POLICY, LEGISLATIVE AND REGULATORY CHALLENGES IN PROMOTING EFFICIENT AND RENEWABLE ENERGY FOR SUSTAINABLE DEVELOPMENT AND CLIMATE CHANGE MITIGATION IN NIGERIA

BY

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INTRODUCTION

Nigeria's indigenous energy resource development reveals that the country's oil reserves (6th largest in the world) were put at 34 billion barrels for 2004 and 40 billion barrels by 2010, giving an effective growth rate of 2.746% per annum. At this growth rate, the reserves will reach 68.7 billion barrels by 2030, or double the 2004 value. Intense exploration activities are taking place in the off-shore fields from the Niger Delta, while the potentials of the inland Benue and Chad Basins are yet to be exploited. By 2000, 53.5% of natural gas reserves of 159 trillion *sq. cubic ft* (9th largest in the world) were associated gas. While the associated gas reserves will increase with oil reserves, there will be increasing activities in exploration for gas only. Corresponding substantial endowments of bitumen (31 billion barrels of oil equivalent and 2nd largest in the world), coal, hydropower and solar energy, as well as plans for their development, exist.

INTRODUCTION (Cont'd)

This paper therefore contends that while much has been written about the science, technology and policies for promoting energy efficiency and renewable energy, little has been written about the legislative and regulatory options necessary to implement these technologies and policies that make a reality in practice. By promoting clean and efficient energy use at the legislative and regulatory levels, governments can ensure that all stakeholders have the opportunity and incentive to adopt new practices that will help to mitigate climate change and reduce pollution while keeping the path of economic and social development.

It is against this background that this paper seeks to realize the following objectives: -

1. To underscore the importance of efficient and renewable energy to produce electricity for the mitigation of climate change and sustainable development in Nigeria;
2. To provide an overview of the policy, legislative and regulatory measures available to promote energy efficiency and renewable energy in Nigeria;
3. To highlight the challenges and strategies to overcome the barriers to use and regulation of renewable and efficient energy for electricity in Nigeria.

PART ONE: - THE IMPORTANCE OF EFFICIENT AND RENEWABLE ENERGY TO PRODUCE ELECTRICITY FOR THE MITIGATION OF CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT IN NIGERIA

For Nigerians, the quest for uninterrupted electric power supply has been a long story of dashed hopes and expectations. Despite the promises by successive administrations in the country to accord priority to the provision of efficient and renewable energy to produce adequate electricity for sustainable development, Nigerians have continued to experience epileptic electric power supply for their different needs.

1.2 Energy Needs for Different Economic Activities in Rural Areas of Nigeria

The basic needs of the poor, rural inclusive are jobs, food, health services, education, housing, clean water and sanitation. Energy plays an important role in ensuring these services. The more accessible it is, the higher the consumption by human beings, the poor inclusive.

Energy Needs for Different Economic Activities in Rural Areas of Nigeria (Cont'd)

The end-use energy requirements for different economic activities in the rural areas are given in table 1 below:

Table 1: - Economic Activities & Energy requirements in the Rural Areas

S/N	ACTIVITY	USE	KW
1.	Agro-Processing	Flour grinding Oil expelling Crop drying Threshing	1-2 2-5 - -
2.	Small-Scale Industry	Saw-milling Wool and Cotton Processing Stone Crushing	10-30 5-25 5-25
3.	Household	Lighting Refrigeration Cooking Water-pumping Ironing Radio/TV	0.2 0.3 0.4 (heat storage cooker) 0.5-1 0.5 0.1-0.3

Energy Needs for Different Economic Activities in Rural Areas of Nigeria (Cont'd)

The urban poor also are dependent on small-scale manufacturing and repair services for income. Fuelwood is still mainly used for small-scale production of bread and other products, thereby increasing the problem of environmental pollution. However, some of these enterprises may become increasingly sustainable and economical if modern energy services are used. The use of modern energy services would improve the quality of life and livelihoods and increase potentials for income generating activities.

Table 2 below reveals the National Energy Consumption pattern as reported by a recent National Energy Study for the industrialization of Nigeria (2006-2030) which took into consideration the thinking of government in terms of the overall economy and the energy sector.

