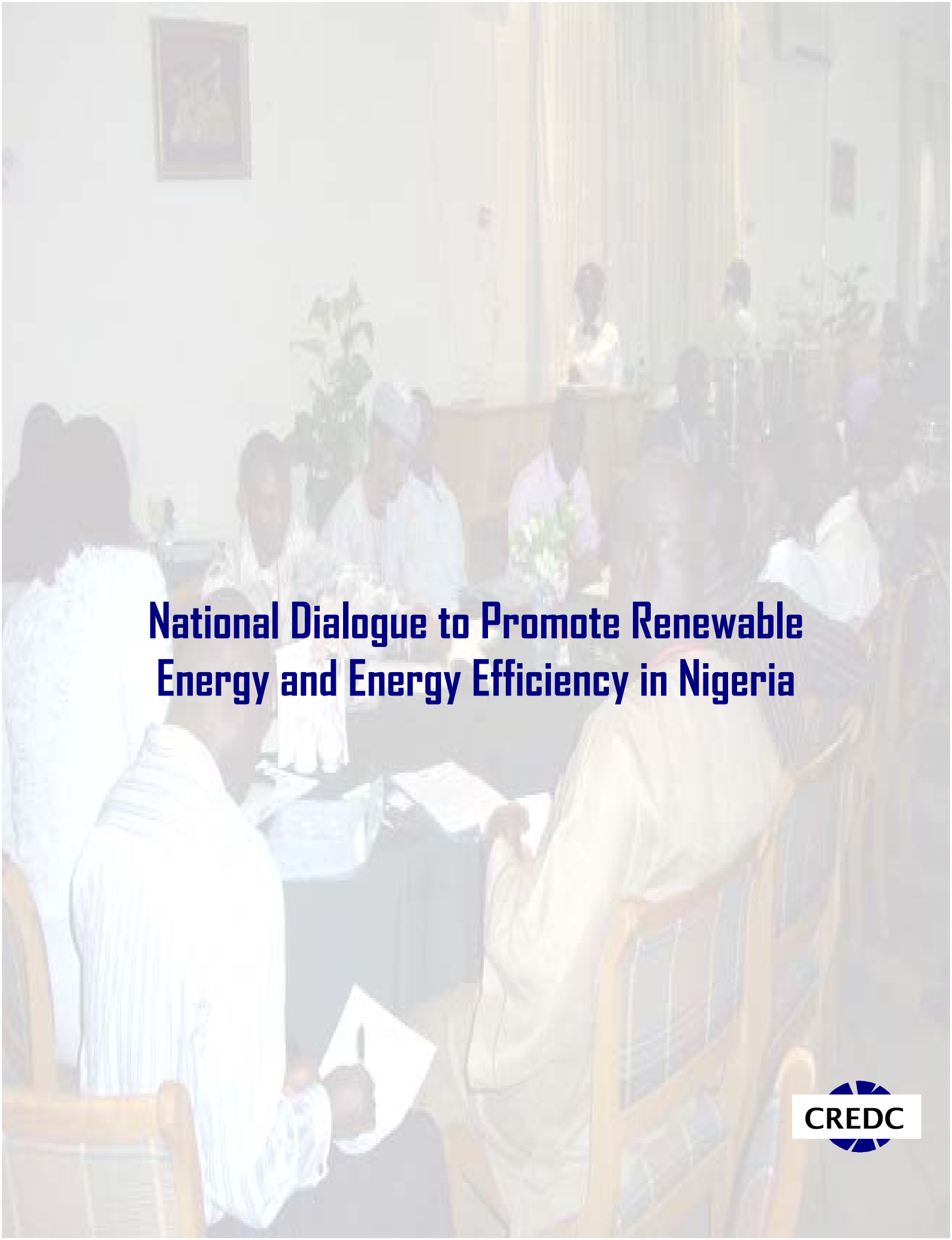

National Dialogue to Promote Renewable Energy and Energy Efficiency in Nigeria

CREDC

The report of a National Dialogue to Promote Renewable Energy and Energy Efficiency in Nigeria, Parkview Hotels, Abuja 10 – 11 November 2008

The conference was organized by the Community Research and Development Centre (CREDC) and received the financial support from the Global Greengrants Fund (GGF) and the Environmental Rights Action/Friends of the Earth Nigeria (ERA/FoEN)

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Many inaccuracies, misquotes and misinterpretation may have occurred in the course of this conference. We apologize for any of such errors that may have occurred.

The views expressed by the authors and other participants of this conference do not imply those of the organizers or our partners, the Global Greengrants Fund and the Environmental Rights Action/Friends of the Earth Nigeria.

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To all our participants during the conference we say thank you for all your time, energy and ideas. The Management and staff of Parkview Hotels are appreciated for all their support.

ABBREVIATIONS

CC	Climate change
CDM	Clean Development Mechanism
CFLs	Compact Fluorescent Lamps
CO_2	Carbon dioxide
CREDC	Community Research and Development Centre
CSOs	Civil society organizations
DARE	Developmental Association for Renewable Energy
DNA	Designated National Authority
ECN	Energy Commission of Nigeria
EE	Energy efficiency
ERA/FoEN	Environmental Rights Action/Friends of the Earth Nigeria
FMEHUD	Federal Ministry of Environment, Housing and Urban Development
FRUIT	Foundation for Rural-Urban Integration
GGF	Global Greengrants Fund
GHGs	Greenhouse gases
HOME	Human Orientation Movement for Environment
ICEED	International Centre for Energy Environment and Development
IFIs	International Finance Institutions
IPCC	Intergovernmental Panel on Climate Change
IPPs	Independent Power Projects
LGAs	Local Government Areas
MDGs	Millennium Development Goals
NEEDS	National Economic Empowerment and Development Strategy
NEPA	National Electric Power Authority
NGO	Non-governmental organization
NIPP	National Integrated Power Project
NNPC	Nigerian National Petroleum Corporation
PHCN	Power Holding Company of Nigeria
PREEEN	Promoting Renewable Energy and Energy Efficiency in Nigeria
REEEN	Renewable Energy and Energy Efficiency Network
SEDI	Sustainable Environment Development Initiative
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization

BACKGROUND TO THE CONFERENCE

Access to energy is essential for socio-economic development and for poverty alleviation. Nigeria is faced with myriad of developmental challenges, one of them being that 60-70% of the Nigerians do not have access to electricity and modern energy services. Renewable energy technologies and energy efficiency are promising solutions to this energy crisis. Renewable energies, apart from being sustainable and inexhaustible in supply, they can be set up in small units and is therefore suitable for community management and ownership. Hence renewable energy technologies can be used to develop a decentralized energy system.

Energy policy has traditionally underestimated the benefits of energy efficiency for the society, environment and for economic growth. In Nigeria, there is currently no policy on energy efficiency and the concept of energy efficiency is poorly developed. The implication of this is that there is energy wastage at household level, at the industrial/organizational level and by public utilities generating and supplying electricity. This energy wastage is mainly due to the use of inefficient technologies, awful human behavior, and low level of infrastructural development. Putting in place the right policy and changing Nigerian behaviour to develop a positive attitude towards their consumption pattern are panacea to this anomaly.

It is against this background that the Community Research and Development Centre (CREDC), in partnership with the Global Greengrants Fund and the Environmental Rights Action/Friends of the Earth Nigeria organized a National Dialogue to Promote Renewable Energy and Energy Efficiency in Nigeria. The event held in Abuja from 10 to 11 November 2008.

The conference was organized to achieve the following objectives: enhance stakeholders' capacity to advocate for energy efficiency and promote renewable energy technologies; to create awareness on the concept of energy efficiency; and to develop strategies to integrate energy efficiency policy into Nigeria's policy framework.

Conference outcomes include: awareness creation on the concept of energy efficiency among policy makers and other stakeholders; development of a road map to integrate energy efficiency policy into Nigeria's policy framework; development of strategies to promote the concept of energy efficiency and renewable energy technologies at the institutional, local, state and national levels; creation of a network named Renewable Energy and Energy Efficiency Network (REEEN) that will promote renewable energy and energy efficiency in Nigeria; and development of partnership with government to achieve the goals and outcomes of the conference.

EXECUTIVE SUMMARY

The conference, National Dialogue to Promote Renewable Energy and Energy Efficiency in Nigeria was organized by the Community Research and Development Centre (CREDC). The conference received financial support from the Global Greengrants Fund and the Environmental Rights Action/Friends of the Earth Nigeria. The event held on the November 10-11, 2008 at the Parkview Hotels, Abuja, Nigeria. The conference is the fourth of a series of conferences organized by the CREDC under the project Promoting Renewable Energy and Energy Efficiency in Nigeria (PREEEN). The objectives of the conference were to enhance stakeholders' capacity to advocate for energy efficiency and promote renewable energy technologies; to create awareness on the concept of energy efficiency; and to develop strategies to integrate energy efficiency policy into Nigeria's policy framework.

The keynote address was delivered by the Honorable Minister of the Ministry of Environment, Housing and Urban Development. Participants in the conference were representatives of civil society organizations, NGOs, religious organizations, academic institutions, the private sector, government and the media. The conference featured paper presentations, exhibitions, discussions, resolutions and the development of a roadmap to integrate energy efficiency into Nigeria's policy framework. Conference outputs were awareness creation on the concept of energy efficiency; development of a road map to integrate energy efficiency policy into Nigeria's policy framework; development of strategies to promote the concept of energy efficiency and renewable energy technologies; creation of a network named Renewable Energy and Energy Efficiency Network (REEEN); and development of partnership with government to achieve the goals and outcomes of the conference.

The PREEEN project was designed to address the energy crisis in Nigeria. An estimated 60-70% of Nigerians do not have access to electricity and modern energy services. Even those that are connected to the national grid experience power outages that last for several hours daily. Although there is no MDG to increase access to energy, the eight MDGs set by world leaders can not be realized without access to energy. Energy is imperative for development and industrialization, hence pivotal in the reduction of poverty. National policies in Nigeria have undermined the benefits of energy efficiency for economic development and environmental sustainability. Currently in Nigeria, there is no policy on energy efficiency.

This particular conference was noble in the sense that it was projected towards encouraging everyone to be sensitive to their environment and adapting to it, especially in the areas of renewable energy and energy efficiency and how to renew our energy source and exploit renewable energy opportunities in Africa. The conference had enhanced synergy between development agencies, donor agencies, financing institutions and other stakeholders for renewable energy commercialization and promotion of energy efficiency in Nigeria and in Africa in

general. As regards policies and renewable energy, progressive policy-making has the greatest impact on our renewable energy future. Studies show that the world is blessed with renewable resources. There is enough potential capacity on each continent to meet the world's entire power generation requirements without the use of fossil fuels.

