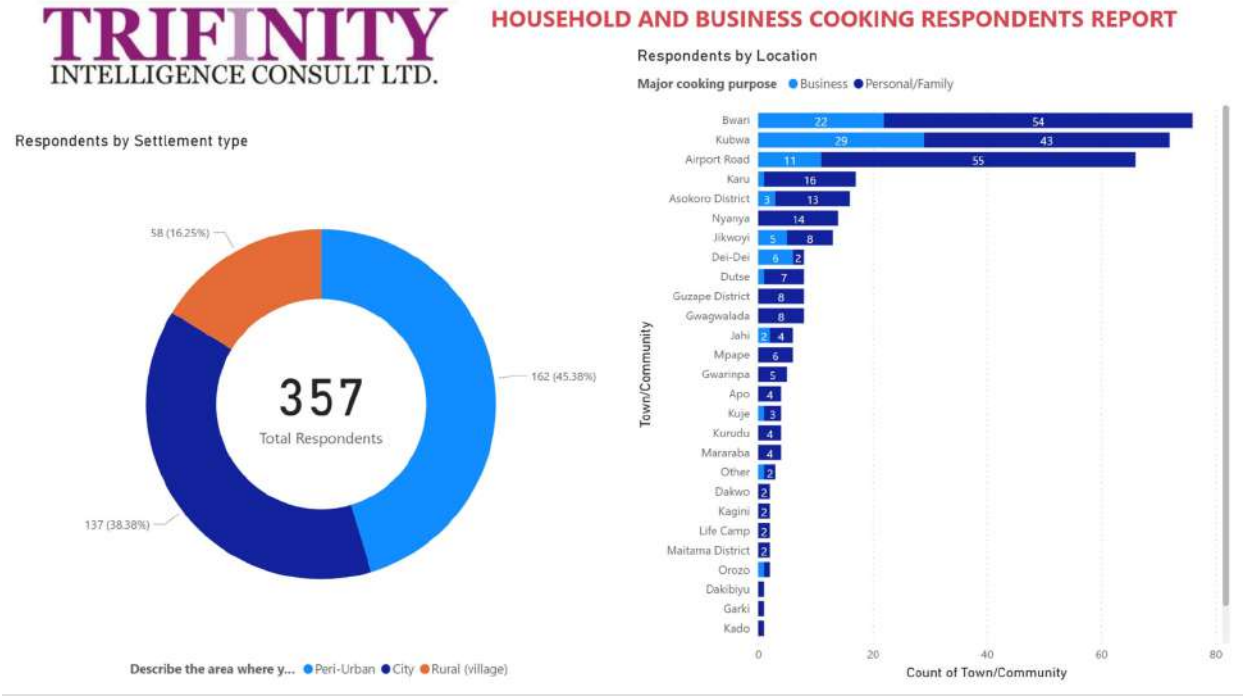


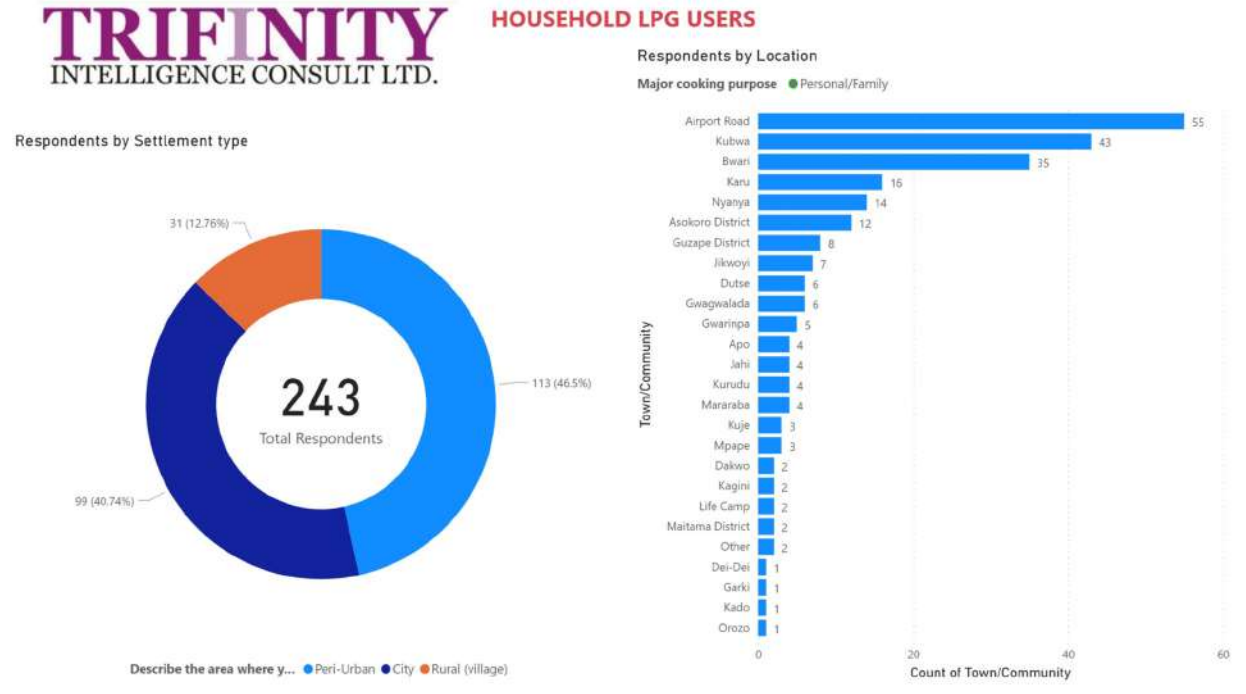
Appendix 2

Link to interview forms
https://tinyurl.com/HouseholdBusinessCookingAS1