Energy Needs for Different Economic Activities in Rural Areas of Nigeria (Cont'd)

Table 2: - Summary of National Energy Consumption Computations for the Household Sector

Fraction of households with A/C	10.71%				
Fraction of households with Water Heater	7.14%				
	(Gas)LPG	**Kerosene**	**Coal**	**Fuelwood**	**Electricity**
% HH Using an Energy Type for Cooking	12.50%	76.79%	1.79%	67.86%	7.14%
% HH Using an Energy Type for Water Heating	8.93%	67.86%	0	66.07%	25.00%
% HH Using an Energy Type for Lighting	0	87.50%	0	0	42.86%
Ave Annual Energy Cons. Per HH					
For cooking (Unit/household)	22.06	34.79		2275.75	21.27
For water heating (Unit/Household)	3.47	7.86		785.61	132.66
For Lighting (Kg/Household)	0	52.7		0	291.75
National consumption per yr					
For cooking (Unit*)	$1.65x10^8$	$6.59x10^8$		$4.31x10^{10}$	$4.03x10^9$
For water heating (Unit*)	$2.60x10^7$	$1.49x10^8$		$1.49x10^{10}$	$2.51x10^9$
For Lighting (Unit*)		$9.98x10^8$		0	$5.53x10^9$
For A/C (Unit*)					$2.20x10^9$
For Appliances (Unit*)					$2.90x10^9$
Total (Unit*)	$1.91x10^8$	$1.81x10^9$	$2.03x10^7$	$5.80x10^{10}$	$1.35x10^{10}$
National Consumption (TOE)					
For Cooking (TOE)	178.63	548217.3		$1.40x10^{10}$	89811.29
For Water Heating (TOE)	28.09	123860.2		$4.83x10^9$	560033.5
For Lighting (TOE)		830358.9		0	1231697
For A/C (TOE)		0		0	490974.6
For Appliances (TOE)					645586.2
Total (TOE)	**206.72**	**1502437**		**$1.88x10^{10}$**	**3018102**

1.3 Implications of Climate Change for the Energy and Industrial Sectors of Nigeria.

Climate change, and more specifically the carbon emissions from energy production and use, is one of the most troubling problems facing society today. Climate change engages the energy sector particularly closely because energy is central both to the problem and to its solution.

Hydropower generation is the energy source most likely to be affected by climate change. It is sensitive to the amount, timing, and geographical pattern of precipitation, as well as temperature. There is the potential for more intense rainfall events (which would require more conservative water storage strategies to prevent flood damage), greater probability of drought (less hydroelectric production), and less precipitation (less water available during warm months); all of which point to less hydroelectric capacity at current powerhouses.

Two categories of industries were identified as being vulnerable to climate change: (1) industries with activities that are dependent on climate (construction, transportation operations and infrastructure, energy transportation and transmission, offshore oil and gas production, thermal power generation, industries, such as paper mills, that depend heavily on water, pollution control, coastal-sited industry, and tourism and recreation), and (2) sectors in which economic activity is dependent on climate-sensitive resources (agro-industry, biomass and other renewable energy production).

Brief Overview of Rural Applications of Efficiency and Renewable Energy

Due to a lack of access to modern electricity, rural populations resort to burning large quantities of wood to satisfy their everyday energy needs. For example, much of the cooking in developing countries is done on wood or coal burning stoves. Use of wood requires women and children to spend much of their time and energy collecting firewood. Using either wood or coal for cooking in enclosed buildings exposes occupants, particularly women and children, to very concentrated health-damaging emissions and contributes considerably to carbon dioxide and other pollutant emissions. Wood burning also causes other severe harm to the environment, including rapid deforestation, followed by irreversible biodiversity loss.

Brief Overview of Rural Applications of Efficiency and Renewable Energy (Cont'd)

Other alternatives to wood burning for cooking, for example, include:

- Fuel-efficient stoves that reduce wood and coal consumption and polluting emissions.
- Hybrid fuels that incorporate biomass waste and reduce the harmful effects of coal burning.
- Biogas units that yield gas from waste agricultural materials and improve sanitation while providing fuel for cooking and lighting.
- Use of Improved building materials and passive solar construction that reduce heating needs.
- Micro-hydropower and other renewable energy generators that provide clean electricity to rural off-grid communities.

Nigerian Initiatives in Climate Change Mitigation Measures/Efficient and Renewable Energy Technologies.

a. Climate Change Mitigation Measures.

National inventories to estimate the annual emissions of greenhouse gases have been undertaken in Nigeria for three years (1988, 1990 and 1994) and reviewed between 2001-2004, using frameworks provided by the IPCC and other agencies. An emissions profile by sector indicates that CO (carbon dioxide) emissions has been dominated by the energy sector (for which gas-flaring, electricity generation and transport sectors are most significant sources), and land-use change (with biomass harvests and forest conversion to managed lands as principal sources, while annual forest growth remains the principal sink or source of carbon removals).