National policies in many countries have underestimated the importance and gains of energy efficiency to the environment and economic growth. In Nigeria and in many developing countries, we have concentrated so much on generation and distribution with little or no efforts given to the ways energy is used. Energy efficiency will help to minimize the building of new power stations; reduce electricity bills; leave more energy available to extend energy supply to other parts of the population; increase the efficiency and resilience of the economy; and reduce the negative environmental and human health impacts from energy production and use. Energy efficiency has become one of the main drivers of sustainable development world wide.

Energy efficiency opportunities in Nigeria exist in the following sectors: industrial sector; transport sector; electricity sector; and household energy. Only about 40% of Nigerians have access to electricity. Electricity consumption per capita in Nigeria is 171Kwh, percentage of population dependent on biomass is 67% and the population of Nigerians dependent on biomass is 96 million people. The numbers of households dependent on biomass use is 21.5 million. The burden of disease attributable to biomass use is 4% while deaths attributable to biomass use are 79,000 people.

In many developing countries, including Nigeria, climate change remains a marginal issue to the pressing issues of food security, poverty, natural resource management, energy access, and urban transport. Finding policies and actions that can drive development and at the same time address the challenges of climate change is a core pre-requisite to achieving the millennium development goals (MDGs). If soundly used, renewable energy technologies can represent a significant lever for poverty reduction, thus contributing to the improvement of the quality of life and sustainable development as a fall out of climate change mitigation strategy.

Desertification gives rise to a multitude of social problems and conflicts in the countries affected with it. Decline of soil productivity and scarcity of water jeopardizes the population's food security and water supplies. Many people abandon their rural homes and migrate to urban centers, where they generally have no alternative but to live in the slums. Desertification prevents sustainable economic and social development. The inefficient use of wood fuel is a major cause of deforestation which in turn leads to desertification. Our traditional way of cooking should be replaced with highly efficiency wood saving stove. The "Save 80" cook stove saves 80% of the wood consumption compared to the traditional

open fire stove. The “Save 80” needs around 250 g of dry firewood to bring 6 litres of water to the boil

The energy consumption mix in Nigeria is presently dominated by oil. Solar energy is currently not part of Nigeria’s energy mix as it is currently at the early stage of development. Energy/electricity poverty in Nigeria can not be alleviated without a deliberate effort on the part of the government to exploit enormous renewable resources available to the country. Mainstreaming energy sovereignty is pivotal in addressing this crisis. Communities should play active part in production and use of energy in sustainable manner. Renewable energy technologies have the ability give self reliance to local communities, where they can utilize the excellent renewable energy resources available for their own good. It will allow local people to have control over their energy resources and determine the type of energy to use for their daily needs.

SESSION ONE: OPENING CEREMONY

The opening ceremony held on the November 10 2008. The welcome speech was given by the Executive Director of the Community Research and Development Centre (CREDC) and the Keynote Address was given by the Honorable Minister of the Federal Ministry of Environment, Housing and Urban Development, represented by Dr. Victor Fodeke, Head of Special Climate Change Unit. There was a session for discussion. The opening ceremony ended with a cocktail party and participants familiarized themselves.

Welcome Speech by the Executive Director of Community Research and Development Centre during the National Dialogue to Promote Renewable Energy and Energy Efficiency in Nigeria, Abuja 10-11 November 2008

All protocols observed.

I feel highly privileged to welcome everyone present here to this noble occasion of the National Dialogue to Promote Renewable Energy and Energy Efficiency in Nigeria, taking place at the Federal Capital Territory, Abuja.

Our country today is faced with myriads of developmental challenges and one of the most prominent is that 60-70% of Nigerians do not have access to electricity and modern energy services. Even those that are connected to the national grid experience power outages that last for several hours daily. Although there is no MDG to increase access to energy, the eight MDGs set by world leaders can not be realized without access to energy. Energy is imperative for development and industrialization, hence pivotal in the reduction of poverty.

National policies in many countries including Nigeria have undermined the benefits of energy efficiency for economic development and environmental sustainability. There are three aspects of energy development – energy generation, distribution and usage. The Nigerian government, over the years has paid so much attention to energy generation and distribution with little or no attention to the way the energy we generate is being used. This implies that there is energy wastage at the household level and institutional/industrial level. Currently in Nigeria, there is no policy on energy efficiency.

The project “Promoting Renewable Energy and Energy Efficiency in Nigeria (PREEEN)” was conceived to address the energy crisis in Nigeria. The goals of the PREEEN project are to increase Nigerian’s access to electricity through the use of renewable energy technologies and to promote energy efficiency. The project started in 2006. Our approach so far has been the bottom-top approach. We started holding conferences at different parts of Nigeria to create awareness and to train stakeholders at the grassroots to advocate for renewable energy and energy efficiency.

We held the first conference in Benin City to cater for stakeholders in southwestern Nigeria, the second conference held in Calabar to cater for stakeholders in eastern Nigeria and the third conference held in Kano City for stakeholder in the Middle Belt and northern part of Nigeria. Today, we are holding the National Conference to influence policy at the national level. Many of the participants present here today attended our previous conferences.

The expected outcomes of this conference are:

- Awareness creation on the concept of energy efficiency among policy makers and other stakeholders
- Development of a road map to integrate energy efficiency policy into Nigeria's policy framework
- Development of strategies to promote the concept of energy efficiency and renewable energy technologies at the institutional, local, state and national levels
- Development of network of renewable energy and energy efficiency network that will front the development of renewable energy and energy efficiency in Nigeria.

We are grateful to our partners, the Global Greengrants Fund and the Environmental Rights Action/Friends of the Earth Nigeria for supporting this conference financially. We thank the Honorable Minister of the Federal Ministry of Environment, Housing and Urban Development for taking time to honor this occasion. And to all our participants that have come from far and near, I pray that God Almighty will replenish all your efforts and time devoted to this course.

I love Africa!
I love the Federal Republic of Nigeria!
God bless Africa!
God bless the Federal Republic of Nigeria!

Once again, I welcome you.

Etiosa Uyigue
Executive Director
Community Research and Development Centre
Benin City, Nigeria

KEYNOTE ADDRESS OF THE HONORABLE MINISTER AT THE CONFERENCE ON NATIONAL DIALOGUE TO PROMOTE RENEWABLE ENERGY AND ENERGY EFFICIENY IN NIGERIA HELD AT PARKVIEW HOTELS, PLOT 2390 TAKORADI STREET OPPOSITE AMUSEMENT PARK, WUSE ZONE 1, ABUJA ON 10-11 NOVEMBER 2008

PROTOCOLS,

I feel highly privileged and honored to stand amongst you eminent stakeholders, experts, scholars and very important persons here today amongst you as a special guest in this conference on National Dialogue to Promote Renewable Energy. I am indeed happy because we are here to brainstorm in discuss and find ways forward that would enhance our capacity to advocate for energy efficiency and promote renewable energy technologies with a major view to create awareness on the concept of energy efficiency and help develop strategies to integrate energy efficiency policy into Nigeria's policy framework.

2. This conference wouldn't have been organized at a better time than now that there has become an increased global concern on the issue of energy accessibility and use and which has become more disturbing due to increasing demand for it as a result of increased demand for industrial products by the increasing population. More so, is the adverse environmental impacts that has been attributed to the exploitation and use of energy for industrial productions.

3. This particular conference is noble in the sense that it is projected towards encouraging everyone to be sensitive to their environment and adapting to it, especially in the areas of renewable energy usage and efficiency and how to renew our energy source and exploit renewable energy opportunities in Africa. I believe that this conference will truly enhance synergy between development agencies, donor agencies, financing institutions and other stakeholders for renewable energy commercialization in Nigeria and in Africa in general.

4. As regards policies and renewable energy, progressive policy-making has the greatest impact on our renewable energy future. We have gathered what we believe to be the most effective government policies around the world to promote renewable energy technologies. Studies show that the world is blessed with renewable resources. There is enough potential capacity on each continent to meet the world's entire power generation requirements without the use of fossil fuels. In the past decade, technology costs have dropped dramatically- yet the key driver for getting renewable onto the grid has been forward-thinking policy-making at the local, state and federal levels.

5. I wish to implore you to also consider some of the under listed key pertinent questions during your deliberations.

- How can we sustainably exploit and make use of renewable energy sources and energy efficient facilities in Nigeria?
- Why is it important to expand the market share of renewable resources for electricity and transportation fuels?
- How will changing government policy affect the future usage/adoption of renewables?
- What are the best policy options for promoting consumption/production of renewables?
- How does a policy-maker decide which policy instrument is best for his/her country?

6. Inculcating the habit towards low carbon economy is an epitome collective responsibility. Therefore all the stakeholders for renewable energy and other industries must decide to begin employing the cleaner sources of energy such as solar, hydro, wind geothermal and the likes. We should also promote and use energy efficiency bulbs in our homes, offices and street lightening in their place of domicile. With this, we would have been contributing to the issue of low carbon economy.

7. As you are aware the issues of Climate Change and global warming is at the front burner of all environmental discuss; globally today. It has exacerbated the negative impacts of various environmental problems. Researches have opened our eyes of reality to the fact that, adaptation to Climate change and global warming is the only option for human survival. Due to the cross-cutting nature of climate change, I wish to implore that an adequate and extensive consideration be given to this issue during your deliberations.

8. Global Warming is as a result of emission of carbon dioxide to the atmosphere and the heating of the earth by the high sun ray. All these happen, through burning of fossil fuel, firewood, bush etc. It is necessary to introduce renewable energy to help us reduce this emission and make our environment friendly to all.

9. I strongly believe that this conference will explore and harness all forms of alternative energy sources especially the renewables in order to meet the energy demand of Nigeria population and introduce successful financing mechanisms for financing renewable energy projects as it is projected.

10. I want to use this opportunity to assure all of us here today that this administration is passionate about and has a candid desire to tackle all environmental related issues including the issues of Climate Change and renewable energy.

11. Government in various capacities has been promoting actions geared towards the following key areas:

- Transforming the way we use energy;

- Powering a cleaner future;
- Promoting research and development;
- Financing the transition to cleaner energy;
- Managing/Combating the impact of Climate Change;
- Combating flooding, drought and desertification;
- Encouraging reforestation and afforestation.

12. Lastly, I would like to appreciate the financial support of the Global Greengrants Fund and the Environmental Rights Action/Friends of the Earth Nigeria. You must not be discouraged as this conference is noble enough to give you a pat on the back. To this end, I will want all other stakeholders to emulate this gesture.