Appendix 3

Charts





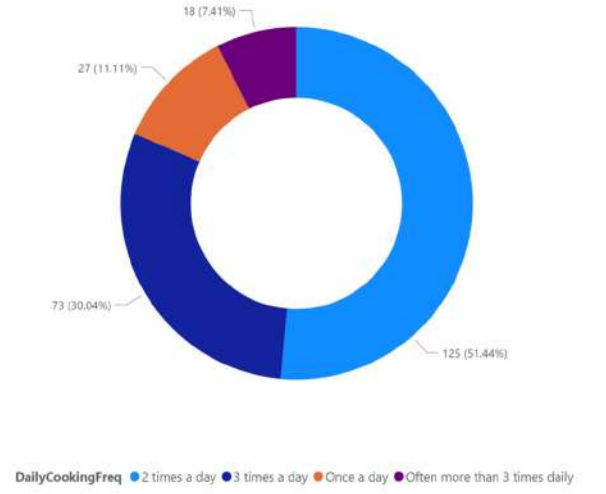
Appendix 3

Charts

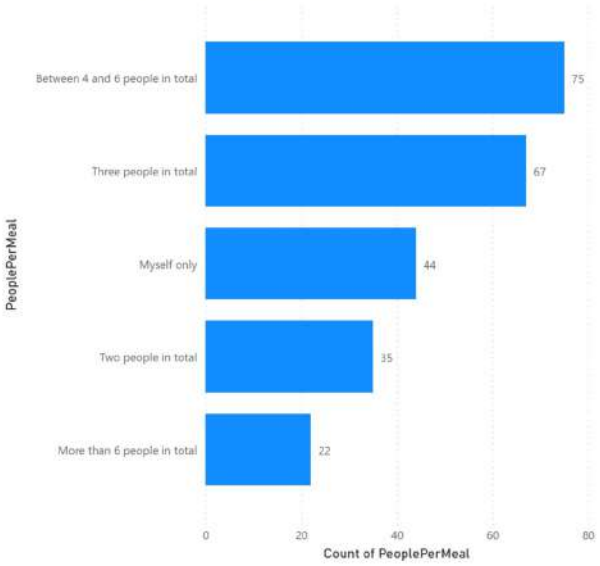
TRIFINITY INTELLIGENCE CONSULT LTD.