The actual results of the analysis of emissions inventories collected (Table 3) indicate that between 1988 and 1994, the gross annual emissions were in the range of 178 to 192 Tg-CO, 2.7 to 5.9 Tg-CH , 11.95 to 18.55 Gg N O, 13.3 to 17.0 Tg CO, 404.3 to 658.3 Gg NO and to 1.0 to 2.2 Tg NMVOC.

Inventories by sector have been additionally undertaken in some industrial sub-sectors, including agriculture. Results (in Table 3 below) indicate that the energy sector still dominates the other sectors in its contribution to gross national emissions.

Climate Change Mitigation Measures (Cont'd)

Table 3: - Summary of National Emissions in Nigeria Between 1988 and 1994

		GROSS EMISSIONS				
SECTOR	YEAR	CO_2	CH_4	N_2O	NO_x	NMVOC
Energy	1988 1990 1994	70311 99514 115109	272.3 567.7 1463.0	6.8 5.8 7.5	886.5 264.3 499.3	1511.6 887.4 1864.4
Process Industries	1988 1990 1994	1970 2171 1761	0.1 9.6 0.1	0.0	5.8 0.5 0.5	78.2 134.6 366.8
Solvent Use	1988 1990 1994	0 260	0.0 0.1	0.0	0.0 0.5	40.8 0.0
Agriculture	1988 1990 1994	0	506.7 1711.0 2344.2	0.0 12.6 4.1	0.0 134.9 148.0	0.0
LUCF	1988 1990 1994	1040 76040 75542	159.2 18.5 18.5	1.0 0.1 0.1	18.1 4.6 4.6	4011.8
Waste Management	1988 1990 1994	0 1761	201.2 425.7 0.1	0.0 0.0	4.0 0.1 0.5	11.9 458.7
Total	1988 1990 1994	73300 177730 192485	1165.0 2733.0 5930.7	7.9 18.6 12.0	930.3 404.4 658.3	5698.0 1022.0 2231.5

Climate Change Mitigation Measures (Cont'd)

Table 4 : - Sectoral and Gross Carbon Dioxide-Equivalent Emissions for the years 1988 to 1994

CO_2 -EQUIVALENT EMISSIONS (Gg)					
SECTOR	YEAR	Co_2 GWP=1	Ch_4 GWP=21	N_2O GWP=270	TOTAL
Energy	1988 1990 1994	70311 99514 115109	5719 11922 30723	1847 1569 2030	77877 113004 147862
Process Industries	1988 1990 1994	1970 2171 1761	1 202 1	0 0 0	1971 2373 1762
Solvent Use	1988 1990 1994	0 260	 1	 0	 261
Agriculture	1988 1990 1994	0 0 0	10641 35931 49228	0 3402 1107	10641 39333 50335
LUCF	1988 1990 1994	1040 76040 75542	3343 389 389	270 35 35	4653 76464 75966
Waste Management	1988 1990 1994	0 1761	4225 8940 1	0 35 0	4225 8942 11762
Total	1988 1990 1994	73300 177730 192485	24465 57393 124545	2144 5009 3227	99909 240132 320256

It is recognized that currently available data have serious gaps and limitations.

b) Initiatives in Efficient and Renewable Energy Technologies

Modern and efficient technologies have been used to develop and adopt devices for the utilization of renewable energy resources by the following Research Centres of the Energy Commission of Nigeria:

a) **Center for Energy Research and Development, Obafemi Awolowo University, Ile-ife, Osun State;**

b) **Centre for Energy Research and Training, Ahmadu Bello University, Zaria, Kaduna State;**

c) **National Centre for Energy Research and Development, University of Nigeria, Nsukka, Enugu State;**

d) **Sokoto Energy Research Center, Usman Dan-Fodio University, Sokoto, Sokoto State.**

Initiatives in Efficient and Renewable Energy Technologies (Cont'd)

The Centres at Ile-Ife and Zaria work on peaceful application of Nuclear Science and Technology while those at Nsukka and Sokoto work on solar energy and other renewable energy sources.