13. I wish you very fruitful deliberations. Thank you and God Bless all.

Dr. Victor A. Fodeke.
Head, special Climate Change Unit
Federal Ministry of Environment,
Housing and Urban Development, Abuja.
For: **The Honorable Minister.**

10 November 2008.

Dr. Fodeke (standing) and Etiosa

Dr. Fodeke and Etiosa (standing)

Some participants during the conference

Some participants

Discussion of issues

Listening with keen interest

SESSION TWO: FIRST PANEL

The first panel discussion held on the 11 November 2008. Two papers were presented followed by a discussion session.

The Concept of Energy Efficiency

By

Etiosa Uyigue
Community Research and Development Centre (CREDC)
Benin City, Nigeria

Introduction

National policies in many countries have underestimated the importance and gains of energy efficiency to the environment and economic growth. In energy development, there are three fundamental areas we ought to consider. They are energy **generation**, **distribution** and **usage**. In Nigeria and in many developing countries, we have concentrated so much on generation and distribution with little or no efforts given to the ways energy is used. These three areas of energy development should be given equal attention, and as we will see later that energy efficiency can play a pivotal role in economic development and environmental sustainability.

Energy efficiency means improvement in practices and products that reduce the energy necessary to provide services like lighting, cooling, heating, manufacturing, cooking, transport, entertainment etc. Energy efficiency products essentially help to do more work with less energy. Thus, the efficiency of an appliance or technology is determined by the amount of energy needed to provide the energy service. For instance, to light a room with an incandescent light bulb of 60 W for one hour requires 60 W/h (that is 60 watts per hour). A compact fluorescent light bulb of 11 W would provide the same or better light and use only 11 W/h. This means that 49 W (82% of energy) is saved. Using energy efficiently would:

- Minimize the building of new power stations and thus free up capital for other investments like health and welfare
- Reduce electricity bills
- Leave more energy available to extend energy supply to other parts of the population
- Increase the efficiency and resilience of the economy – including reduced reliance on oil and thus improve balance of payments
- Improve industries' competitiveness internationally
- Reduce the negative environmental and human health impacts from energy production and use

- Increase employment through interventions e.g. in industry, housing, and transport sector

Energy efficiency has become one of the main drivers of sustainable development world wide (UNDP, 2000). One of the goals of energy efficiency is to exploit ways to reduce the amount of energy used to produce a service or a unit of economic output and indirectly reduce emissions. At the global level, only about 37% of primary energy is converted to useful energy, meaning that about two-third is lost. In Nigeria, it has been estimated that about 40% of energy generated is lost. Thus, more efficient energy use is one of the main options for achieving global sustainable development in the 21st century.

The objectives of this paper are to help us understand what energy efficiency entails and the roles it can play in ensuring sustainable development and economic growth. The paper will also help us understand the obstacles to energy efficiency in developing countries in general and Nigeria in particular. It will suggest policy options for energy efficiency in Nigeria.

Definition of Terms

End-use Efficiency: End-use efficiency refers to technologies, appliances or practices that improve energy efficiency at the level of the final user. It includes technologies that help to conserve or better use energy. End-use efficiency covers measure from improving the ability of houses to absorb and retain heat in winter and keep out heat in the summer to changing individual and business behavior to include maintenance and repair of industrial production equipment.

Demand-side Management: Refers to practices or policies usually implemented by utilities and energy planners that encourage users to use energy more efficiently or to move their energy use away from peak demands. The later is known as load shifting. Load shifting allows for more effective use of generating capacity and can significantly defer the need for building new generating stations.

Energy Management

Good energy management can contribute to energy efficiency and it includes:
• Ensuring that spare heat are not vented away but put into use
• Lighting is activated when required
• Carrying out energy audits i.e. measuring and analyzing the amount of energy used by a building or company to ensure that all aspects of energy management are optimized

Dispersed Generation

In Nigeria and in some parts of the world, energy is generated from a central location and distribute through long distances to other parts of the country. Energy is lost when transmitted through long distances. Energy losses due to grid transmission over long distances could be minimized if energy generation is

dispersed. That is energy is generated locally and fed directly into distribution systems.

Energy Conservation

This refers to reducing the need for energy particularly electricity to achieve greater overall efficiency. For example the use of solar water heater helps to capture thermal energy of the sun in panels and connected to an insulated storage tank. With the solar heater, the use of electricity to heat water will be minimized. Another example of energy conservation practices is the locating work places closer to public transport or closer to living areas.

Approaches to Energy Efficiency

There are many ways to increase the energy efficiency of homes and organizations and reduce energy bills and indirectly ensuring environmental sustainability. Households and institutions can save up to 50% of their energy consumption and enhance their economy. In discussing energy efficiency issues, there are two approaches we talk about. We talk about technological approach and behavioral approach.

The **technological approach** involves the use of energy efficient appliances or technologies to reduce the energy needed to provide services in the homes or industries.

Lighting

We can save about over 50% of the energy we spend for lighting if we use energy efficiency light bulbs. Linear and compact fluorescent lamps are much more efficient that incandescent bulbs and they last six to ten times longer. Although they are more expensive than incandescent bulbs, fluorescent lamps pay for themselves by saving energy over their life time. If you replace incandescent lamps with compact fluorescent lights, you can save 60-80% energy and it will produce more light and it will produce less heat and discomfort.

Please permit me to do a simple computation to make this clearer. In Nigeria, we have incandescent bulbs that come in various capacities. The common ones found in the market are 60W, 100W and 200W. The common fluorescent bulbs in the market are those of 20W and 36W. If a particular household using 20 incandescent bulbs of 60W and decides to replace them with fluorescent bulbs of 20W. Instead of spending 20 x 60 = 1200W (that is they are spending 1200 watts per hour). If the incandescent bulbs are replaced with fluorescent bulbs of 20W, the same household will be spending 400 watts per hour. Thus they will be saving approximately 67% of energy for lighting alone.

If we have a scenario in Nigeria where we fade out one million incandescent bulbs of 60W and replace them with energy-saving bulbs of 20W, the country will be saving 40 million watts, which is equivalent to 40 mega watts. This is enough to provide electricity for many communities in Nigeria that do not yet have access

to electricity. Policy option for Nigeria will include fading out incandescent bulbs from the Nigerian systems and putting a ban on the importation and production of incandescent bulbs. Policy to encourage the importation and production of energy efficiency light bulbs will enhance the efficient use of electricity.

Heating and Cooling

The use of energy for heating and cooling account for about 44% of a typical utility bill. Heating and cooling uses more energy and drains more money than any other system in the home. This has a negative effect on the environment. For example, in the United States, the heating and cooling systems emit more than half billion tons of carbon dioxide into the atmosphere each year, thus adding to global warming and generating about 24% of the nation's sulfur dioxide and 12% of nitrogen oxide. These gases are the chief ingredients of acid rain (Foundation for Community Association, 2007). By combining proper equipment maintenance with appropriate insulation, weathering and thermostat setting, energy bills and pollution can be cut by 50%. Do not place lamps or TV set near your air conditioning thermostat; otherwise it will sense heat from these appliances and can cause the unit to run longer than necessary.

Housing

Landscaping is a natural and beautiful way to keep your home comfortable and reduce your energy consumption by up to 25%. Apart from adding aesthetic value and environmental quality to your home, trees, shrub or vine can help deliver effective shade and act as windbreak. A well designed home can reject overhead heat to reduce the energy spent for cooling. Low quality windows can cause your air conditioner to work two or three times harder. In warm climates, it is advisable to use windows with special coating that will help to reduce heat gain. Replacing single paned windows with double-paned windows can help to reduce heat gain and reduce the energy spent on cooling.

Transportation

Road transportation is the dominant mode of transportation in Nigeria. Many of the vehicles imported are used vehicles. Potential energy savings are achieved by using road worthy vehicles. In many cases, fuel efficiency is low because vehicles are old and poorly maintained. Other causes of low efficiency of fuel are traffic congestion and bad driving habits. Energy saving of up to 30% can be achieved by shifting from energy intensive transport to a less energy-intensive transport and by adopting traffic management schemes. In Nigeria and Ethiopia, the demand for gasoline and diesel could be cut by 30% by emphasizing public transportation over private transportation (Adugbulugbe, 1992; Mengustu, 1995).

Obstacles to Energy Efficiency

Obstacles to energy efficiency programmes in many developing countries include:

- Lack of awareness
- Lack of energy efficiency policy

- Inappropriate energy pricing and cost subsidies
- Lack of trained staff, operators and maintenance workers
- Lack of capital and the importation of inefficient used plants and vehicles
- Proliferation of inefficient equipment and the desire to minimize initial cost
- Low income

Conclusion

Key drivers of energy efficiency include technical improvement, new technologies, cost competition and energy conservation programmes. Structural changes in industry, integration with global markets and investment in new processes, buildings and infrastructure are expected to improve energy efficiency considerably over the next 20 years (UNDP, 2000). In more developed countries, household appliances have become more energy efficient. Most of the technology used by industry in developing countries is imported from industrialized countries. These industries should continue to benefit from technological improvements that promote rational energy use. The transfer of energy efficient technology will provide the following advantages:

- reduce energy imports
- increased demand for skilled workers
- reduce operation cost of facilities

Recommendations

- Develop policies on energy efficiency and integrate them into current energy policies
- Promote energy efficiency products and practices at the side of end users and utilities
- Create awareness on renewable energy and energy efficiency
- Establish agency to promote the use of energy efficiency products and ensure energy efficiency practices
- Develop and imbibe energy efficiency technologies
- Develop appropriate drivers for the implementation of energy efficiency policy

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Nigeria's Energy Development: The Role of Energy Efficiency

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Overview

- Climate Emergency and Energy Poverty
- Energy Efficiency in Nigeria
- Energy and Poverty in Nigeria
- Woodfuel Resource Base
- Woodfuel use in Semi-urban Areas
- The 10 Million Improved Woodfuel Stove Project

Climate Emergency and Energy Poverty

- Sahara Desert shifted at the rate of 25 – 35km southward into Sahel Savanna from 1970-1990
- Forest fires, loss of fog water
- Loss of 5 million hectares of forest per year between 1990 and 2000
- Semi arid/arid lands increase by 8%

Energy Efficiency Opportunities in Nigeria

- Industrial sector
- Transport sector
- Electricity sector
- Household energy

Energy and Poverty

Population	140 million
GDP per capita	1,037USD
Population on less than 2USD	91%
Life Expectancy	47%
Illiteracy rate	32%
Access to improved water source	57%
Infant mortality/1000 births	200
Access to electricity	40%

Electricity consumption per capita	171kwh
Biomass % of primary energy consumption	37%
Biomass as % of rural energy consumption	95%
% of population dependent on biomass	67%
Population dependent on biomass	95 million
Number of households dependent on biomass use	21.5 million
Burden of disease attributable to biomass use	4%
Deaths attributable to biomass use	79,000

