Project Title: Proposal for Lowcost Biogas Household Production for Rural Women in Nigeria

Affix Recent Passport Photograph of project leader

EXECUTIVE SUMMARY

This project proposes to implement the production, benefits, demand, acceptance and feasibility of utilizing the large volume of biogas (methane) and its byproducts, which was generated in the University of Maiduguri during a trying period. In the research conducted by the researchers, a cumulative volume of about 77.62m^3 of the biogas was generated with a maximum volume of 0.5165m^3 in 52 days before declining by 50%. However, this was sustained and used for a period of 157 days. The use of the gas was restricted to laboratory and minimal household use. If one considers the population of Nigeria and the rate of demand for domestic energy, then the outcome of this research should be extended to a larger population for usage.

The gas generated, if accepted is expected to cover all the rural communities of the five states, (Sudan Savanna and Sahel savanna) of Nigeria considering their varying level of vegetation, human population and demand for fuel wood, which has been the main source of domestic fuel for cooking, heating, light and warming without alternative especially in the rural areas of the States.

The outcome of the project implementation is expected to be successfully accepted and used by the rural communities of the five states as Model Energy (ME) communities to be emulated

or copied by the neighboring communities and the country at large. The alternative fuel may not be an end to deforestation, poverty, environmental degradation, desertification, pollution and the risk of exposing women and children to the danger of searching fuel in the bush, but a mitigation of those environmental problems.

In conclusion the project will serve as a state yard stick for measuring the rate of domestic energy demand, use and benefits, and to prepare the federal and state governments in the states against all environmental odds.

Keywords: Biofuel, improved stoves, bio-fertilizer, deforestation, waste material.

Duration of project: ___ Six (6) **___ months**

1.0 GENERAL BACKGROUND OF THE PROJECT IMPLEMENTATION

1.1 Introduction

Biofuel or Biogas (methane) is an alternative source of energy for domestic or industrial use, especially in rural areas where petroleum based energy has been expensive or scarce. Meynel (1976) reported that natural gas has an energy content of 10% higher than methane because of added liquid gas like butane, however biogas is safer and easily generated and can be used in all energy consuming applications designed for natural gas. Biogas can be burned in internal combustion engine to generate electricity.

The gas is produced using local waste materials like farm residues, animal waste (like cow dung) sugar cane bites or peels, chicken droppings (guano), grasses, decomposed vegetables etc. The technology and yield of biofuel depend on the composition, variety, degradability of the plant being used or organic material, microbial growth, temperature, Ph condition and season of the year. In the case of biogas, the feedstock is anaerobically degraded by methanogen bacteria in an airtight digester. They will undergo a number of processes from composting, fermentation, hydrolysis and methenation. When the gas is generated, it is collected in a gas collector depending on usage of the gas, but usually, it is collected in a floating metal cylinder or heavy duty vehicle tire tube of varying sizes and this is connected to the kitchen appliance for use.

Before the biogas is used, a devise to scrub the carbon dioxide (CO_2), moisture (H_2O) and hydrogen sulphide (H_2S) content is attached and this improves the efficiency of the gas. At the end of the digestion process, the slurry is collected, because it retains all nutrients originally present in the feeding material which makes bio-slurry a potent organic fertilizer. Proper application has been proven to provide higher yield than regular manure. It also provides a viable solution to nutrient depletion and soil amendment of many agricultural soils in developing countries. It also improves the productivity of fish rearing (aquaculture). When slurry is generated from a 1:1 ratio of dung and water the composition of slurry is 93% water and dry matter 7%. The

nitrogen (N), Phosphorous (P) and Potassium (K) composition are the most required to the plant. The NPK content in liquid slurry is 0.25%, 0.13% and 0.12% respectively (Limbah and Berkah, (2015).

The Bio- slurry being:

(i) Fermented is odorless and does not attract flies

(ii) It repels termites and pests that are attracted by raw dung

(iii) It reduces weed growth. Application of bio-slurry has proved to reduce weed growth by up to 50%

(iv) it is an excellent soil conditioner, adds humus and enhances the soil capacity to retain water

(v) Bio slurry is pathogen free. The fermentation of dung in the reactor kills organic causing plant disease. This is either used in a liquid form or baked in nitrogen flakes or cake.

Based on a number of trials in the Department of Biological Sciences, University of Maiduguri, large volume of the Biogas was extracted from cow dung and sugar cane bites, but without usage or further research, however this was followed in the Department of Biological Sciences University of Maiduguri, where, about $77m^3$ of the gas was generated and used in the University Laboratories and cooking trial at a minimal scale.