Raw materials used for some of these devices have more than 90% local contents. Some of these appliances include:

- Solar Crop Dryers (such as the 2 tonne capacity Rice Solar Dryer at Agbani, Enugu State and 2 tonne capacity Forage Solar Dryer at National Agricultural Production Research Institute, Ahmadu Bello University, Zaria, Kaduna State), which can be used to process agricultural products such as rice, maize, pepper, tomatoes, cocoa, tea, and coffee;
- Solar Water Heaters for providing hot water in hotels and hospitals for bathing and washing, such the 1000 litre capacity Solar Water Heater at the maternity ward of Usman Dan-Fodio University Teaching Hospital, Sokoto, Sokoto State;
- Solar PV Water Pumping for clean potable water, such as the 7.2k Wp Solar PV Plant at Kwalkwalama in Sokoto, the 2.85kWp Solar PV Plant at the centre for mentally-ill Destitutes at Itumbuzo in Abia State and the 5.00kWp Solar PV Plant at Comprehensive Health Centre in Laje, Ondo State;

Initiatives in Efficient and Renewable Energy Technologies (Cont'd)

- Biogas Plants for cooking gas and bio-fertilizer, such as the 20m^3 Biodigester at Ifelodun Cooperative Farm at Agege, Lagos State, the 10m^3 biogas plant at Achara in Enugu State and the 30m^3 biogas plant at Zaria Prison in Kaduna State; and 5kWp wind power plant at Sayya Gidan Gada in Sokoto State;
- The Energy Commission of Nigeria, the Power Holding Cooperation of Nigeria and MTN-Nigeria are collaborating with the World Bank on a bio-fuel for rural electrification project in Nigeria. The bio-fuel is to be sourced from Jatropha Plant or any economically viable energy crop on a long term basis. Similarly, the Energy Commission of Nigeria signed another MOU with Green Shield of Nigeria (a registered NGO with diversed interest in alternative energy sources etc) to produce bio-diesel as a renewable energy for domestic and commercial uses in Nigeria, using Jatropha plant;

2.1 Policy Goals for Efficiency and Renewable Energy Decision-Making

What policy goals can guide rural applications of efficiency and renewable energy decision-making in developing countries?

Policy Goals for Efficiency and Renewable Energy Decision-Making (Cont'd)

While there is no single logarithm for determining universally applicable policy goals that can guide rural applications of efficiency and renewable energy decision-making, the policy goals, however they are couched, can amongst others stress the need to:

- Promote rural applications of efficiency and renewable energy in all its ramifications;
- Maintain fair, just and reasonable rates for rural electricity consumption;
- Ensure uninterrupted electricity to rural areas;
- Promote rural energy efficiency;
- Promote technological innovations and transfer of renewable energy technologies to rural communities (and to the people who would directly benefit from their use);
- Facilitate and encourage effective competition, education, training and public participation;
- Improve people's lives and livelihoods;
- Meet goals of sustainable development, including obligations and norms per multilateral environmental agreements such as those for greenhouse gas emissions reductions.

2.2 National Electric Power Policy, 2001

The overwhelming objective of the Electric power policy Statement is to ensure that Nigeria has an ESI (electricity supply industry) that can meet the needs of its citizens in the 21st Century. This will require a fundamental reform at all levels of the Industry. A technically and commercially efficient ESI is critical for achieving Nigeria's growth and development goals.

The priority is to create efficient market structures, within clear regulatory frameworks, that encourage more competitive markets for electricity generation and sales (marketing), which at the same time, are able to attract private investors and ensure economically sound development of the system. This will ensure that, the demand in an efficient and economically viable manner. The policy objectives are divided into the short-to-medium term (3-5 years) and the long-term (to commence beyond 5 years).

2.3 Nigerian Electricity Regulatory Commission

A privatized electricity industry, with competition over monopoly transmission and distribution grids, requires an effective regulatory agency that is independent both of Government and of all the companies operating in the industry. The Ministry of Energy is responsible for providing in a new Electricity Law for an independent regulatory body that:

- has clear appointment and dismissal rules;
- has a source of independent funding; and
- faces appropriate checks and balances to ensure that regulation not only operates in a fair transparent way but is also seen to operate in a fair and transparent way.

Nigerian Electricity Regulatory Commission (Cont'd)

Hence, an independent regulatory agency for electricity in the form of a Regulatory Commission shall be called the Nigerian Electricity Regulatory Commission (NERC), based on the following regulatory arrangements among others.

- NERC will be an independent Federal agency and electricity regulator for grid connected services;
- NERC will have decision making powers on the key aspects technical and economic regulation (viz: tariff regulation, approval of capacity expansion plans and regulated company business plans, oversight of capacity, tending, competition, standards, quality of service, service obligation etc);

The objective of this policy is ultimately to establish a log-term electricity market structure in Nigeria in which multiple operators provide services on a competitive basis to the broadest range of customers. Under such a regime, competitive market forces would be the best determinant of the appropriate and sustainable levels of prices charges by various carriers for their services.