House Hold Energy Use Profile for Urban Areas

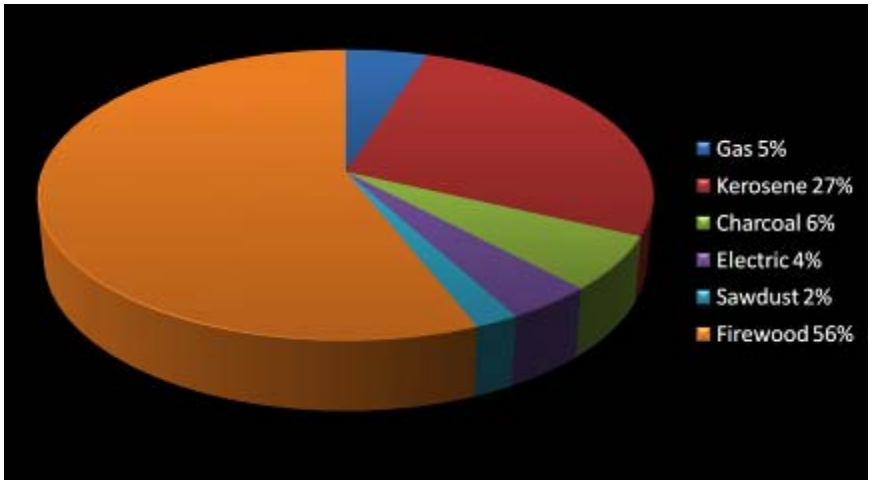


Fig. 1: Household energy use profile for urban areas

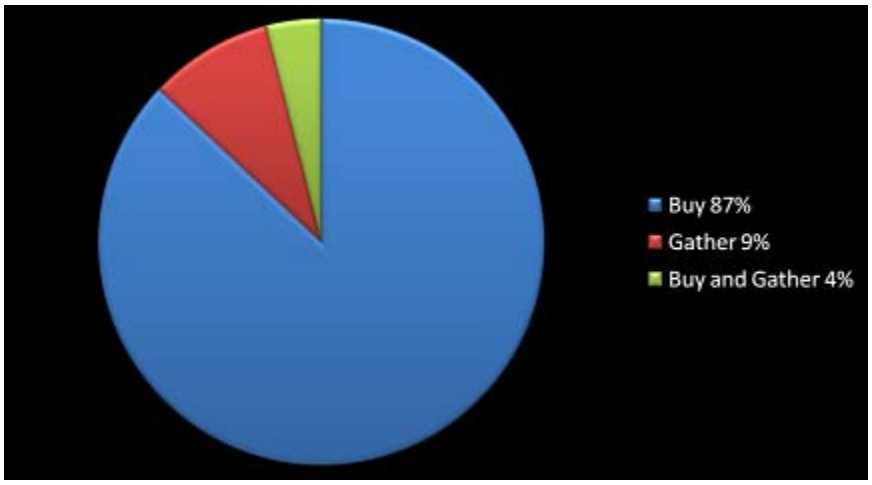


Fig. 2: Buying/Gathering of Firewood

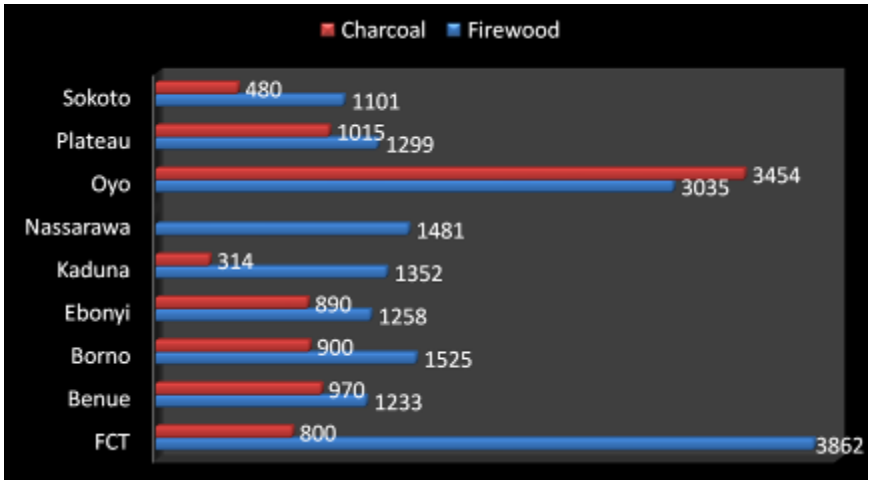


Fig. 3: Monthly expenditure on firewood and charcoal

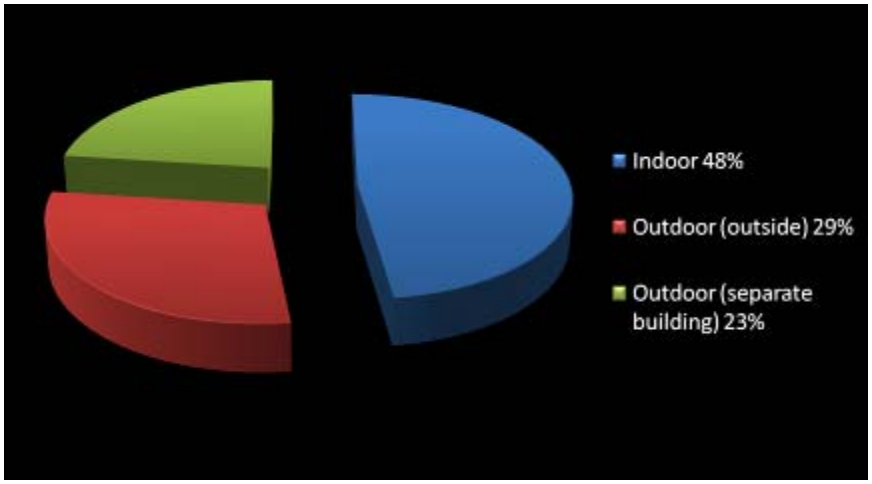


Fig. 4: Where kitchen are situated

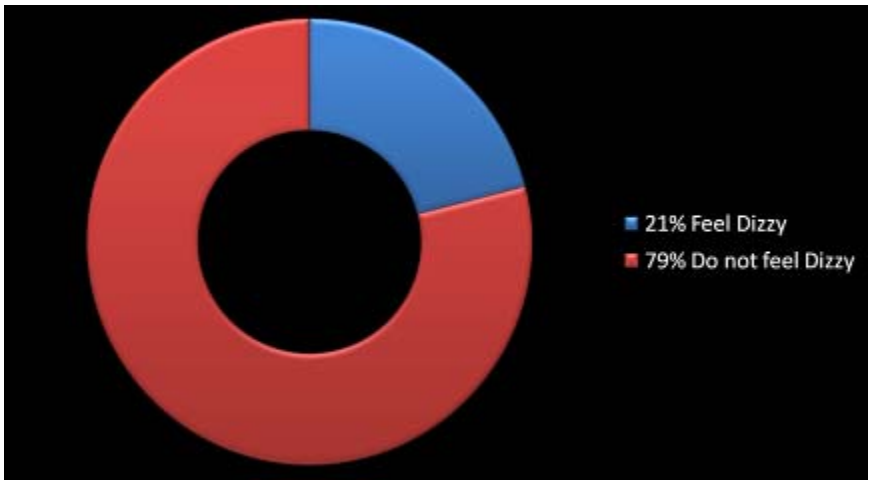


Fig. 5: Percentage of cooks that feels dizzy

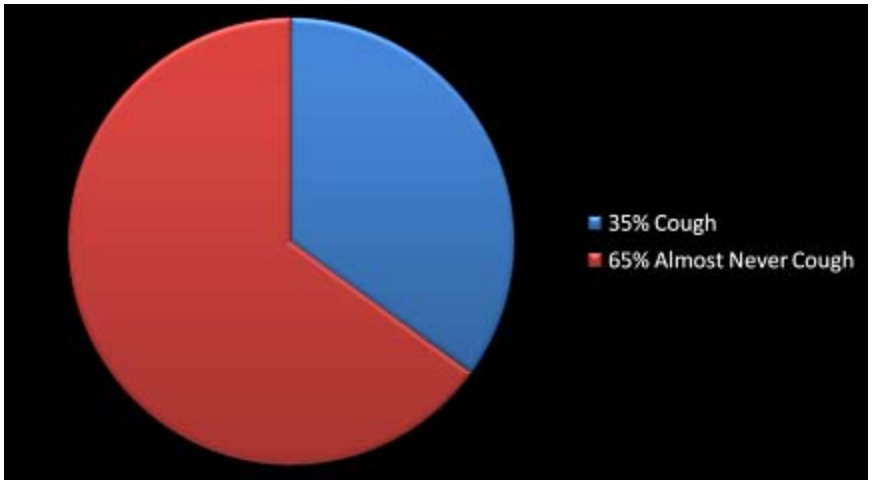


Fig. 6: Cooks that experience coughing

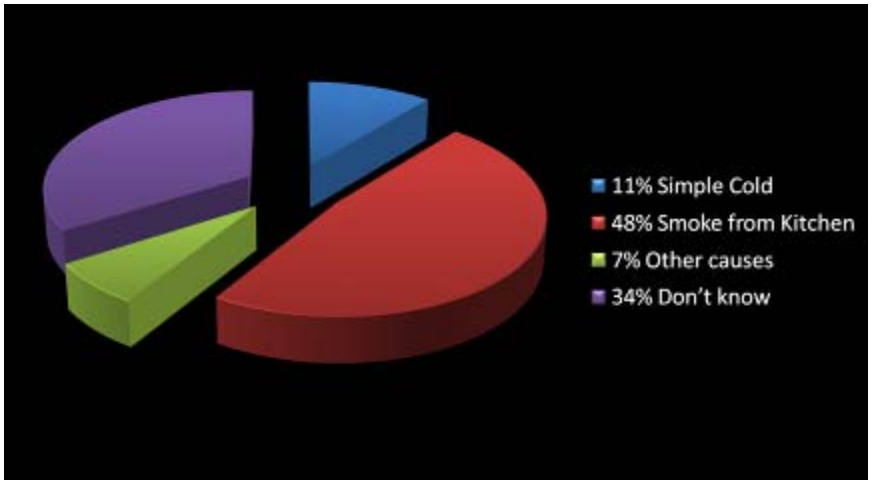


Fig. 7: Causes of cough (cooks)