HOUSEHOLD LPG USERS

Average number of cooking times per day



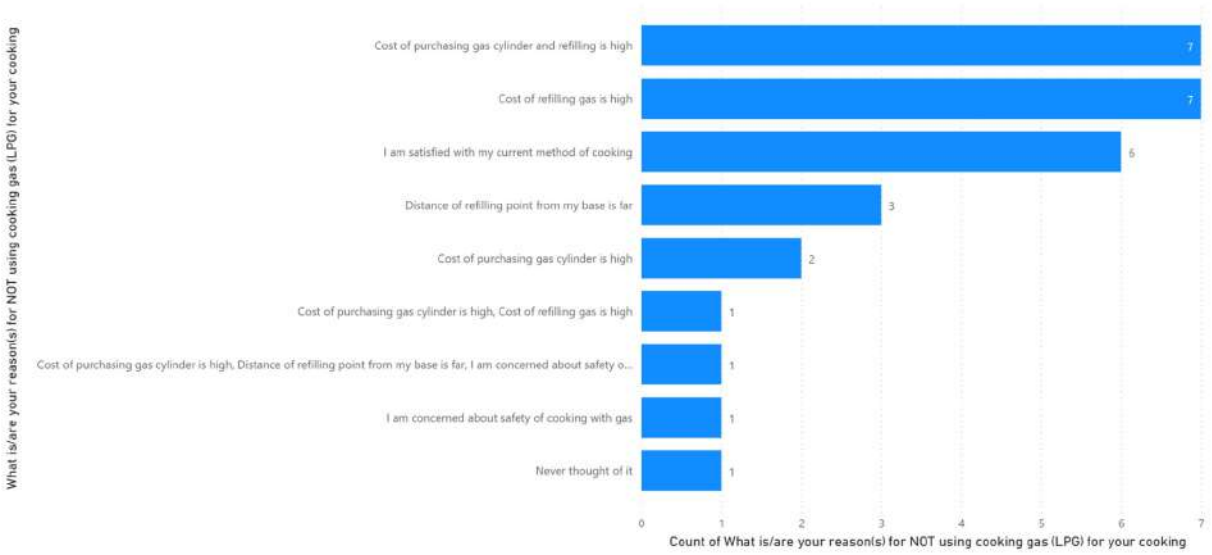
Average number of people cooked for per meal



TRIFINITY INTELLIGENCE CONSULT LTD.