Nigerian Electricity Regulatory Commission (Cont'd)

The Nigerian electricity fuel mix will, of course, continue to use and expand the use of hydro generation, renewable and will continue to use some liquid fuels. Nevertheless, natural gas (and the use of currently flared associated gas) represents the major likely fuel for the future expansion of generation. In addition, gas powered electricity generation is the most obvious growth market for the commercial development of gas markets and will be explored by the Independent Power Projects (IPPs).

2.4 National Energy Policy, 2003

The policy objectives and implementation strategies have been carefully defined with the fundamental guiding premises that energy is crucial to national development goals, and that government has a prime role in meeting the energy challenges facing the nation. Furthermore, the dependence on oil can be reduced through the diversification of the nation's energy resources, aggressive research, development and demonstration (R,D & D), human resources development, etc. Consequently the overall energy policy objectives may be summarized as follows:

- To ensure the development of the nation's energy resources, with diversified energy resource options, for the achievement of national energy security and an energy delivery system with an optimal energy resource mix.
- To guarantee increased contribution of the energy sector to national income and to productive activities.
- To guarantee adequate, sustainable and reliable supply of energy at appropriate costs and in an environmentally friendly manner, to the various sectors of the economy, for national development.

National Energy Policy, 2003 (Cont'd)

- To guarantee an efficient and cost effective consumption pattern of energy resources.
- To accelerate the process of acquisition and diffussion of technology and managerial expertise in the energy sector and indigenous participation in energy sector industries, for stability and self-reliance.
- To promote increased investments and development of the energy sector industries with private sector participation.
- To foster international co-operation in energy trade and projects development in both African region and the world at large.
- To successfully use the nation's abundant energy resources to promote international co-operation.
- To ensure a comprehensive, integrated and well informed energy sector plans and programmes for effective development.

National Energy Policy, 2003 (Cont'd)

The Energy policy further recognizes the fact that a substantial percentage of Nigeria's urban poor and rural populace depend on fuelwood for cooking and other domestic uses.

The rate of consumption of fuelwood far exceeds the replenishing rate to such an extent that desert encroachment is now a serious problem in the country. Also associated with this is soil erosion and loss of soil fertility.

National Energy Policy, 2003 (Cont'd)

Hence the policy states that: -

- The nation shall promote the use of alternative energy sources to fuelwood.
- The use of wood as a fuel shall be de-emphasized in the nation's energy mix.
- The nation shall intensify efforts to increase the percentage of land mass covered by forests in the country. This is with a view to realizing the following objectives: -
- To conserve the forest resources of the nation.
- To greatly reduce the percentage contribution of fuelwood consumption in the domestic, agricultural and industrial sectors of the economy.
- To arrest the ecological problems of desert encroachment and deforestation.
- To facilitate the use of alternative energy resources to fuelwood.

2.5 Nigeria Policy Goals: Renewable and Efficient Energy/Rural Electrification

In Nigeria, there is no national policy dedicated specifically to energy efficiency and renewable energy or its applications to rural areas. There are, however, other policy instruments on the environment and energy that may be relevant to supporting such applications. The Nigerian National Policy on the Environment provides that the goal of the Policy on the Environment is to achieve sustainable development in Nigeria, and in particular to:

- Secure a quality of environment adequate for good health and well being;
- Conserve and use the environment and natural resources for the benefit of present and future generations;

Nigeria Policy Goals: Renewable and Efficient Energy/Rural Electrification (Cont'd)

Strategies to achieve this objective include:

- Implementing a detailed Environmental Impact Assessment (EIA) on all planned energy projects backed by a detailed baseline ecological data against which subsequent environmental changes and/or impacts can be measured;
- Developing a rational National Energy Utilization Master-Plan that balances the need for conservation with the utilization of premium energy resources for premium socio-economic needs;
- Encouraging the use of energy forms that are environmentally safe and sustainable, particularly solar energy;
- Promoting and encouraging research for the development and use of various locally available energy sources especially non-conventional resources such as geothermal, solar, wind and other complex forms of hydrocarbons other than oil and coal.

Nigeria Policy Goals: Renewable and Efficient Energy/Rural Electrification (Cont'd)

One of the most important objectives of the National Electric Power Policy adopted by the Electric Power Sector Reform Implementation Committee and approved by the National Council on Privatization is to ensure that Nigeria has an electricity supply industry that can meet the needs of its citizens in the 21st Century. On rural electrification, the primary policy objective is to expand access as rapidly as can be afforded in a cost-effective manner.