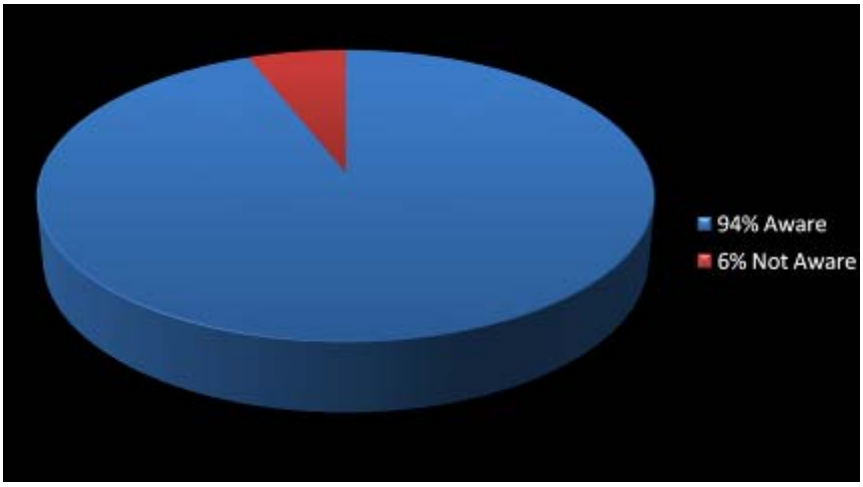


Fig. 8: Energy efficiency awareness

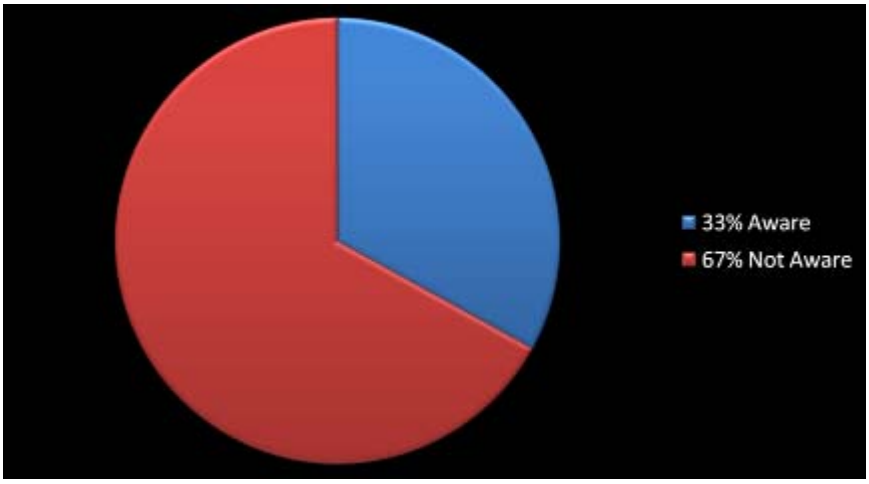


Fig. 9: Awareness of improved wood fuel stoves

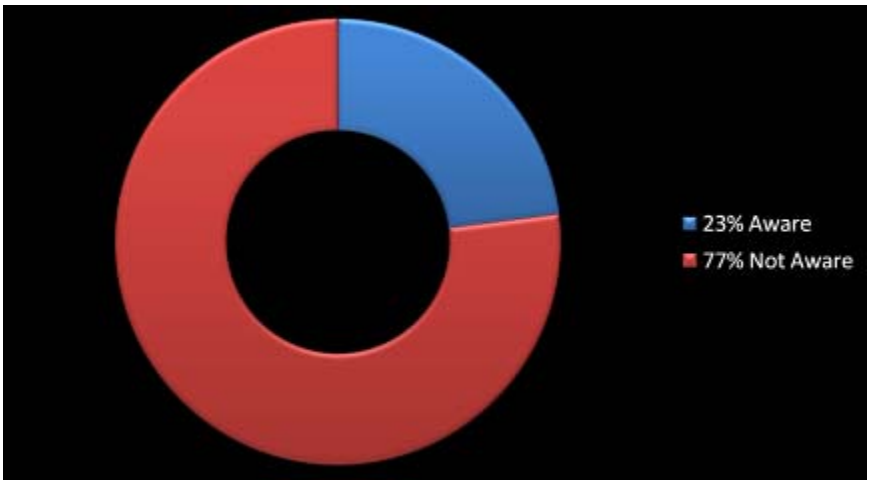
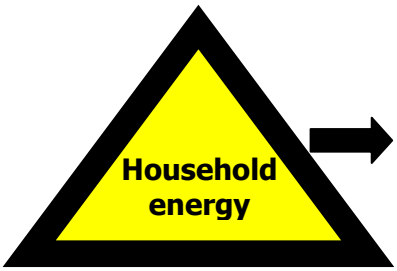


Fig. 10: Do you know of any wood stove producer?

Healthy and affordable household energy is essential for achieving the MDGs

"Improved energy services — including modern cooking fuels — are necessary for meeting almost all the Goals. (…) The UN Millennium Project proposes that countries adopt the following specific target (…) by 2015: Reduce the number of people without effective access to modern cooking fuels by 50 percent and make improved cookstoves widely available."

UN Millennium Project, Investing in Development: A Practical Plan to Achieve the Millennium Development Goals.



MDG 1: Eradicate extreme poverty and hunger

MDG 3: Promote gender equality

MDG 4: Reduce child mortality

MDG 5: Improve maternal health

MDG 6: Combat HIV/AIDS and other diseases

MDG 7: Ensure environmental sustainability

Source: Eva Rehfuess, WHO

The 10 Million Improved Wood Stove Project

Vision: To reduce by half the number of Nigerian households and institutions cooking with inefficiency woodstove by 2015

Objectives

- Assist poor families adapt to climate change impacts
- Reduce the cost of cooking fuels for poor families
- Mitigate national morbidity and burden of diseases from indoor air pollution
- Address deforestation and desertification
- Reduce GHG emissions and enhance capacity to adapt to climate change

Targets

- 10 million efficient household stoves by 2015
- 10,000 institutional stoves

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FIRST DISCUSSIONS SESSION

Question by Maryam Haruna (SWAPHEP): *May I know how bad roads can cause the inefficient use of fuel?*

Answer: *Bad roads affect the smooth movement of vehicles, hence causing traffic jam. Sometimes, vehicles can stay on traffic jam for more than one hour. The more time motorists are held up in traffic jam, the more fuel they consume and hence the more of greenhouse gases are emitted into the atmosphere. To check this, there is need to put in place good road networks and to develop efficient transport scheme. The government should also encourage public transportation over private transportation.*

Question by Tom Aneni (SEDI): *How will the Nigeria Climate Action Network (CAN) be sustained in the future?*

Answer: *The Nigeria CAN is one year old; a lot of our work has been complimented by the attention of some other organizations. Sustaining the network is only dependent on our ability to deliver.*

Question by Joshua Kasai (POD): *Experiences have shown that policy formulation has not been a problem but the implementation. What strategy is being put in place to address this problem of implementation of policies in Nigeria with regards to energy efficiency?*

Answer: *The issue of energy efficiency is still new in Nigeria. The Obasanjo Administration focused so much on energy generation. The absence of good distribution system will lead to energy wastage. The three hydro electric dam we have in Nigeria are all located in Niger State. It has been proven that energy dissipates with distance from the source. We advocate for a decentralized system whereby energy is generated at the point where it is used.*

Comment by Ahmed Yahaya: *If we can create awareness among the citizens, we can help reduce the degree of emissions. Even the use of these energy efficiency bulbs can be encouraged in communities without waiting for the government.*

Response: *We should not wait for the government to change things while we are waiting and folding our arms. We should begin to mobilize the civil society, not to confront the government but to collaborate with the government and make proposals that will develop the country. The Nigeria civil society is so relaxed; we should move out of our comfort zone and align with our government to move the country forward.*

Comment by Kemi (CSC): *I think our prepaid meter should be made compulsory for all households to check energy usage. Our government is not monitoring the use of these facilities.*

Response: *When energy tariff is increased, people will become conscious of the way they use energy. In developed countries, the price of energy is used to enhance efficiency. When the price of energy is too low, the tendency for people to misuse the energy is high. In many parts of Nigeria, people leave their security lights on during the day.*

Comment by Noah Mc'Dickson(FNW): *Despite the fact that we do not get light from PHCN, the officials of PHCN still bring bill to us*

Response: *PHCN has a faulty structure and the monopolistic nature is unhealthy for the energy sector. The energy sector should be liberalized and the monopoly broken. In 2005, the Electricity Reform Act came into force. The government should not suspend a law made by the legislators. From the Electricity Reform Act, the government has no business with power generation. Our problem is not the government but the civil society. We should build a strong civil society platform to check the implementation of these laws. In Cuba, the government has prohibited the use of incandescent bulbs.*

NB: Since electricity generation and supply require huge investments, it is important to build upon the existing experience of government agencies in supplying electricity. Government should provide better funding for state owned utilities. Government could establish a government-run utility that is compelled to implement energy efficiency. Policy that encouraged a public-private partnership could be developed. However, the involvement of the private sector should be preceded by policies and legislations that will regulate their activities; private companies could capitalize on social, political and environmental circumstances for exploitation.

Question by Charles Ayede (FRUIT): *Efficient wood stove and solar facilities, how available and affordable are they? Where are they from? Are they friendly (cost wise) to the rural poor?*

Response: *Solar facilities and efficiency woodstoves are expensive for rural poor. Government and private organizations can help to subsidize them to make them affordable to rural dwellers.*

Comment by Osayande (ERA/FoEN): *It will not be proper to step up energy tariff because we have resources to generate enough energy in this country. In advanced countries, privatization is not total. There is public intervention in every sector.*

Response: *We have targeted subsidies. Subsidies should be given to those in the rural areas. But those in the middle class and the rich should be made to pay the full cost for energy services. The government can harness solar energy in the*

northern part of the country to generate electricity and use wind and ocean driven waves to generate electricity in the south.

Question: *If you are asking the rural women to stop fuel wood business, what is the alternative for them?*

Response: *We are not saying that these women should give up their wood business. We should think of other sources of income for them. Again, we should plant fast growing threes to replenish the lost forest trees. There are tree that can mature in a period of three years.*

Efik, Ewah (standing) and Etiosa

Participants listening

Group photograph

Cross section of participants

Ewah with media personnel

Etiosa with media personnel

PARALLEL SESSION

The entire participants were divided into two groups. One group discussed extensively the ways to create awareness on energy efficiency while the other group developed a roadmap to integrate energy efficiency into Nigeria's policy framework.