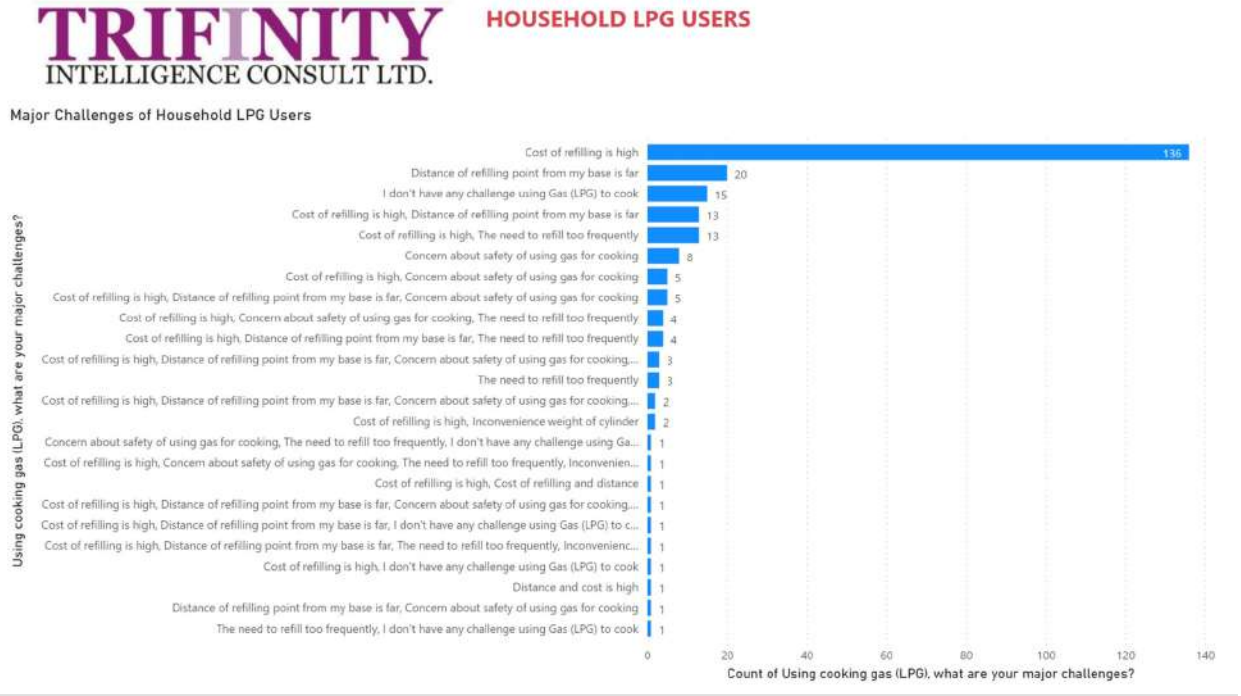
HOUSEHOLD NON-LPG USERS

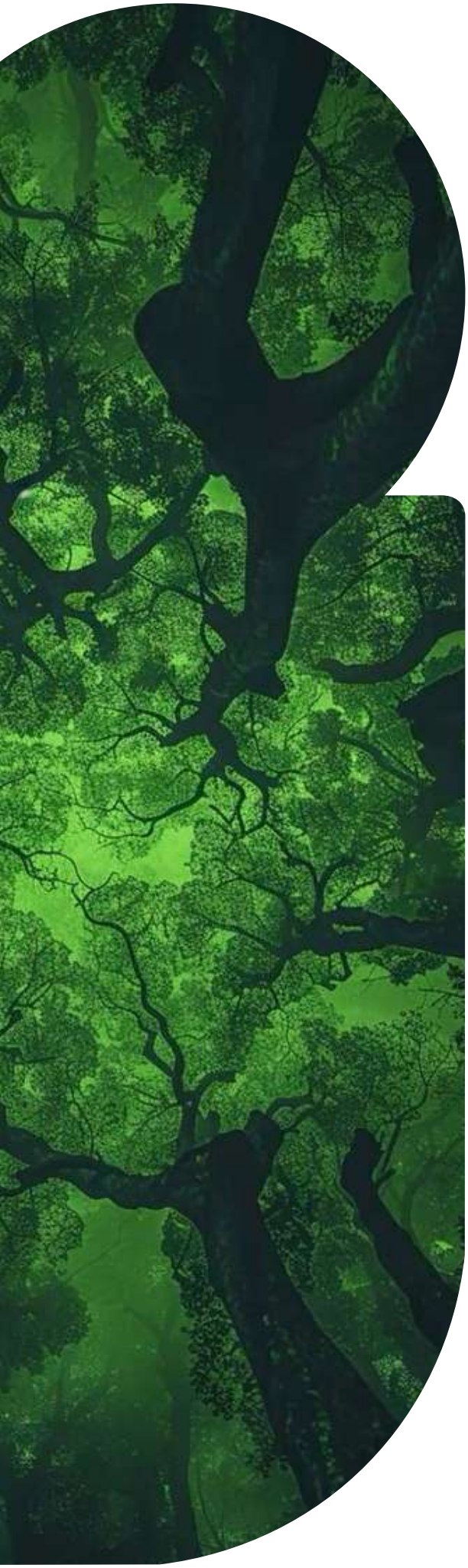
Reasons for not using LPG



Appendix 3

Charts





Turning Waste to Wealth: Community Perspectives on Agri – Wastes to Biofuel in Ogun State's Energy Transition

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About the Fellow

Adio Babatunde, is a climate advocate who led an initiative at a local soap processing facility in Ota. He tackled barriers to clean energy adoption—such as cost, cultural practices, and operational resistance. His efforts promoted climate-friendly practices among community businesses and women's groups, improving health outcomes for women and children by raising awareness of the dangers of fuelwood dependence.

Abstract

This case study examines Cabax Farms' circular biofuel initiative in Ota, Ogun State, Nigeria, which transforms palm kernel shells into clean bio-energy, organic fertilizer, and green jobs. Using a mixed-methods approach—community surveys, semi-structured interviews, focus groups, and project data—the study captures how farmers, women, and youth perceive and benefit from this energy transition. Findings reveal reduced dependence on diesel and firewood, improved soil fertility, and strengthened rural livelihoods. Over 100 farmers' to be trained, 10 tons of waste converted, and 4.3 tons of CO_2 emissions avoided in the first year. However, challenges include financing barriers, high technology costs, and cultural resistance to new practices. Recommendations include integrating community bio-energy into Nigeria's Energy Transition Plan, expanding micro-finance for smallholders, and deepening women and youth engagement. Cabax Farms demonstrates how grassroots, circular economy models can deliver both climate mitigation and inclusive rural development.