It was observed by Letcher (1994) that the maximum possible volume of gas from a ton (1000g) of dry organic plant material is $416m^3$ at 25^0C with 20% to 40% moisture content. Alternatively, the maximum amount of heat that can be generated from burning 25 liters of methane gas (1mole) is 890 kj/mol. *Ukpabi et al., (2017)* observed that cow dung alone produces higher biogas than chicken droppings (guano) or the two combined.

This project intends to combine the use of cow dung and sugar cane bites and peels littering our environment as wastes to be used as substrates to generate the biogas using the float and pit digesters in the various communities and some selected communities of the five States of Nigeria. Charlie (2002) indicated that as a general rule in biofuel production a cubic meter of biogas will cook three meals a day for a family of 4 – 6 and provide light when the type of feed stocks or raw materials are considered It was concluded that two cows can produce the amount of dung required for the biogas.

Finally, in order to achieve the aim and objective of this project, in addition to the gas generated, the most suitable cooking devise is advised by the researchers. Such cooking device may include improved stoves using a well-controlled nozle as alternative to the traditional three stone cooking kiln or stove in circulation in the state (Makubar) which has been inefficient, wasteful , polluting and a source of respiratory diseases.

1.2 Aims, General and Specific Objectives of the Project:

The aim and objective of this project is to generate biogas (methane) from the cheapest and available local materials.

The specific objectives are to:

(i) generate biogas from local waste materials to serve as alternative sources of fuel.

(ii) sanitise the environment of degradable waste materials which are responsible for environmental degradation.

(iii) reduce the rate of indiscriminate fuel wood extraction(deforestation) and consumption.

(iv) provide bio slurry as a potent source of organic fertilizer (providing a higher yield than ordinary manure) and an alternative to inorganic fertilizer.

(v) increase the rate and means of soil amendment in the already degraded environment of the states

(vi) empower the rural populace through poverty reduction.

(vii) reduce pressure and hazards on women who have to travel a long distance in the bush in search of fuel.

(viii) to remove the social ills associated with the use of biogas from cow dung

1.2 Statement of the Problem

In all the five states, especially Maiduguri the state capital, the traditional domestic fuel for cooking, running of generators, vehicles and other machineries has been petroleum based fuels like kerosene, petrol and diesel, these products has been scarce expensive and responsible for polluting the environment due high carbon emission without alternative. The second reason for this project is poor method of sanitation in the state which has been to sweep and burn waste materials which is also polluting and complicates the already depleted soil and loss of soil fertility. This project therefore, intends to investigate how to collect the various forms of waste material as part of sanitation to be degraded to biogas as alternative source of fuel for domestic cooking. Also the slurry from biogas will serve as bio-fertilizer for organic agriculture. Greater part of our soils are depleted of nutrients giving our farmers low agricultural yield and subsequently affecting the vegetation cover and other secondary human activity. This issue is compounded by the high cost and scarcity of organic fertilizer. It is justified therefore to use alternative source of fuel like biogas or methane because greater part of the domestic fuel has been fuel wood and a challenge to the people's standard of living due to scarcity, cost and it contributes to deforestation. Petroleum based fuels are now beyond the purchasing power of the general populace and not environmentally friendly compared to the methane gas which is easy and cheap to generate and less hazardous.

The use of cow dung, sugar cane bites and peels and agricultural wastes as raw materials due to the large heads of cattle that are slaughtered in the state on daily basis, the amount of sugar cane that is imported and consumed and the rate of waste generated from domestic,

industrial and agricultural activity are adequate enough to sustain the project

1.4 Conceptual framework of the project

This project implementation was initiated for the purpose of addressing the lack of alternative domestic fuel for cooking, heating and warming in rural areas. The proposal intends to address the large volume of waste materials generated and dumped at abattoirs (like cow dung), sugar cane markets and streets (sugar cane bites and peels) corn stalk and rice hull (agricultural waste) and rice hull and saw dust in rice and saw mills respectively, these waste materials are not recycled into useful products in the state. The traditional fuel wood for cooking, warming and heating have no alternative and have been contributing to deforestation, desertification, carbon emission and global warming. Biogas was found to be better alternatives to firewood.

Secondly, biofuels are beneficial as a form of environmental sanitation, where wastes materials that constitute an eye sore are evacuated and recycled into useful products, this is followed by the slurry which serve as bio-fertilizer for soil amendment empowerment of the rural populace. Also the danger associated with women extracting firewood in the bush has been reduced. Finaly, this will result in reduction of social ills associated with cow dung use, multiple environmental problems particularly desertification, indiscriminate disposal of waste, neglect of some potential biofuel plants and plant wastes in five states of Nigeria.