The rural electrification policy includes a full menu of options – grid and off-grid, mini-grid, non thermal and renewables, while ensuring close co-ordination of rural electrification expansion with economic development objectives and encouraging states, local communities as well as the private sector to develop and contribute financially to rural electrification.

Nigeria Policy Goals: Renewable and Efficient Energy/Rural Electrification (Cont'd)

It is imperative to state that the vision and mission of the Rural Electrification Agency (REA) which places so much emphasis on "private sector driven investment" "reasonable returns on investment" "appropriate tariff" and without a reference to the contribution of communities will defeat the obvious ends of rural electrification which in most instances can not be commercially and financially reward driven. The need for government subsidy or fiscal mechanism to guarantee access to electricity for rural dwellers, where the "return on investment" cannot motivate the private sector, needs to be emphasized in the conceptualizations of REA.

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

What legislative measures can best advance rural applications of energy efficiency and renewable energy in developing countries?

In most jurisdictions, a principal law of the power sector usually establishes an electricity regulatory board or other regulatory agencies with powers to process and recommend applications for licenses, set, review and adjust transmission and distribution tariffs, enforce environmental and safety regulations, investigate complaints, ensure there is competition and approve power purchase contracts and transmission and distribution contracts. The provisions are usually broad and permissive, with the enactment of subsidiary legislation or regulations to deal with specific aspects of electricity regulation. Since the bulk of regulatory matters are usually addressed through subsidiary legislation or regulations in order to maintain a fair degree of flexibility in dealing with ever-changing and fluid power sector needs, an opportunity exist for regulating off-grid electrification in rural areas not easily accessible by the grid network. Additionally, other statutes may complement the electric power legislation in the regulation of the power sub-sector by paying specific attention to rural applications of efficiency and renewable energy.

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Cont'd)

Regulatory institutions can either promote or defeat the goals of regulatory policy captured in legislation or regulations. Every regulatory institution needs at least to have:

- A clearly defined organizational structure;
- A hierarchical relationship within its structure;
- Sufficient qualified staffing and financing;
- Strategic policy goals;
- Internal and external reporting requirements;
- Licensing provisions; and
- Consultation, hearing and expeditious approval processes.

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Cont'd)

The legislative and regulatory provisions for promotion and regulation of energy efficiency and renewable energy are addressed below for Nigeria, as typical of a developing country.

The 1999 Constitution of Nigeria provides the legal basis for off-grid electrification in rural areas falling within each state of the federation in the form of renewable energy by empowering the House of Assembly of each state to establish electric power stations within their respective states, generate and transmit and distribute electricity to areas not covered by the national grid system within that state amongst others.

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Cont'd)

The Nigerian Electricity Act of 1988 is stated to be "An Act to provide for the regulation and control of electricity installations, and of the generation, supply and use of electricity energy." Every undertaking in the development of the sub-sector must comply with this Act. Section 2 provides as follows:

> "This Act and the regulation made there under shall apply in respect of any undertaking for the manufacturing, distribution or supply of electricity established by the Government of a State or any of its agencies to the same extent as the Act and regulations apply in respect of any such undertaking established by any other person or authority."

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Cont'd)

The Electric Power Sector Reform Act (EPSRA) was enacted into law in March 2005 to consolidate and give legal backing to the reforms being undertaken in the sector. So far, the agencies expected to be set up under it to drive the reform process such as the Nigerian Electricity Regulatory Commission (NERC) and the Rural Electrification Agency (REA) have been functioning since May 2005 and March 2006, respectively. Also in line with the Act, the National Electric Power Authority (NEPA) ceased to exist and in its place emerged the Power Holding Company of Nigeria (PHCN). NERC has stated its rulemaking and regulatory functions.

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Cont'd)

The 2005 Act was aimed at deregulating the power sector, developing the capacity to transmit and distribute the envisaged higher level of generation. This involved a complete unbundling of the National Electric Power Authority into 18 other independent bodies. The federal government had hoped to generate 10,000 megawatts by December 2007, a figure that many people though was too low for a population of 140 million. But even this low figure has not been achieved.

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Cont'd)

With respect to hydroelectric power, the Water Resources Act governs water resources development in Nigeria. This Act establishes the legal framework for the development of water resources. It places ultimate responsibility for the proper development of the nation's water resources on the Ministry of Water Resources and Rural Development. The Act vests rights to the use and control of water resources in the state. This does not preclude the rights of individuals to take and use water for domestic or industrial purposes including the generation of hydropower. Nevertheless, a license is required for any person to operate any hydraulic work on the waterways or underground. The mode of application is spelled out under Section 10 of the Act that requires an application for the grant of a license to carry out hydraulic works to be made to the Secretary in such form and manner and containing or be accompanied by such information and document as the Secretary may from time to time prescribe.