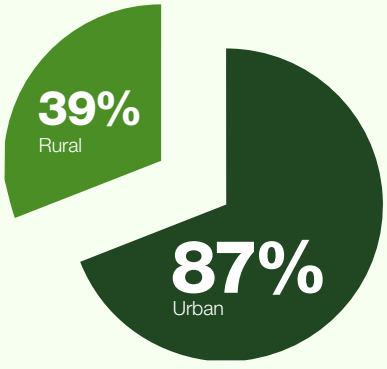
1.0 Introduction

Africa's energy transition is not only a technical shift from fossil fuels to renewable but also a question of justice, inclusivity, and relevance to local realities. More than 600 million Africans lack access to electricity, while millions more depend on expensive and polluting fuels like diesel, kerosene, and firewood. The consequences are especially severe for rural populations who face higher costs, poorer health outcomes, and limited opportunities for productivity. In Nigeria, the urgency of this transition is striking.

Oil and gas revenues account for over 85% of export earnings and 40% of government revenues, yet more than 80 million Nigerians remain without reliable electricity access. This paradox highlights how national wealth from fossil fuels has not translated into universal energy access. The impact falls disproportionately on smallholder farmers, women processors, and rural youth who depend on energy for agricultural processing, irrigation, and household needs.

Nigeria's Energy Poverty in Numbers

Indicator	Value (Nigeria)	Rural Impact
Population without electricity access	80 million (40% of population)	Mostly rural communities
Dependence on biomass (firewood/ charcoal) for cooking	70% of households [3]	Women & children most affected
Diesel reliance in agro-processing	>30% of milling costs [4]	Farmers & processors bear high costs
Deforestation rate (annual)	3.7% [5]	Linked to fuel wood collection



The data illustrates how rural Nigeria is left behind in national energy planning. Without clean, affordable alternatives, communities face high production costs, reduced competitiveness, and environmental degradation from firewood use.

2.0 Methodology

To capture the perspectives of rural communities engaged with Cabax Farms' biofuel initiative, this study employed a mixed-methods approach combining both quantitative surveys and qualitative interviews. This ensured inclusivity, gender sensitivity, and local ownership of the research process.

2.1 Tools & Instruments

Community Surveys – 50 households across 3 villages were surveyed to assess baseline and post-intervention energy use, costs, and fertilizer adoption.

Table 1: Sample Size & Tools

Method	Participants	Purpose
Household surveys	50 households	Energy use, costs, fertilizer adoption

2.2 Data Sources

Multiple data sources were triangulated:

- Primary Data – Collected via household surveys.
- Cabax Farms' Reports – Production data (palm oil yield, biofuel conversion ratios, fertilizer distribution).
- Impact Metrics – Farmers trained, jobs created, CO_2 avoided.
- Field Observation – Direct on-site observations of processing units, household fuel use, and cooperative meetings.

2.3 Analytical Frameworks

Two participatory frameworks guided the analysis:

- **Participatory Rural Appraisal (PRA):** Tools such as seasonal calendars and ranking exercises identified community priorities and energy use patterns.

- **Sustainable Livelihoods Approach (SLA):** Assessed how the initiative influenced the five livelihood capitals:
  - Human (skills/training),
  - Natural (soil/environment),
  - Financial (income/savings),
  - Social (networks/cooperatives),
  - Physical (infrastructure/tools).

2.4 Ethical Considerations

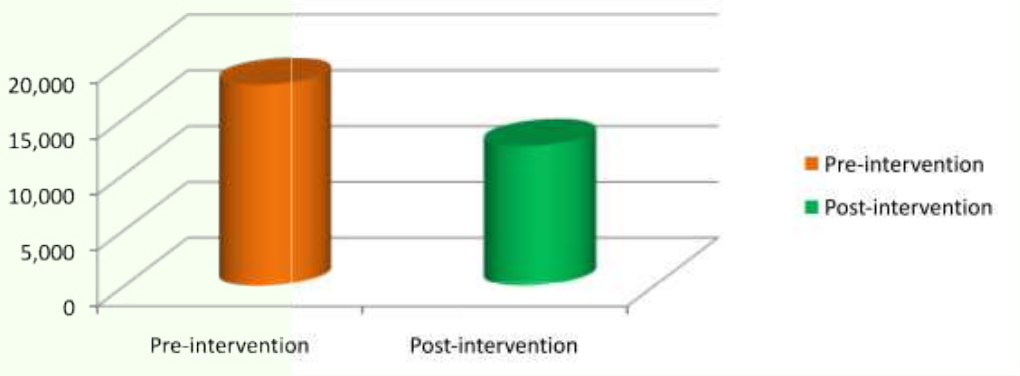
- Informed consent was obtained from all participants.
- Special emphasis was placed on amplifying women's and youth voices, often underrepresented in energy decision-making.
- Anonymity was preserved for all interviewees.