The objective of this proposal is to implement the feasibility of generating and using bio-fuel from waste material as alternative to the traditional fuel wood which has been contributing to deforestation, desertification, pollution and carbon dioxide accumulation. The specific causes of fuel crisis in the region has been increasing human number, loss of vegetation, high cost of petroleum products as domestic fuel and lack of alternative.

1.5 Project Goals

The immediate goal of this project is to provide alternative sources of domestic fuel to the immediate community as far as waste materials are generated. In the project locations waste materials from homes, market and commercial areas are generated without proper disposal methods. The technology of biogas generation will be employed as a means of disposing wastes in the immediate communities from time to time. The accessories used in generation may vary depending on the type of waste material used in generating the fuel. Therefore, the traditional fuel wood and kerosene which has been scarce and expensive will no longer be a challenge to the communities and this will reduce the current environmental challenges of desertification, deforestation, high cost of domestic fuel, exposure of women and children to the dangers of fuel wood extraction in the bush, absenteeism of children from school hours

and provision of organic fertilizer in the arid zones of Borno State, Nigeria. Before this innovation, the only alternatives at government hand were to plant trees or control the cutting down of trees for fuel wood.

1.6: Project Impact:

The impact of this project would be indicated by the sanitary condition of the project location, adequate supply of domestic energy, youth employment, provision of organic fertilizer and adequate time for women to perform domestic responsibilities and school children to be in school. The effort and resources used by government to plant trees annually will reduce and this will influence forest law compliance.

2.0 PROJECT IMPLEMENTATION DETAILS

2.1 Literature Review

In developing countries like Nigeria the traditional domestic fuel for cooking and heating has been fuel wood or any biomass amounting to about 70% – 90% (Guy et al.2005) The availability and accessibility of such biomass like fuel wood, agricultural residue, cow dung, charcoal, sawdust and rice husk is declining due to persistent extraction collection and usage as domestic fuel in different parts of the world (World Energy Council, (2006). This is becoming more expensive and scarce due to a number of factors like increasing human number and demand, depletion of fossil fuel, deforestation, desertification lack of proper cooking devices. The current irrational use of fossil fuels and the impact of greenhouse gases on the environment are responsible for the desire to do research in to renewable energy products from organic resources and waste materials. Bharathiraja et al. (2018) observed that, the use of fossil fuels which has been responsible for greenhouse gasses in the environment is responsible for the increased desire to conduct research in renewable energy generation from organic degradable resources and wastes. This has been justified as an alternative and efficient technology for biofuel, waste management and environmental sanitation. As a renewable energy in combustion engines and its use in internal combustion engines at a large scale has been challenged by the instability of the component of the gas, which is due to differences in the production process and the raw material species (Qian, 2017). Growing energy demands and environmental degradation with uncontrolled exploitation of fossil fuels have compelled the world to look for alternative. Biogas is a promising alternative, which can be utilized in IC engines for vehicular as well as decentralized power generation applications. The primary constituent of raw biogas is methane (CH_4) that defines the heating value and carbon dioxide (CO_2) that acts like a diluent. The dilution effect reduces the flame speed and heating value of biogas (Verma et al., 2017) Anaerobic digestion is an efficient alternative technology that combines biofuel products with sustainable waste management (Spyridon et al, 2017). The continuous use of fossil fuel and the effect of greenhouse gases (GHGs) on the environment have initiated research effort into the production of alternative fuels from bio resources. It is

noteworthy that the global energy demand is 88% of the energy production at the present time being based on fossil fuels (International Energy Agency (IEA), 2015, (United Nation Environmental Programme (UNEP, 2014).

The United States, China and India are also investigating an alternative technique for biogas production from cellulose resources and are likely future producers (Soetaert, 2009, Lin, 2006). The necessity for global sustainable waste management had led to research interest in alternative fuels based on agro-waste and bio-waste (Weirland, 2009, Deublein, 2008). The biogas is an anaerobic process using anaerobic bacteria through fermentation of organic matter at a certain temperature and Ph. and total solid concentration (Dioha et al, 2003). The gas consists of 50%-70% methane (CH_4), 30% - 40% Carbon dioxide (CO_2) and Hydrogen Sulphide (H_2S). The entire process takes place in a device which consists of a tank in which the organic material is digested combined with a system to collect and store the gas. The specific bacteria is called methanogenic which plays a significant role in methane production as greenhouse gas and energy source (Ezeonu et al., 2005).