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Cont'd)

Bio-fuels in the forms of wood, charcoal, and biomass constitute at least 70% of the energy consumed all over Nigeria. The demand for wood fuels, for example, is expected to rise by about 350% by 2030 and beyond, while urban consumption is expected to grow by 250% within the same period. The requirement for an environmental impact assessment in respect of any project embarked upon by any private or public authority with likely environmental impact under the Environmental Impact Assessment Act No. 86 1992 all combine to reduce the trend towards massive deforestation in Nigeria.

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Cont'd)

Other renewable energy resources that could in principle meet almost all Nigeria's needs, such as solar power, wind power, geothermal energy and wave power are not given any specific regulatory prominence. Nevertheless, the Energy Commission of Nigeria Act established the Energy Commission of Nigeria and charged it with responsibility for coordinating and general surveillance over systematic development of the various energy resources of Nigeria including new and renewable energy sources. The Jigawa Alternative Energy Trust fund, with the United States Department of Energy is constructing a solar electric project in Jigawa State. The project is a result of a $600,000 solar rural electrification and water-pumping project for 3 villages in Jigawa State.

In Nigeria, the regulatory institution specific to efficiency and renewable energy is the Energy Commission of Nigeria (ECN), which was established by the ECN Act No. 109, Laws of the Federation of Nigeria (LFN) 2004, as the agency responsible for the co-ordination and general surveillance over the systematic development of energy resources of Nigeria.

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Cont'd)

The National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, 2007 Act No. 25, provides under section 2 that the agency, shall, subject to the provisions of this Act, have responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general and environmental technology including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines.

Under section 3(1) of the NESREA Act 2007 the Agency shall:

- Enforce compliance with the provisions of international agreements, protocols, conventions and treaties on the environment, including climate change, biodiversity, conservation, desertification, forestry, oil and gas, chemicals, hazardous wastes, ozone depletion, marine and wild life, pollution, sanitation and such other environmental agreements as may from time to time come into force;

LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (Cont'd)

Although, existing legislations in Nigeria are skewed towards fossil fuels and secondarily hydro-power, there is recognition that an appropriate legal framework is a prerequisite for maximizing investment opportunities in the renewable energy sector. A Nigerian National Energy Policy similar to that of the White Paper on the Energy Policy of the Republic of South Africa in December 1998 will better articulate the framework for rural applications of efficiency and renewable energy.

PART THREE: - CHALLENGES AND STRATEGIES TO OVERCOME THE BARRIERS TO CLIMATE CHANGE MITIGATION/USE AND REGULATION OF RENEWABLE AND EFFICIENT ENERGY FOR ELECTRICITY IN NIGERIA

3.1 Challenges and Barriers to Climate Change Mitigation in Nigeria

Substantial data gaps exist in the database for both the emissions inventories and mitigation analyses considered above. For instance, in the downstream energy sector, data is obtained from the Nigerian National Petroleum Corporation (NNPC) Annual Reports and National Bureau of Statistics (NBS) Annual Abstracts of Statistics, while other reports provide annual data on petroleum products consumption by the whole country, and for each state of the federation. These reports are lacking on sectoral energy consumption, which are necessary inputs to emissions inventories.

Challenges and Barriers to Climate Change Mitigation in Nigeria (Cont'd)

Similar gaps in the database were observed in all other emissions-relevant sectors such as the upstream energy sector, industries, agriculture, land-use change and wastes management. The back-up statistics, which could have made the estimation of petroleum products consumption in the downstream sectors possible, are also currently weak. For instance, there are no statistics on the total vehicles in Nigeria from year to year. The data published annually is the annual new vehicle registrations.

Challenges and Barriers to Climate Change Mitigation in Nigeria (Cont'd)

A number of barriers to implementing and/or improving future national mitigation analysis identified in both the energy and forestry sectors include:

- low literacy level;
- lack of/low level of awareness of the mitigation technologies and their potential benefits;
- inefficient energy use;
- inappropriate energy pricing;
- financial constraints;
- low income-level;
- technological incapability; and
- pressures from population growth.