2.5 Analysis

- **Quantitative Data:** Survey responses were analyzed descriptively, comparing pre- and post-intervention energy costs and yield changes.

- **Qualitative Data:** Interviews were thematically coded, highlighting recurring patterns of economic relief, cultural acceptance, and gender empowerment.

Figure 2: Survey Results – Change in Household Energy Costs (Naira)



- Pre-intervention: Average monthly energy cost = ₦18,000
- Post-intervention: Average monthly energy cost = ₦12,500
- Result: **30% savings** after adopting biofuel briquettes

3.0 Case Study

3.1 Community Background

This case study focuses on three rural farming communities in Ota, Ogun State, Nigeria. These villages are home to roughly 2,500 smallholder farmers and processors, whose livelihoods depend heavily on palm oil production. Agriculture provides 80% of household income, yet most farmers face persistent challenges such as outdated processing methods, reliance on costly diesel, and dependence on firewood for household energy. Prior to the intervention, women and youth were disproportionately burdened: women spent hours collecting firewood, while youth lacked employment opportunities in the agricultural value chain. Energy poverty, agricultural inefficiency, and environmental degradation were tightly linked.

3.2 Energy Needs Pre-Intervention

Before Cabax Farms' project:

Diesel Dependence: Palm oil processors spent 30–40% of their production costs on diesel, which was often unavailable due to shortages.

Post-Harvest Losses: Up to 20% of harvested palm fruit (FFB) was lost due to processing delays when diesel generators failed.

Firewood Reliance: Households used firewood as their primary cooking fuel, leading to deforestation and indoor air pollution.

Social Impacts: Women and girls spent 6–10 hours per week collecting firewood, reducing time for education and cooperative activities.

3.3 Cabax Farms' Intervention

Cabax Farms designed a circular biofuel model that integrates palm oil production with renewable energy and farmer empowerment.

Three core components:

1. **Biofuel Production –** Palm kernel shells (PKS), a waste byproduct, were processed into biofuel briquettes and biochar. Each ton of PKS produced ~500 liters of biofuel, replacing diesel and firewood.

2. **Organic Fertilizer –** Byproducts were processed into biochar-based fertilizer, improving soil fertility and reducing chemical dependence.

3. **Farmer Training –** Farmers, women processors, and youth received training on renewable energy, sustainable farming, and cooperative management.

3.4 Key Stakeholders

The initiative was a multi-stakeholder collaboration:

Stakeholder	Role in Project
Farmers'	Provided FFB, supplied shells, adopted biofuel and fertilizers.
Women Processors	Adopted biofuel in milling, reduced costs, improved safety.
NJFP * UNDP - INTERN	To be trained as biofuel operators, distributors, fertilizer blenders.
Stanford University, USA	Partnership to provide Carbon Credits Certification, Secured.
Busara Lab, Kenya	Supplied technical expertise, training modules, and M&E frameworks.

3.5 Implementation Process

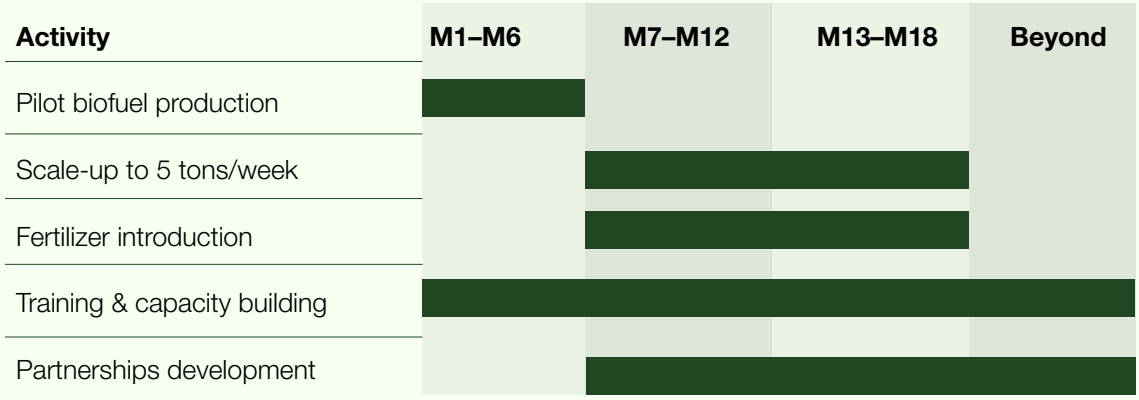
The project was implemented in **three phases:**

