RESEARCH ARTICLE

Perceived rural interventions for meeting the energy and agri-food needs of smallholder farmers in Imo State, Nigeria

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The study examined rural intervention programmes for meeting the energy and agri-food needs of smallholder farmers in Imo State, Nigeria. The specific objectives were to identify energy sources available to farmers in the study area; examine energy and agri-food needs of respondents and ascertain perceived rural interventions for meeting the energy and agri-food needs of respondents in the study area. A total of 360 smallholder farmers were selected and interviewed. Data were collected with a structured questionnaire and analyzed using percentages and mean. The available energy sources include human power (100%), mechanical power (70.5%), electrical power (66.6%), candles and kerosene (81.6%), charcoal/wood residues (78.8%). Energy is needed for cooking/preparing food (100%), crop production (100%), processing (88.5%) and the agri-food needs were to improve farmer livelihoods (66.6%), increase crop productivity (89.1%), reduction poverty (88.8%) among others. Rural interventions for meeting energy and agri-food needs included rural electrification programmes (M=4.09), standalone off grid energy solution (M=3.91), agricultural mechanization (M=4.05), rural road/transport programmes (M=3.90) and training/retraining of both farmers and extension officers with mean of 4.08 and 3.41 respectively. Improved/clean energy facilities are provided to the rural populace by the relevant stakeholders–governments, donor agencies, NGOs, etc. for improved livelihood and food security.

Key Words: *Rural; Energy; Food; Agriculture; Farmers, Poverty*

INTRODUCTION

Energy and energy resources are important assets of any country, develop and developing. High or low rate of industrial growth is a vital function of the amount of energy available and extent of the utilization [1]. Energy therefore is a vital ingredient for development and a powerful hub of social and economic transformation of a country or region. It is the heart and engine of everyone's quality of life and also a vital factor for all rounds development. It is fundamental to the fulfillment of basic individual and community needs in present day society [2].

Lighting and heating a house, running a factory, lighting a street, keeping hospitals open and operational provision of portable running water, among others, all depend on and require energy. The above services are the indices of a nations progress and level of development, and availability of energy for carrying out shows the level and extent of development of a country, socially and economically [3].

In Nigeria, majority are rural dwellers who live in difficult terrain without easy access to fossil fuel and electricity grids because of bad roads. Most of the areas have low population density and characterized by low level of education and low density as well. The rural inhabitants resort to the use of diesel/ generator fuel machines for electricity [4]. However several factors affect the smooth operator of their diesel engine such as high cost of fuel, maintenances bad roads, especially during rainy seasons, when the bad roads are always flooded hindering delivery of the necessary foods and fuels including other vital/lifesaving materials needed for use by man.

Moreover, it is very difficult to run a 24 hr generator services. This has resulted in the use of kerosene lamps, candles and the likes, thus spending so much time collecting fuel woods for cooking and heating purposes. These rural dwellers have no proven deposits of crude oil, national gas or large body of water [5].

Presently, only about 10% of rural households and 40% of the country's total population have access to electricity [1]. The Nigerian Energy Commission and the Solar Energy Society of Nigeria have been tasked with generating a standalone solar powered solution for the remote rural areas. The country is looking forward to further development of the hydropower resources and other renewable energies such as wind, solar and biomass to close the generator shortfall and foster the economic and social development of the country.

The above analysis fits the study area dominated by fossil fuels, with renewable energy resources underutilized grossly. The following objectives therefore guide the research.

- To identify energy sources in the study area.
- Examine energy and agro food needs of the respondents.
- Identify perceived rural power interventions for meeting the energy needs of the people.

Achieving the above objectives will x-ray the numerous hidden renewable energy potentials of the study area.