The byproduct of biogas called digestate is a high value fertilizer for crop cultivation and can replace common mineral fertilizer. The slurry or bio-fertilizer retains all nutrients originally present in the feeding material which makes the bio slurry a potent organic fertilizer. Proper application has been proved to provide higher yield than regular manure. It also provide a viable solution to nutrient depletion of many agricultural soils in developing countries, especially fish farming. When a 1:1 ratio of dung and water, the slurry composition is water 93% and dry matter 7%. The Nitrogen (N), Phosphorous (P) and Potassium (K) are the most required nutrient to the plant. The NPK content in liquid slurry is 0.25%, 0.13% and 0.12% respectively. In Europe, the product of biogas has reached 135 $x10^7$t in 2014, Germany is the pioneer country in biogas production with approximately 25% installed capacity due to the strong development of agricultural biogas plant on farm. At the end of 2014, more than 8000 agricultural biogas production units were operating in Germany (Wagner, 2015). Many European countries have established favorable condition for electricity production from biogas. The agro-biomass used is as high as 1.5 $x10^9$ t in Europe (Edita, 2015). Chibueze et al (2017) reported that using organic materials like cow dung could produce higher yield of cow dung (39.5ml) than chicken droppings (15.30 ml) or the two combined (20.30ml).

Deublein and Steinhauser (2008) reported that biogas provides a clean and efficient fuel in a lamp for light or burner for cooking. The biogas passes through the nozzle; air is allowed to be drawn into the mixing chamber. To obtain the desired flame, temperature, nozzle adjustment is done by trial and error. Biogas stoves normally operate at gas pressure of 75 – 90 mm (3 – 3.5 inch) water column. Brightness and combustibility of gas can be controlled by regulating gas pressure and air- fuel ratio which is generally maintained at a ratio of 10:1. Combustibility of gas is maximum when flame is slightly yellow, a bit bright and burnished. When the flame is turned blue and smokeless after air jet adjustment, it burns at a temperature of about 800^0C. Cooking appliances are available in wide range both single and double burner category with each burner consuming between 0.25 to 1.25 m^3 of gas per hour, this is because about 0.28 to 0.42 m^3 of gas is needed for meeting the cooking needs of one person per day and also,biogas cannot be burned on LPG natural gas stoves as it tends to lift off due to slower flame speed factor. This can be solved by reducing gas pressure, but this result in to higher gas consumption. Burning of gas on a Country (locally made) stoves suffer from poor thermal efficiency of not more than 20% and flame temperature seldom exceeds 500^0C. During the process, the microorganisms transform biomass waste into biogas mainly methane, carbon dioxide and digestate. There are two main processes:

The mesophylic and thermophylic digestion is dependent on medium and high temperature respectively. In a 1000 Liter digester using psychophilic bacteria one can produce 200 – 300 liter of methane per day (New Scientist, 2011) .The danger associated with biogas is, air pollution produced from biogas is similar to that of natural gas. The content of toxic hydrogen Sulphate present additional risks and has been responsible for serious accidents. Leaks of unburned methane are an additional risk because methane is a potent greenhouse gas.

Biogas can be explosive when mixed with a ratio of one part biogas to 8 – 20 parts air. The pressure should not be less than one, if not it will be explosive. Leakages and gas removal can cause low pressure. Generally the biogas production provides a new opportunity for skilled employment (Anaerobic Digestion, 2011).

2.2 Project Methodology

The methodology of this project involves the anaerobic digestion of degradable organic material which has been an eye sore and an environmental threat. The common raw materials found are sugar cane peels and bites, cow dung at abattoirs, The processes or methods of production are as follows:

Biogas Production

The biogas production involves the anaerobic digestion of organic waste materials by anaerobic organisms or methanogen in to renewable energy called biogas (methane). The methanogen digest the material inside a closed system or fermentation chamber The system is called anaerobic digester or bioreactor, producing the biogas which is primarily methane (CH_4) and Carbon dioxide (CO_2) and may have small amount of hydrogen sulphide (H_2S), moisture and silicones. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. The digester is an airtight tank with different configurations. The digester is fed with the organic waste material or cow dung depending on what is available as waste

During the process, the microorganism transform biomass waste into biogas mainly methane, carbon dioxide and digestate. There are two main processes:

The mesophilic and thermophilic digestion processes are dependent on temperature as medium and high temperature respectively. In a 1000 liter digester using psycophilic bacteria (low temperature), one can produce 200 - 300 liter of methane per day (New Scientist, 2011).The digestion process begins with bacterial hydrolysis of the raw material. Insoluble organic polymers, such as carbohydrates are broken down to soluble derivatives that become available for other bacteria. Acidogenic bacteria then convert the sugars and amino acids into carbon dioxide, hydrogen, ammonia and organic acids. This bacteria converts this resulting organic acid into acetic

acid, along with additional ammonia, hydrogen and carbon dioxide
Finaly methanogens convert these to methane and carbon dioxide. The gas is then collected in a devise known as gas collector. Biogas can also be compressed like LPG. The collector is connected to a burner; biogas cannot be burned in LPG natural gas stoves as it tends to lift off due to slower flame speed factors. This can be solved by reducing the gas pressure, but this will result into higher gas consumption. Burning of the gas on a country made stoves suffer from poor thermal efficiency of not more than 20% and flame temperature may exceed 500^0C.

2.3 Project Activities and Output

Activity	**Expected Outcome**
(i) Collection of degradable organic waste as part of environmental sanitation and degradation of the waste	Large quantity of biogas and bio fertilizer will be generated from the waste material as alternative to firewood and kerosene
(ii) The waste products of biogas generation extraction will be processed and tested as organic fertilizer	The processed waste products of biogas will serve as alternative to the toxic inorganic fertilizer. This waste has a high nutrient content as a bio fertilizer.

2.4 Time Frame:

	Description Of Activity	Duration	Year	Quarter			
				1st	2nd	3rd	4th
1	Collection of various waste materials for biogas generation and brick construction of a pit as digester dump dumping growth of and cultivation of Jatropha plant species	Period of three months in every quarter	2024	Waste materials for biogas	Materials for biodiesel	Harvesting of Jatropha plants for biodiesel	biofuel from various sources.
2	Replication of activity in the previous year,2019	Same	2025	Same	Same	Same	
3	Replication of activity in the previous year	Replication	2026	Replication	Replication	Replication	Replication
4	Construction of biogas stoves	Period of three months	2024	Distribution of stoves	Trial of stoves	ofdata on performance of stoves	performance

2.5. Activity Indicators

(i) Biogas generation will be indicated by drastic reduction in importation, buying and use of firewood by communities in the states. Low smoke emission will be noticed in communities

(ii) Reduced rate of going to the bush for fuelwood extraction.

(iii) Reduced rate of engaging children to extract firewood during school hours

(iv) Reduced rate of women being raped and sexually harassed in the bush

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2.6 The Project Location

The project will be located in the communities and residents of the 750 and 1200 of the rural women in the five states of Nigeria.

2.7 Data Management and Analysis

Collection, storage, management and analysis of data will commence as soon as the biogas is generated. The most important parameters to be considered are volume of gas generated per unit quantity of raw material and time. The type of raw materials and stove used.

2.8 Ethical and Environmental Considerations

The ethical and environmental considerations of the region have been considered before the proposal was initiated. The various ethics considered were government and community laws, social norms and values of the stake holders, the Eco theology and the geographical location of the various communities involved in the project.

2.9: Monitoring and Evaluation Mechanism

The monitoring and evaluation will involve collection of data on amount of fuel generated per unit time and how many beneficiaries are covered and how effective the biofuel is reaching those beneficiaries by the usage of the result. This will be followed by tracking performance on the expected result and this will be continuous. The immediate beneficiaries of the project will include, those for paid labor, metal and earth stove fabricators, transporters, farmers and idle school leavers.

2.10: Dissemination Strategies

The outcome of the project will be disseminated through online publication of the comprehensive result of the project and the use of satellite usage of the gas in the locations.

3.0 THE PROJECT IMPLEMENTATION TEAM

3.1. Composition of the Project Team

A. Project Lead

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3.2. Research Works of Project Leader to Date

List the relevant team publications. Also list not more than 3 relevant on-going research works

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LIST OF ONGOING RESEARCH WORKS

(i) Study of the factors responsible for the success or failure of a model village project from 1995 to Date, sponsored by Federal Ministry of Environment/ University of Maiduguri Linkage

(ii) Study of The Effect of Moisture Content on the Burning Rate of Some Selected Trees and Shrubs in the Arid Zone of Northern Nigeria

(iii) Study of Community Based Improved Stoves Using Agricultural Waste or Farm Residue

3:3. Previous Research Grant [Provide short summary of grants won and managed in the last five years]

(1) (i) Tittle: Sustainable biogas generation as heating points in the Department of Biological Sciences, University of Maiduguri

(ii)Amount: Three hundred thousand Naira only(N300,000.00)

(iii)Sponsor: University of Maiduguri

(iv)Date: From 2007 to 2008

(v)Duration: One Year

(vi) Present Status: Completed

(2) (i) Tittle: Biofuel Generation and Utilization in the University and Rural Communities in Nigeria

(ii)Amount: Two million Naira only(N2000,000.00)

(iii)Sponsor: TETFUND: Ref. No. TETFUND/DESS/UN/MAIDUGURI/IBR/2016/VOL.1.