Table 1: Implementation Phases

Phase	Duration	Activities	Key Results
Pilot Phase	**Partial Completion**	1-ton/week PKS- briquettes; distributed to 20 households, 10 processors.	30% energy cost savings; diesel use halved.
Scale-Up	**Ongoing**	5-tons/week PKS processed; fertilizer distribution to 100 farmers.	20% crop yield increase; 500 tons waste diverted.
Capacity Building	**Ongoing**	Training for 200 farmers, 60 women, 40 youth; entrepreneurship workshops.	120 green jobs created; women processors saved 10 hrs/week.

3.6 Timeline of Activities

Figure 1: Project Timeline



3.7 Early Outcomes

- **Energy Access:** 300 households/processors to adopt biofuel.
- **Environmental Impact:** 500 tons of PKS to be converted, avoiding ~1,200 tons CO_2 emissions.
- **Agricultural Productivity:** Fertilizer use increased cassava and maize yields by 20– 25%.
- **Social Benefits:** Women processors saved **₦5,000–₦7,000** monthly on diesel and 10 hours weekly from firewood collection.
- **Youth Employment:** 120 jobs to be created in production, logistics, and sales of biofuel and fertilizer.

4.0 Community Voices

The impact of Cabax Farms' biofuel and circular agriculture project comes to life most vividly through the voices of those it directly affects. Farmers, women, and youth share stories of transformation, challenges, and aspirations that highlight both the successes and complexities of grassroots energy transition in rural Nigeria.

4.1 Farmers: Turning Waste into Wealth

For many farmers, palm kernel shells (PKS) were once a burden. Left in heaps after milling, they caused odors, pests, and occasional fires. Today, they are a source of income and pride.

Mr. Kehinde, a smallholder farmer, explained:

"Before, the shells just rotted behind the mill. We saw them as useless. Now Cabax Farms will pay us for them, and we feel part of something important. What was waste is now money."

Farmers emphasized that this additional income helps cover school fees and farm inputs. On average, households projects earning of ₦15,000–₦20,000 monthly from shell sales—previously unthinkable from "waste."

Below are survey responses from farmers;

Frequency of biofuel use (electricity)	Count	%
A. Daily	10	20%
B. Several times a week	12	24%
C. Occasionally	8	16%
D. Rarely	10	20%
E. Never	10	20%
Total	**50**	**100%**

Cultural and Social Dimensions

The project also influenced cultural perceptions and social relations. Waste, once viewed as "dirty," is now considered a valuable resource.

Chief Dada, a community elder, summarized:
"We used to throw shells away. Now they bring us light, food, and work. It has changed how we think about farming and waste."
This mindset shift toward circular economy practices may foster long-term sustainability and stewardship.

Moreover, intergenerational dynamics shifted. Youth are now more respected in cooperative meetings due to their technological knowledge. Women, empowered by economic participation, gained more voice in family decisions.

4.2 Challenges and Concerns

Despite successes, community voices also revealed challenges.

Supply Gaps: Some processors complained of shortages during peak milling season.

"Sometimes demand is higher than supply. We need Cabax Farms to expand faster."

Adoption Barriers: A few farmers remained skeptical of fertilizers made from "waste."

"It is good, but some of us still trust chemical fertilizer more."

Inclusion Gaps: Women urged for more training slots, particularly for widows and marginalized processors. These challenges underscore the importance of scaling production capacity, sustained sensitization, and equitable inclusion.

5.0 Outcomes & Lessons Learned

The Cabax Farms biofuel pilot in Ota, Ogun State, demonstrates how circular agriculture can simultaneously deliver economic, environmental, and social outcomes. Measured results highlight both the tangible benefits of the initiative and the challenges that must be addressed for long-term sustainability.

Key Outcomes
Table 1: Early Impacts of Cabax Farms' Biofuel Initiative

Impact Area	Indicator	Outcome Achieved (2025 Pilot)
Farmer Capacity	Farmers trained in sustainable practices	100 to be trained
Waste Management	Palm kernel shells converted	10 tons processed
Climate Mitigation	CO_2 emissions avoided	4.3 tons avoided
Employment	Rural jobs created (youth & women)	120 jobs
Agricultural Productivity	Yield improvements (cassava/maize)	20–25% increase
Energy Costs	Reduction for processors	30–40% savings

These outcomes underline the project's effectiveness in addressing energy poverty, agricultural inefficiency, and climate change simultaneously.