Summary from Group One: Awareness Creation

Facilitator: Surveyor Efik ***Secretary*:** Edem Edem

- For Nigeria to benefit from the gains of energy efficiency, implementation of strategies and policies should be done through NGOs
- Strategic partnership with NGOs, government and development partners is imperative to create awareness on energy efficiency
- Partnership with the media will go a long way to increase awareness on energy efficiency
- Government in partnership with NGOS should initiate pilot projects to enhance creation of awareness
- Provision should be made for energy efficiency pavilion in every trade fair in Nigeria.
- Stakeholders to work together to develop a strategic plan to create awareness on energy efficiency
- NGOs should partner with PHCN and the Federal Ministry of Environment, Housing and Urban Development (FMEHUD) to promote the use of compact fluorescent lamps (CFLs) and pre-paid meter installation
- NGO and Federal Ministry of Energy should work together to formulate policy to ban the use, importation and manufacturing incandescent bulbs and promote CFLs
- A special day (save-energy day) should be created and marked in Nigeria to create awareness on energy efficiency. On that day, all Nigerian will be asked to put off all their light.
- CSOs should mainstream energy saving tips into their activities
- Stakeholders should embark on one-on-one awareness creation among citizens
- Embark on rural sensitization using local meeting, town hall meeting etc
- Intensify synergy among CSOs to promote energy efficiency
- Facilitate information sharing and provide practical demonstration
- Develop and distribute climate change documentaries to increase awareness
- Conduct training for the media to facilitate awareness creation
- Using religious activities to create awareness and involving traditional institutions in the process
- The Legislative arm of government should be involve in creating awareness
- Advocating for best practices on energy efficiency in government establishment

- Oppose the activities of multinational companies working against promotion of renewable energy
- Use internet to create awareness and use local languages/pidgin English to create awareness
- Higher institutions should create course on energy efficiency and integrate them into school curriculum
- Mainstreaming green energy concept into the manifestoes of political parties
- Banners advertising renewable energy should be placed at public places to create awareness

Summary from Group Two: Roadmap for Energy Efficiency Policy in Nigeria

Facilitator: Tom Aneni ***Secretary****:* Ms. Omoye Odigie-Emanuel
We are articulating four points:

1. Wastage at household level
2. The use of inefficient technology
3. Human Behavior
4. Research and Development

1. Wastage at Household Level

- Policy should contain aggressive awareness creation/public enlightenment for specific group that is men, women and in different languages, using method accessible to both poor and the rich, educated and uneducated including domestic staff.
- Policy should also help to integrate energy efficiency courses into school curriculum and accelerate access to prepaid meters.

2. Inefficient Technology

- Policy should contain the gradual progressive phasing out of inefficient technology used for lightings, industries and the transport sector
- Promoting financial options for access to efficient energy sources
- Decentralization of energy sources
- Housing design should promote energy efficiency

3. Research and Development

- Promoting research and development at all stages with wide collaborations with relevant stakeholders including CSOs
- Increase funding for research in respect of energy efficiency and renewable energy and energy efficiency policy implementation
- Linkages between research output and policy formulation should be strengthened.

4. Human Behavior and other cross-cutting issues

- Policy and behavioral pattern
- Alternative renewable energy sources
- Legislative/budget backup

Group One

Group Two

SESSION THREE: SECOND PANEL

In this session, three papers were presented.

Climate Change in Nigeria: The Need for Sustainable Renewable Energy

Presented by

Mansur Bako Matazu
Department of Geography
Federal University of Technology, Minna, Niger State

Abstract

In many developing countries, including Nigeria, climate change remains a marginal issue to the pressing issues of food security, poverty, natural resource management, energy access, and urban transport. Finding policies and actions that can drive development and at the same time address the challenges of climate change is a core pre-requisite to achieving the millennium development goals (MDGs). This paper highlights new approaches to the planning and implementation of actions to improve renewable energy access for both rural and urban communities in Nigeria.

Introduction

Nigeria's Vulnerability to Climate Change

Over the last 200 years, human activities have resulted in increased emissions – primarily carbon dioxide (CO_2) above natural levels. Forest fires and other forms of deforestation which have altered the composition of the atmosphere and caused global warming resulting in climate change defined by the United Nations Framework Convention on Climate Change (UNFCCC) as:

> *"A change of climate which is attributed directly and indirectly to human activities that alter the composition of global atmosphere and which is addition to natural climate variability observed over comparable time periods"*

Climate change is increasingly emerging as a serious threat to sustained economic growth. In the last two (2) years, two major reports – the 2007 Fourth Assessment Report (AR_4) of the IPCC and the Stern Review – entered the public domain and stimulated professional discussions to be reflected on development of strategies and thinking. These two reports provide compelling evidence, analytical explanations of observed trends, and simulation models projections, drawing strong cause-and-effect linkages between human socio-economic activities and greenhouse gas (GHGs) emissions, and between the latter and climate change.

Climate Change and Nigerian Circumstances
There is ample evidence that climate change is taking place at the local level in Nigeria. Investigations so far conducted confirm that the country is one of the most vulnerable nations with impacts including:

a. Floods in both north and south and erosion in the south
b. A 2.5^0C increase in sea surface temperature (SST) within the last 20 years in the Gulf of Guinea from 26^0C in 1979 to 28.5^0C in 1998. A tornado like is about to ravage the coastal zones of Nigeria.
c. Hot dry season with record breaking temperatures which exceed 50^0C in recent years.
d. Drought and desertification that have taken over states north of 12^0 parallel – sand dunes are approaching very fast, vegetation and settlements are being wiped at north eastern part of the country.
e. Distortions of the onsets and cessation dates of wet seasons have multiplier effects on agriculture and food security.

Alternative Renewable Energy Sources in Nigeria
The entire issue of energy, the environment and poverty is extremely complex and cannot be reduced to the energies we know and use today. Agricultural and industrial residues, solar, winds, small scale hydro-power dams, count among the potential non-conventional sources of energy. Both rural and urban populations need energy to meet their various household end uses (cooking, heating, lighting and drinking water), social requirements (communication, health, education) and production activities (e.g. mechanical energy for milling) etc.

Agro-Allied resources
Among the available unconventional household energy sources are the agro-industrial residues (groundnut shells, rice husks, cotton stalks, etc.) and certain plants, in particular aquatic ones can be potential energy sources. Moreover, this contributes to a better conservation of the local ecosystem. *Typha australis* presence in most of the dams, water ways and irrigation sites is included in this category.

Optimizing the forest resource processing
A low plant cover and particularly low afforestation rate characterize this country. Paradoxically, another feature is the predominance of the use of wood energy compared to the other forms of fuel. The absence of sound management practices has resulted in these forests being anarchically exploited at a rate of about 400,000 ha per annum, resulting in harmful effects to environment and to the living standards of the populace as well.

Solar Energy
Nigeria has huge lighting and refrigeration requirements. Inspite of a considerable solar resource in the country (about 3,000 sunshine hours per annum), this renewable energy excellence is underdeveloped.

Development and increase in the use of biogas, wind, thermal energy and micro-electric power stations etc.

The Concept of Clean Development Mechanism
The carbon market is the most tangible result of efforts to mitigate climate change. By creating a market for emission reductions, in effect paying people and businesses to reduce greenhouse gas emissions, the carbon market provides a financial incentive to invest in clean energy projects, in energy efficiency, in fuel switching etc. The carbon market is now worth roughly $64 billion, and is doubling in value each year (World Bank, 2008). Under the Kyoto Protocol, most developed countries have agreed to limit or reduce their emissions of greenhouse gases relative to a baseline year (in most cases 1990). The Clean Development Mechanism (CDM) permits project-based carbon trading between developed and developing countries.

The CDM allows 'carbon projects' to be undertaken in developing countries. A carbon project is one that reduces or avoids the emissions of greenhouse gases into the atmosphere. Six (6) greenhouse gases or families are eligible

- Carbon dioxide
- Methane
- Nitrous oxide
- Per fluorocarbons (PFCs)
- Hydrofluorocarbons (HFCs)
- Sulphur hexafluoride

Examples of Carbon projects Include:
- The use of renewable energy (wind, hydro and solar etc)
- The use of biomass residues
- The implementation of energy efficiency measures (such as the introduction of compact fluorescent light bulbs or more efficient cook stoves)
- Waste management practices (such as capturing the methane emission from waste water treatment plant, treatment plants, landfill dumps or animal waste)

The above projects are undertaken by project developers, who can be private-sector companies, public sector bodies, utilities or NGOs. For every tonne of greenhouse gas that is reduced, the carbon project is awarded a 'carbon credit' known as certified emission reduction (CER). CERs can then be sold by the project developer, thereby generating a monetary revenue stream. The

magnitude of this revenue varies from hundreds of thousand of dollars per year to potentially tens of millions.

The carbon revenue stream exists in addition to any other revenues the project may deliver. For example, the primary revenue stream of a hydro power project may be the sale of electricity, the primary revenue stream from a reforestation project may be the sale of timber and the economic rationale for undertaking energy efficiency measures may be the cost savings that follow.

The intention of the CDM is to add to these revenue streams thereby enhancing the economics of 'clean' projects and giving incentive for more of such projects to be undertaking.

Linking Development to CDM

MDG Targets	CDM Project Types
Goal 1: Eradicate extreme poverty and hunger	Energy for local enterprises, lighting to facilitate income generation, employment opportunities
Goal 2: Achieve universal primary education	Reduce time spent by children on energy provision, lighting for reading, energy for educational media.
Goal 3: Promote gender equality and empowerment of women	Modern energy services free girls and women's time spent on energy provision.
Goal 4: Reduce child mortality	Energy supply for health clinics, reduced air pollution from traditional fuels
Goal 5: Improved maternal health	Energy supply for health clinics reduced air pollution from traditional fuels
Goal 6: Combat HIV/AIDS, Malaria and other diseases	Energy supply for health clinics, cooling of vaccines and medicines
Goal 7: Ensure environmental sustainability	Afforestation/reforestation, substitution of non-renewal biomass, waste management

Conclusion

Renewable energy development was treatised as a major challenge in Nigeria. If soundly used, renewable energy technologies can represent a significant lever for poverty reduction, thus contributing to the improvement of the quality of life and sustainable development as a fall out of climate change mitigation strategy. In this context, innovative, climate change-related financial instruments (CDM) offer an unprecedented opportunity to explore this overlooked potential for the socio-economic benefit of the country.

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Save-80 Cook Stove

Presented by

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Introduction

The term desertification is used when natural resources (land, vegetation, water) in areas with a relatively dry climate are impaired or destroyed as a result of overexploitation by humans. The United Nations Convention to Combat Desertification (UNCCD) defines desertification as:

> *"land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities".*

Desertification gives rise to a multitude of social problems and conflicts in the countries affected; decline of soil productivity and scarcity of water jeopardizes the population's food security and water supplies; many people abandon their rural homes and migrate to urban centers, where they generally have no alternative but a leave in the slums. Desertification prevents sustainable economic and social development in the countries affected. The net effect of desertification, therefore, is:

- it increases poverty,
- it worsens poor nutritional status and
- it adds to the already high risk of disease
- it encourages large-scale migration from rural areas

The consequence of desertification for Nigeria is that the Middle belt will be choked up; resources will be scarce; chaos will be the order of the day; and people shall be fighting and killing each other.