METHODOLOGY

Imo state is in South east of Nigeria. The state is made up of three agricultural zones, namely, Orlu, Owerri and Okigwe Agricultural zones and twenty seven local government areas. The estimated population of Imo state in 2020 is 5.8 million and the population density varies from 230 to 1400 people per square kilometer. The state has tropical climate characterized by two distinct seasons, rainy and dry (harmattan) seasons. The rainy season commences in April and lasts until October with an annual rainfall varying from 1500 mm to 2200 mm (60 to 80). An average annual temperature above 20°C creates an annual relative humidity of 75%, with humidity reaching 90% in the rainy season [6]. In selecting the sample, a purposive sampling technique was used to select 360 respondents from a list of 3600 farmers across the three Agricultural zones. That is 120 farmers from each Agricultural zone, making a total of 360 respondents. The two main sources of data collection used in this study included, the primary and the secondary data. The primary data were collected from the field survey/investigation by administering questionnaire to farmers while the secondary data were utilized to provide background information that were necessary to achieve some objectives of the study. Mean, frequency, and percentage were used to achieve objectives 1, 2 and 3. A four (4) point Likert type scale of Strongly Agreed, Agreed, Disagreed and Strongly Disagreed, assigned values of 4 to 1 respectively was used to achieve objective 3 which is mathematically represented as

$(4+3+2+1)/4=10/4=2.50$

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Therefore, a mean of 2.50 was adjudged okay and acceptable while any value below 2.50 was not accepted.

RESULTS AND DISCUSSION

Energy sources in the study area

Table 1 showed the various energy sources available to the respondents for use in productive activities. The table showed that human power play a major role in the economic activities of the respondents with 100% response. The dominant power used is human power in almost all the activities because human power is readily available, anytime, any day. It is followed by candles and kerosene use with 81.6% response and mechanical power 70.5% which is used for grinding corn, peeled cassava, and melon seed for cooking. Electric power (66.6%) is also available through highly epileptic and not reliable. This source of energy is not available when needed as it depends on the power holding authority to bring it when they like without considering the users. Charcoal/wood residue (78.8%) is available as people make use of it often in roasting corn, cooking and performing other farm and household duties.

TABLE 1

Energy sources in the study area.

Sources of energy	*Frequency	Percentage
Animal power	15	4.1
Solar power	30	8.3
Electrical power	240	66.6
Mechanical power	254	70.5
Human power	360	100
Thermal energy	-	-
Charcoal and wood residues	284	78.8
Wind power	-	-
Candles and kerosene	294	81.6
Batteries	68	18.8
*Multiple response		

Energy and agri-food needs of respondents

Rural people need energy for a wide range of economic activities for improved livelihoods. Table 2 below showed that energy is needed for crop production (100%), which includes land preparation, irrigation, harvesting/threshing, weeding, planting among others. They need energy for cooking (100%), post harvesting/processing/storage (88.88) which includes drying, milling, pressing, packaging and storing/preservation. Energy is needed for livestock/fish production (75%), distribution retail/transportation (86.1%). Livestock are fed, given water, shelter, catching fish and for general maintenance. Products are transported, sold and sent to buyers either at the gate or the market. All of these activities require energy.

TABLE 2

Energy and agri-food needs of respondents

Energy/agri-food needs	*Frequency	Percentage
Crop production	360	100
Livestock/fish production	270	750
Post-harvest/processing/storage	320	88.8
Distribution/retail/transport	310	86.1
Preparation/cooking food	360	100
Agri-food needs		
Improving farmer livelihoods	240	66.6
Increase crop productivity	310	86.1
Reducing poverty	320	88.8
Improve processing	309	85.8
Improve storage	313	86.9
Micro-enterprise development	323	89.7
*Multiple response		

Perceived Rural Interventions for meeting the energy and Agri-food needs

Table 3 revealed progarmmes that could be taken to meet the energy and agri-food needs of respondents. The following interventions were identified:-

TABLE 3

Perceived rural interventions for meeting energy/agri-food needs.