5.1 Economic Benefits

Processors reduced energy costs by 30–40%, making palm oil production more competitive. Farmers who supplied palm kernel shells will gain additional monthly income of ₦15,000–₦20,000. Youth and women will be employed in production, logistics, and fertilizer blending, contributing to 200+ new rural jobs.

5.2 Environmental Gains

By converting 10 tons of waste into biofuel, the project prevented open burning and waste accumulation, avoiding 4.3 tons of CO_2 emissions—equivalent to removing 1 car from the road for a year. Fertilizer substitution also reduced chemical dependence, improving soil health.

5.3 Social Transformation

- Women saved 6–10 hours weekly from reduced firewood collection, redirecting time to cooperative meetings, businesses, or education.
- Youth gained dignified work, reducing rural-to-urban migration.
- Household decision-making became more inclusive, as women's contributions to savings and energy choices gained recognition

5.4 Challenges

Despite strong outcomes, several barriers emerged:

1. **Financing constraints** – Limited funds slowed scale-up of biofuel units and fertilizer distribution.
2. **Technology costs** – Biodiesel Machine requires regular maintenance and skilled technicians.
3. **Cultural resistance** – Some farmers preferred chemical fertilizers or distrusted "waste-to-fertilizer."
4. **Supply gaps** – Briquette shortages occurred during peak milling periods. We only possess 3,000 trees for 66,000 liters of biofuel yearly.

5.5 Lessons Learned

1. Local ownership drives adoption. Farmers and women who co-designed interventions showed higher commitment. Participatory planning increased trust and reduced resistance.
2. Partnerships accelerate progress. Collaboration with cooperatives, local government, and NGOs provided resources, credibility, and broader reach. Without these alliances, adoption would have been slower.
3. Capacity building is essential. Training not only built technical skills but also reshaped mindsets about waste and renewable energy. Sustained mentorship is needed to ensure behavioral change.

6.0 Recommendations

The Cabax Farms pilot demonstrates that community-led biofuel systems can significantly reduce energy poverty, enhance agricultural productivity, and improve livelihoods. However, scaling impact across Nigeria requires supportive policy frameworks, innovative financing, and stronger community participation. The following recommendations are proposed:

6.1 Policy-Level Recommendations

- Subsidies and tax incentives should be introduced for community bio-energy projects to offset high technology costs and encourage adoption among smallholders.
- The Nigeria Energy Transition Plan (ETP) should formally integrate smallholder-led circular bio-energy models, ensuring rural communities are recognized as key contributors to climate action.
- Establish dedicated financing windows under renewable energy and agricultural programs for waste-to-energy initiatives, particularly those that integrate women and youth.

6.2 Project-Level Recommendations

- Expand the role of farmer cooperatives in managing energy hubs. Cooperative-led ownership increases sustainability, enhances feedstock supply, and strengthens local governance.
- Develop micro-finance schemes or green credit lines that enable farmers and processors to invest in biofuel systems, briquette stoves, and fertilizer application tools.
- Strengthen partnerships with research institutions for ongoing technology validation and to reduce dependence on imported equipment through localized innovations.

6.3 Community Engagement Recommendations

- Prioritize women and youth inclusion by providing targeted training, leadership roles in cooperatives, and access to microfinance.
- Launch energy literacy campaigns using local languages, storytelling, and peer-to-peer learning to address cultural resistance and build long-term awareness of renewable energy benefits.
- Establish feedback loops (community surveys, participatory monitoring) to ensure local perspectives shape scaling strategies and improve trust.

6.4 Conclusion

By aligning national policies, cooperative-led implementation, and inclusive community engagement, Nigeria can unlock the transformative potential of circular bio-energy systems. Cabax Farms' model proves that when rural farmers, women, and youth are empowered, the transition to clean energy becomes not just a technological shift, but a socially just and economically inclusive transformation.

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Appendix

Figure 1: Biofuel during Pyrolysis

Figure 2: Biofuel after purification

10 Hectares Maize Farm– They Apply Organic Fertilizer – Front View Location: Owode, Yewa

PKS – PALM KERNEL SHELL

BioDiesel Plant – Third Party License

Biochar – Organic Fertilizer