(iv)Date: 2018

(v)Duration: 12 months

(vi)Present Status: Completed, with progress report submitted

3:4. Group Research Members

Previous working relationship as a group [For group research, applicants are encouraged to consider gender, age and discipline. They should also provide details about roles and responsibilities of each member.]

3:4.1.Mohammed Bukar, Umar

Discipline: Microbiology

Date of Birth:28 th December 1969

Gender: Male

Roles and Responsibilities: Laboratory Analysis

3;4.2 Juliana Adam

Discipline: Medical Laboratory Science

Date of Birth:3 rd January 1987

Gender: Female

Roles and responsibility: Domestic activities using biofuel and community based improved stoves from house to house

Email: julianaadamu@gmail.com

4.0 FINANCIAL ASPECTS OF THE PROJECT IMPLEMENTATION

4.1 Project Budget:

DESCRIPTION OF ITEM	EXPECTED FROM			TOTAL
	THE UN	INSTITUTIO	OTHER	
1.0 Personnel Costs/Allowances				
1.1Project Leader	**₦6,000,000.00**	**Monthly salary**		
1.2 SixTeam Members	**₦24,000,000.00**	**Monthly salary**		
1.3Five Technical Support	**₦15,000,000.00**	**Monthly salary**		
1.4 Others (Five Communities	**₦10,000,000.00**			
Sub-Total (Not >20% of budget)	**,000,000.00**			
2.0 Equipment (List & Specify)				
2.1750&1200 units of digesters	**₦292500,000**			
2.2Improved Biogas	**₦195000000.00**			
Sub-Total	**487,500000.00**			
3.0 Travels				
3.1Transportation of materials and	**N5000000.00**			
3.2Travelling to and fro	**N12000000.00**			
Sub-Total	**₦17000000.00**			
4.0 Dissemination				
4.1 Seminars and workshops	₦20500,000.00			
4.2 Journal and publications	**₦6000,000.00**			
Sub-Total	**₦26,500,000.00**			
5.0 Others/Miscellaneous (Specify)				
5.1Community /researcher public	**₦4000,000.00**			
5.2Unforseen events	**₦2000,000.00**			
5.3New secondary ideas of fuel	**₦2,000,000.00**			
Sub-Total	**₦8,000,000.00**			
Community Contribution	Labour and			
GRAND TOTAL	**N3,000,000.00**			

4.2 Budget Justification

One of the promising areas in biofuel development is biogas, which has huge potentials as renewable and clean source of domestic energy. If the raw materials, stove and acceptance of the project by members of the communities, this project would be problem-solving and innovative in environmental sanitation, agriculture and control of desertification. This is in addition to erratic rate of inflation in Nigeria

The use of biofuel would reduce dependency on fuel wood, current environmental challenges of desertification, deforestation and high cost of domestic fuel. These factors alone make biogas worth considering the budget.

Any data generated in the course of the implementation of the project will be analyzed using the relevant statistical analysis and the work published.

4.3. Additional Source(s) of Funding

There are no additional sources of funding at the moment, except for the community participation in the activities and acceptance of the project. However, with success of implementation additional sources of funding could be negotiated with state and local governments and community development fund (where available).

5.0 COMMITMENTS

The Project Leader, the other project associates and the Institutions involved must commit themselves to the successful completion of the project.

5.1. Project Team Declaration

I/we declare that information given in this application form is to the best of my/our knowledge complete and correct.
*I/we confirm my/our commitment to the successful implementation of the project.

Name and Signature of Project Leader	Ibrahim Yerima Ph.D
Name and Signature of Partner in Project	Dr. Babagana Boso
Name and Signature of Project Associate	Dr. Hadiza Mali Bukar
Name and Signature of Project Associate	Yunusa Maina Ngulde
Name and Signature of Project Assistant	Mohammed Bukar Umar
Name and Signature of Project Assistant	Juliana Adamu