What we are proposing is providing alternatives to using wood as alternative fuel; encouraging the use of renewable energies; empowering women to establish cottage industries; when necessary, use the least amount of wood as possible in cooking; continue organizing seminars on renewable energies especially for women groups; and training youths to assembly the cookers. Our traditional way of cooking should be replaced with highly efficiency wood saving stove.

The Save 80

As the name implies, cooking with the "save 80" saves 80% of the wood consumption compared to the traditional open fire place. The "Save80" needs around 250 g of dry firewood to bring 6 litres of water to the boil.

Nominal effective thermal power:	1.5Kw
Pot capacity:	8 litres
Recommended pot content:	6 litres

The interior parts of "Save80" are made of stainless steel to ensure a life-span of many years, high efficiency and burning at high temperatures for complete combustion with low emission of smoke.

Time for bringing 6 litres of water to the boil is about 25 minutes. The supply of air is regulated automatically by the design of the cooker. "Save80" is not affected by the wind.

Basic Rules for the Use of "Save80"

"Save80" can be used mainly for cooking, frying and deep frying. Kindling is done by setting fire to a sheet of paper and some small pieces of wood in the burning chamber. When the fire is lighting, the pot is inserted. Afterwards the fire is maintained by throwing small firewood sticks through the quadratic aperture. What is of particular importance is that small pieces of wood, which are not traditionally collected and burnt, can be used in the "Save80". With its interior parts being made of stainless steel, a guarantee of 10 years is given to every stove.

The "Wonderbox" is used for cooking with retained heat and for conserving high temperature of the content for many hours. It is suited to the 8-litre-pot (with lid) of "Save80". After 2 hours, the temperature of 6 litres of water will decrease from 100°C to about 90°C; after 12 hours the temperature is still above 65°C. The "Wonderbox" can save more than half of the firewood consumption, in addition to the saving by the "Save80". The material of the "Wonderbox" is specially designed for the heat retaining of food and water, up to the boiling point and has a life-span of years (no polystyrene).

Manufacturing information: Mass production has started; capacity of production can be adapted in a short time to any quantity needed.

Basic Rules for the Use of the "Wonderbox"

Cooking by retained heat is very simple and needs no surveillance. The pot is introduced into the lower part and the "Wonderbox" is closed by putting on the upper part. After bringing the pot content to boiling point, the pot is introduced into the "Wonderbox". Porridge, for example, can be cooked without stirring. The

“Save 80” can be used cook any type of meal. Some examples are given below:

Rice
5 litres of water, 800 g rice

Bring the water (with a teaspoonful of salt) to the boil by "Save80" and add the rice. Boil it up and place the pot with lid into the heat retaining box. The rice is ready after 30 minutes in the "Wonderbox". Fire wood consumption is about 250g.

Dried Vegetables (Beans, Peas, Lentils)
4.5 litres of water, 1 kg dried vegetables

Add the dried vegetables to the cold water, without salt and bring it to the boil by the "Save80". Boil up and put the pot with lid into the "Wonderbox". After about 2 hours the peas, beans or lentils are cooked. Season only at the end. Soak the beans (especially large beans) overnight in cold water. The "Wonderbox" saves all the labor usually connected with the time and firewood consuming cooking of dried vegetables. The pot remains in the box without supervision and burning. Firewood consumption is about 250 g.

Maize porridge
5 litres of water, 1 kg maize flour
Bring the water to the boil and pour the maize meal into the boiling water stirring continuously. Boil up briefly and put the pot with lid into the "Wonderbox". After 30 minutes the porridge is ready. The porridge is the same grade as encountered in Africa. The smaller the amount of maize porridge one is preparing, the better the mixing has to be done. Minimum time in the "Wonderbox" is half an hour. The "Wonderbox" saves the tedious stirring of the porridge when it is thickening and it avoids the danger of scorching. In a well closed heat retaining box the porridge is kept hot, unattended, for many hours. Firewood consumption: less than 300 g

Potatoes
3 kg potatoes (large potatoes cut into halves), 3 litres of water

Put the potatoes into the pot with the cold water. Heat it to the boiling point by "Save80". This takes about 25 minutes. Cook the potatoes 5 minutes. Transfer the pot with the boiling content into the "Wonderbox". It takes 30 minutes in the "Wonderbox" to finish the cooking of the potatoes. Firewood consumption is about 250 g

Meat and chicken (comparative test)
800 g meat (400 g one lump; 400 g cut into pieces), a big chicken leg, 6 litres of water, some vegetables, herbs. The pot content was brought to the boil and the pot was transferred to the "Wonderbox". Before the transfer to the "Wonderbox", the big piece of beef (400g) was half done, the smaller pieces were nearly

cooked. The chicken was already finished. After two hours in the "Wonderbox" the chicken meat was detached from the bone and was very soft. Firewood consumption is about 250 g

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Energy Development in a Fossil Fuel Economy: The Nigerian Experience

By

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Introduction

The critical role that energy plays in virtually all human activities has been widely acknowledged. Without a reliable and affordable source of energy, governments, institutions and individuals would find it difficult to realize their social and economic aspirations. Planners, especially those in the developed countries have long recognized the importance of energy as a veritable resource for improving human welfare and driving industrial growth. Statistics have also shown that the amount of energy produced and consumed within a country is actually indicative of the country's level of industrial and economic development.

In this paper, we will examine the state of energy production and consumption in Nigeria, discuss the various energy production potentials of the country and identify the major obstacles militating against the development of an efficient energy system in Nigeria. Emphasis would be laid on the issue of electricity generation, because this is one area that Nigeria is lagging behind compared to other fossil fuel economies. We, however, state here that the energy future of Nigeria is in the development of renewables.

The state of energy production and consumption in Nigeria

Globally, Fossil fuels (coal, oil and gas) currently provide 95% of the world's total energy demands and about 66% of the world's electrical power.[1]Nigeria has abundant primary energy resources. These include reserves of crude oil and natural gas, coal and renewable energy resources such as hydro, fuel-wood, solar, wind and biomass. The energy consumption mix in Nigeria is presently dominated by oil (58%), followed by natural gas (34%) and Hydro electricity (8%). [2] Coal, nuclear, wind and solar energy are currently not part of Nigeria's energy mix, as they have either been neglected (as in the case of coal) or are currently at their early stage of development (as in the case of solar). Between 1984 and 2004, the share of oil in Nigeria energy mix fell from 77% to 58% while the consumption of natural gas increased from 18% to 34%. Hydroelectricity also witnessed a slight increase from 5% to 8% within the same period of time.[3]

In most developing countries, electricity is the most popular form of energy known to the people. This popularity stems from its diverse applications, flexibility and ease of transmission and distribution. Availability of electricity remains a major factor in the location of industries and a strong instrument of social development. During the past twenty-five years, electricity supplies have been

extended to 1.3 billion people in developing countries.[4] But despite this achievement, about 1.6 billion people, that is about one quarter of global population, still lack access to electricity and some 2.4 billion people rely on traditional biomass, including wood, agricultural residues and dung for cooking and heating.[5] More than 99 percent of people without electricity live in developing countries, and four out of five of these people live in rural areas of South Asia and sub-Saharan Africa.[6]

In the case of Nigeria, commercial electricity is generated mainly from hydropower, steam plants and gas turbines. Between1968 and1991, the installed capacity for electricity generation in Nigeria increased by a factor of 6 to stand at 5881.6 MW.[7] However, no further addition to generating capacity was embarked upon by the government over the subsequent decade. Consequently, availability of power in the country varied from about 27% to 60% of installed capacity, while transmission and distribution losses accounted for about 28% of the electricity generated in the country.[8] In 2001, the available generating capacity was raised by the Obasanjo-Administration to 4000 MW, but this soon dropped to 2,600MW within the first quarter of 2002.[9] Thus, as at 2004, electricity production in Nigeria stood at 19 billion kilowatt hours while consumption was 18 billion kilowatt hours.[10]

But the United Arab Emirate, a small fossil fuel economy in the Middle East produced and consumed 45 billion kilowatt hours in 2004.[11] Iran, another fossil fuel economy generated 156 billion kilowatt hours and consumed 145 billion kilowatts hour in the same year. 146 billion kilowatt hours was generated by Iran by conventional thermal electric power and the remaining 11 billion kilowatt hours was generated by hydroelectric power.[12] In 2005, Saudi Arabia's Electricity Generation was 165.55 billion kilowatt hours (Bkwh) while consumption for the same year was 146.95 billion kilowatt-hours (Bkwh). [13]

Commercial electricity generation in Nigeria currently comes from the following power stations: Egbin Thermal Station, Lagos (with installed capacity of 1,320 MW); Afam Thermal Station, Rivers State (with installed capacity of 969 MW); Sapele Thermal Station, Delta State (with installed capacity of 1,020 MW); Ijora Thermal plant, Lagos (with installed capacity of 40 MW); Kainji Hydro Station, Niger State (with installed capacity of 760 MW); Jebba Hydro Station, Niger State (with installed capacity of 578.4 MW) and Shiroro Hydro Station, Niger State (with installed capacity of 600 MW). The various Independent Power Projects springing up around the country are expected to generate about 4,155 MW into the national grid by 2010.[14]

Substantial expansion in quantity, quality and access to energy services especially electricity is fundamental to rapid and sustained economic growth and poverty alleviation. Yet, for the past three decades, inadequate quantity, quality and low access to electricity services have been a regular feature in Nigeria. Nigeria's electricity crisis is striking for a variety of reasons. First the country the

crisis persist despite that the country is blessed with enormous renewable and non-renewable energy resources. Although Nigeria holds the seventh largest reserve of natural gas in the world and exports large quantities of liquefied natural gas (LNG) to other countries, her gas-dominated electricity grid still experiences frequent collapse due to inadequate gas supply and obsolete infrastructures.