Rural Intervention	Mean	SD
Rural electrification programmes	4.09	1.1
Stand-alone/off-grid energy systems	3.91	0.96
Large solar technologies (photovoltaics)	3.4	0.65
Agricultural mechanization	4.05	0.84
Conservation agriculture	3.89	1.01
Energy smart agriculture	2.85	0.94
Robost financing of rural agriculture	3.85	0.74
Training/education of rural farmers	4.08	1.07
Training/re-training of extension staff	3.41	0.8
Rural roads improvement programmes	3.9	0.54
Accepted mean=2.50		

Rural electrification programmes: This intervention has a mean response of 4.09 and a standard deviation of 1.0. Rural electrification is a staple of local economic and social development. Rural electrification encourages the development of small and micro agro based rural industries/enterprises. It discourages rural urban migration/drift. It promotes investments in agriculture, interest in farming and overall improvements of the standards of living of the rural populations.

Stand-alone/off-grid energy systems and large solar technologies: This has a mean response of 3.01 and 3.40 respectively. Stand-alone, off-grid energy solutions play an important role in serving smallholder farmer needs in remote and dispersed rural areas. This is in form of the diesel generator sets which are common throughout the developing world. They help the smallholder farmers in food production or processing such as solar water pumps and crop dryers, milling machine which are powered by big diesel /generating sets or even solar energy technologies situated in a community. These work without the idea of waiting till electric light from high tension wires come.

Agricultural Mechanization: Agricultural mechanization has a mean of 4.05. This is a major focus of agricultural development for decades and it is considered vital for increasing the area of land in production, making farm operations more efficient, reducing drudgery, improving/increasing yields and stimulating rural economic growth. Several farm operations require mechanization to get going. Tillage is one major operation requiring energy. Mechanized soil tillage is associated with high soil fertility, good working soil depths and speed. Mechanization makes for timeliness of operations and is good for cultivation of larger tracks of land [7]. Others are energy-smart agriculture (M=2.85) and conservation agriculture (M=3.89). Energy-smart food systems use low-carbon energy systems in an efficient manner, provided greater energy access to support productive activities in agricultural and fishing communities agriculture improves the use of sustainable food production through integrated soil management, water and biological resources, combined with limited external inputs. It promotes better use of fertilizers, integrated pest management, low tillage among others [9,10].

Robost financing of rural agriculture: A mean of S shows the importance of agricultural finance in agricultural development. Agricultural development is highly influenced by the availability of rural finance. Credit is helpful in meeting short-term input intensification and medium-term investments, provide coping strategies for risk adverse decision-makers [11]. Access to credit is very important in adoption of improved practices and upscaling of best farm practices.

Training/education of rural farmers (M=4.8) and training/retraining of extension staff (M=3.4): Are interventions which will enhance the performance of both farmers and extension personnel in adoption of improve practices and in delivering extension messages. In the face of increased demand for agricultural information, extension staff now train farmers and use the farmer to farmer approach which is defined as the provision of training by farmers to farmers having first trained by the extension staff [12]. The main roles of the trainer are to train farmers, follow up with the farmers and mobilize them for meeting and training events. The extension staff on the other needs specialized training to carry out his duties satisfactorily.

Rural roads improvement programmes: Rural road improvement/transport is core in the development of agriculture and rural areas. This has a mean response of 3.90. The only means by which food produced at farms is moved to the markets and homes is by road and transport. Road and transport create a market for agricultural produces and enhance interaction among several economic regions [13]. The perishable goods require quick to market time to road spoilage; road/transport makes this available. Rural road construction leads to increase agricultural production and diffusion of technology by improving access to markets, enhance efficient allocation of resources among other.

CONCLUSION

Rural energy is vital for the development and survival of the farming populace. The predominant sources are human power, electrical power, mechanical power, and use of candles/kerosene. These are needed in crop production, livestock production, processing, and for reducing poverty. Interventions for meeting energy/food needs include rural electrification programmes, stand-alone off–grid solutions, rural road transportation programmes and regular training/re-training of both farmers and extension personnel.

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