Nigeria and Her History of Failed Independent Power Projects

In a bid to meet the growing demand for electricity in the country and stabilize its generating capability, the Federal government of Nigeria and some state governments decided to implement several independent power projects (IPPs) to boost power supply in the country

In June 2000, Nigeria signed a revised, two-part agreement with U.S-based Enron for an emergency 270-megawatt (MW) power supply project for Lagos State. The Lagos State government had originally contracted Enron in August 1999 to provide 90 MW. The project entails the installation of nine-barge-mounted (30 MW each) gas turbines[20]. The barges were to feed power into the national grid through a link with the nearby Egbin power plant. Power generation from the barges was expected to begin in September 2001, but the target was never met due to the problems encountered by Enron and the bureaucratic squabble that ensured between NEPA (now PHCN) and the Lagos State Government.[21]

Rivers State also tried to develop its own plans for the generation of about 90 MW from three new gas turbine stations located at Eleme, Trans-Amadi and Omuku. In 2001, the state government took delivery of the equipment and started their installation at the Trans-Amadi Industrial Layout, near Port Harcourt. The power station was to provide Port Harcourt with 36 MW of electricity, but that objective was never realized. The project, which was commissioned in October 2002, was bugged down by lack of gas supply.[22]

Several Independent power Projects agreements consummated between the Nigerian Government and the various oil companies operating in the Niger Delta are also yet to make any impact in terms of improved power supply in the country. Among such project is the ENI/Agip IPP plant, designed to supply 450-MW of electricity from its base at Kwale in Delta State as well as the Exxon-Mobil gas-fired power plant intended to supply 388 MW of electricity its base at Oso oil field in Bonny.[23]

Perhaps, the biggest power project failure in Nigeria is the Federal Government initiated National Independent Power Projects (NIPP), which were intended to supply about 10, 000 MW[24] of electricity from their different locations in the federation. Some of the project locations and their proposed capacity are: Calabar in Cross River State (5000MW), Egbema in Imo State (350MW), Eyaen in Edo State (500MW), Gbarain/Ubie in Bayelsa State (250MW), Ikot Abasi in

Akwa Ibom State (300MW), Sapele in Delta State (500MW), Omoku- Rivers State (250MW). [25]

However, corruption and bureaucratic bottleneck have led to the suspension of the project, after it was discovered that the sum of $16b has been misappropriated by the contractors and their politician-friends, without any commensurate work. The on-going probe by the House of Representatives would determine whether the projects would eventually go on or not.

Conclusions

In conclusion, it should be noted that there is no way the energy/electricity poverty in Nigeria can be alleviated without a deliberate effort on the part of the government to exploit enormous renewable resources available to the country. Previous effort of the government to exploit fossil fuel and hydro power resources to address the energy crisis has failed. This is pointing to the fact that the government out to take their attention away from generating electricity using fossil fuel and focus on renewable energy resources. Renewables present a unique opportunity to generate energy in places where they are needed. They can be set up in small unit and therefore suitable for community ownership and management. In this way, hey have the potential to create job opportunities in local communities.

Mainstreaming energy sovereignty is pivotal in addressing this crisis. Communities should play active part in production and use of energy in s sustainable manner. This would necessarily have to be from discrete community units of production from solar, wind and similar sources. Renewable energy technologies have the ability give self reliance to local communities, where they can utilize the excellent renewable energy resources available for their own good. It will allow local people to have control over their energy resources and determine the type of energy to use for their daily needs. In Africa, this issue of energy sovereignty needs to be scaled up. Renewable energy can also help to limit the insecurity in terms of supply of energy and promote access to more vulnerable populations. We therefore advocate that renewable energy should be integrated into local development plan .

Ultimately, elimination of the curse of electricity in Nigeria goes beyond the provision of adequate and reliable electricity to end-users. It must also include giving consumers widely accessible, affordable and environmentally friendly electricity service.

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Bako Matazu (Standing)

Ahmed Yahaya (Standing)

Habiba Ali presenting the "Save 80”

L-R: Etiosa, Agharese and Ose (CREDC Team)

Osayande (Standing)

Participants listening

SECOND DISCUSSION SESSION

Question: *There are some communities that do not have metal or steel pot. I do not know if you have tried using earthen pots as an alternative on the Save 80*

Answer: *There is a project going on presently on this.*

Comment: *We should diversify on the way we generate energy. We should make use of the resources available at the community to generate energy for the community. We should operate a decentralized energy system. In places like the Niger Delta, where it is expensive to erect pylons across rivers and marsh land, a decentralized system will be most appropriate.*

The participant discussed extensively the propose network. It was agreed by consensus that the network be called Renewable Energy and Energy Efficiency Network (REEEN). REEEN will promote renewable energy and energy efficiency in Nigeria.

Vote of Thanks

Agharese Edevbaro, the Programme Manager of CREDC gave the vote of thanks of behalf of CREDC.

Appendix One: Communiqué

Communiqué Issued at the National Dialogue to Promoting Renewable Energy and Energy Efficiency in Nigeria Organized by the Community Research and Development Centre (CREDC) at Parkview Hotels Abuja 10 - 11 November 2008

Preamble

A National Dialogue to Promote Renewable Energy and Energy Efficiency in Nigeria was organized by the Community Research and Development Centre (CREDC). The conference received financial support from the Global Greengrants Fund (GGF) and the Environmental Rights Action/Friends of the Earth Nigeria (ERA/FoEN). The conference took place on the 10 – 11 November 2008 at the Parkview Hotels, Abuja. The event attracted 50 participants from different parts of Nigeria. The Special Guest of Honour was the Honorable Minister of the Federal Ministry of Environment, Housing and Urban Development ably represented by Dr. Victor Fodeke, Head of Special Climate Change Unit who delivered the Keynote address.

Participants in the conference were representatives of civil society organizations, NGOs, religious organizations, academic institutions, the private sector, government and the media. The conference featured paper presentations, exhibitions, discussions, resolutions and the development of a roadmap to integrate energy efficiency into Nigeria's policy framework.

Conference Objectives

The conference had the following objectives:

- Enhance stakeholders' capacity to advocate for energy efficiency and promote renewable energy technologies.
- To create awareness on the concept of energy efficiency.
- To develop strategies to integrate energy efficiency policy into Nigeria's policy framework.

Conference Outcomes

The following were achieved at the end of the conference:

- Awareness creation on the concept of energy efficiency among policy makers and other stakeholders
- Development of a road map to integrate energy efficiency policy into Nigeria's policy framework
- Development of strategies to promote the concept of energy efficiency and renewable energy technologies at the institutional, local, state and national levels
- Development of a network named Renewable Energy and Energy Efficiency Network (REEEN) that will promote renewable energy and energy efficiency in Nigeria.
- Development of partnership with government to achieve the goals and outcomes of the conference.

Observations

The participants at the National Dialogue to Promote Renewable Energy and Energy Efficiency in Nigeria observed that:

- Nigerian policy has underestimated the importance and gains of energy efficiency on the environment and economic development.
- The Nigerian government has given so much attention to energy generation and distribution with little or no attention given to the efficient use of the energy generated.
- Nigeria can save over 50% of the energy we spend for lighting if we use energy efficiency light bulbs.
- The obstacles to the development of energy efficiency in Nigeria are lack of awareness; lack of energy efficiency policy; inappropriate energy pricing and cost subsidies; lack of trained staff, operators and maintenance workers; lack of capital and importation of used machines and vehicles; proliferation of inefficient equipment and desire to minimize initial cost; and low income.
- The efficient use of energy will help to minimize the building of new power stations and thus free up capital for other investments like health and welfare and reduce electricity bills.
- The efficient use of energy will leave more energy available to extend energy supply to all parts of the population.
- Energy efficiency will increase the efficiency and resilience of the economy – including reduced reliance on oil and thus improve balance of payments.
- Energy efficiency will reduce the negative environmental and human health impacts from energy production and use and increase employment through interventions in the industry, housing, transportation etc.
- The inefficient use of biomass to generate energy is contributing to the emission of greenhouse gases and leading to high rate of deforestation and desert encroachment in Nigeria.
- Energy efficiency is one of the main drivers of sustainable development worldwide.
- The importation of used and inefficient vehicles into Nigeria is contributing to inefficient use of fuel.
- Energy saving of up to 30% can be achieved by shifting from energy-intensive transport to a less energy-intensive transport and by adopting traffic management schemes.
- The demand for gasoline and diesel could be cut by 30% by emphasizing public transportation over private transportation and putting in place good road networks that enhance the smooth flow of vehicular movement.
- Nigeria is not benefiting from the CDM.
- Nigeria is blessed with abundant renewable energy sources which are being under utilized

Resolutions

It was thus resolved by the participants that:

- Government should partner with the civil society and other stakeholders to develop policies on energy efficiency and integrate them into current energy policy
- The government should partner with civil society organizations and other stakeholders to implement energy efficiency policy in Nigeria.
- There is need for NGOs/government/civil society/media partnership to create awareness on the concept of energy efficiency in Nigeria.
- NGOs and relevant stakeholders should carry out pilot projects to enhance the awareness creation process.
- Government and organizers of trade fairs around the country should create renewable energy and energy efficiency stands during trade fairs.
- NGO and civil society groups should partner with Power Holding Company of Nigeria (PHCN) and the Ministry of Environment and Urban Development to promote energy efficiency.
- Policy should be made to ban the importation and manufacturing of incandescent bulbs and encourage the use of energy saving light bulbs such as compact fluorescent lamps (CFLs).
- Government should encourage the use of public transportation over private transportation.
- Government should develop efficient transport schemes to enhance the efficient use of fuel thus reducing the emission of greenhouse gases.
- Government, NGOs and relevant stakeholders to embark on one-on-one awareness creation on energy saving tips.
- Stakeholders should target religious organizations to educate them on renewable energy and energy efficiency.
- The legislative arm of government should make laws to back up energy efficiency policy.
- Multinational companies should deemphasize on activities that are environmentally unfriendly and use technologies that are energy efficient.
- Government and relevant stakeholders should integrate energy efficiency courses into school curriculum in Nigeria.
- Civil society organizations should develop strategies to mainstream energy efficiency and renewable energy into manifestos of political parties in Nigeria
- Government should establish agency to promote the use of energy efficiency products and ensure energy efficiency practices
- Government should develop appropriate drivers for the implementation of energy efficiency policy
- Government should commit more funds to the development of renewable energy technologies to provide electricity for many Nigerians that do not have access to electricity especially those in the rural areas.

The participants then called on the Nigerian government, NGOs, international partners and the private sector to support the implementation of the resolutions made during the conference and support the implementation of the roadmap developed by the participants to integrate energy efficiency policy into Nigeria's policy framework.

The 50 participants of the conference then organized themselves into a network which was unanimously named the Renewable Energy and Energy Efficiency Network (REEEN). The mandate of REEEN is to promote renewable energy and energy efficiency in Nigeria. The network will be coordinated by the organizers of the conference.

Signed:
Etiosa Uyigue – *Chairman*
Surveyor Efik – *Secretary*
Ms. Agharese Edevbaro – *Member*
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