3.2 Challenges and Barriers to Renewable and Alternative Electricity Sources in Nigeria

3.2.1 Renewable Electricity

In accordance with the provision of EPSRA Act 2005, it is expected that targets on access to electricity will be met through grid based extension, independent mini-grids for remote areas with concentrated loads where grid service is not economical or will take many years to come and stand alone renewable electricity systems for remote areas with scattered small loads. The interest here is on renewable energy which is defined to include energy from solar, wind, biomass cogeneration and gasification, less intrusive hydro, geothermal and hydrogen energy.

The current total contribution of renewable energy to the energy mix is about 35MW composed of 30MW small hydropower and 5MW solar PV.

Renewable Electricity (Cont'd)

A number of barriers were identified as militating against the development of the renewable electricity industry and they include:

- Policy and regulatory issues, including guarantees of access to the grid for renewable energy;
- Financial and investment barriers since renewable energy have high initial costs and Nigeria lacks manufacturing capacity for components of renewable energy. Average electricity tariff in Nigeria is about 6.75 per KW-h – about 5cents. The average cost of sources of renewable electricity for mini hydro is 5-10 cents, solar PV is 20-40 cents, biomass power 5-12 cents, wind power 6-10 cents. Thus, financial incentives for Market entry are currently lacking. Incidentally, these relatively higher cost initiatives may be needed to satisfy the electricity needs of the poor who cannot afford high tariffs and are not in governments to influence favourable policies for renewable sources of energy;
- Technological barriers of full import dependent renewable facilities;
- Low public awareness and poor standards and quality control from the regulatory agencies (such as SON);
- Inadequate resources assessment; and,
- Intermittency of resource availability.

3.2.2 Alternative Sources of Electricity –Nuclear Energy

Even if the country were to be able to generate sufficient electricity for its population from the thermal, hydro and gas sources, there would still be the need to explore other available options. This is the practice world wide. Countries are trying out electric power sources that may not only be cheaper but are also sustainable and environmentally friendly. Coal, solar energy and nuclear energy are for the above three reasons currently being promoted as alternative sources of electricity. The focus of this discussion will be on nuclear energy.

PART FOUR: - CONCLUSION

It is evident from the above that the use of renewable energy can lead to the development of rural industries with attendant job opportunities and thus contribute to poverty alleviation. The proper management of renewable energy resources in the rural areas can play an important role in environmental protection.

As Nigeria's economy improves, its per capita greenhouse emissions may approach those of the developed nations of the world today. This, combined with continued gas flaring and a large population, will further worsen Nigeria's standing as a key emitter of greenhouse gases globally, with all the attendant consequences on all sectors of the economy, particularly, the energy and industrial sectors a well as the rural populace and urban poor.

CONCLUSION (Cont'd)

Although the reforms in the electricity industry has started on the right note, by the enactment of a new sector law in 2005, the establishment of the regulatory agency, rule making and fair management of the sector by the agency, the crises in the energy sector today justifies the need for the sector to be disciplined by accountability and transparency mechanisms in the management of energy resources and budgetary allocations for effective separation, transmission and distribution of electricity nationwide.

The legislative and regulatory framework for rural applications of efficiency and renewable energy is a combination of policy instruments seeking to set clear goals, legislative requirements and subsidiary instruments that provide legal bases for policy perspectives as well as institutional mechanisms for policy implementation.

CONCLUSION (Cont'd)

Renewable energy has a large and geographically widely spread resource base. However, the following have been observed as obstacles in its application:

- The lack of or inadequate awareness on alternative energy options;
- The lack of reliable data to undertake specific projects;
- Poor or no research and development base or even commercial business models contribute to the difficulty of accessing the latest renewable energy technology,
- Limited financial resources;
- Insufficient number of personnel qualified to administer energy efficiency and renewable energy programs;
- The lack of supporting policies, up-to-date and comprehensive regulations, inefficient infrastructure and equipment for their use; and
- Other constraints such as competition from other energy resources, mainly fossil fuels.

CONCLUSION (Cont'd)

An adequate regulatory framework must, therefore, specifically address these issues in order to put renewable energy squarely on the national agenda.

Additionally, a law on renewable energy must contain provisions on qualifications, application, grant, as well as conditions of licenses and incentives to harness any form of renewable energy including procedures for facilitating renewable energy technologies through effective implementing institutions. Such a law must provide for the rights and obligations of both host country, or rural community and private investors and impose standards.

An example of the regulatory needs to promote renewable energy may be found in the treatment of small hydro projects. Hydropower for rural electrification can help minimize local, regional and global environmental impacts in the long run, while ensuring people's livelihoods.

These benefits, not just of hydropower, but for all renewable energy resources, can hardly be realized without a coherent and adequate legislative and regulatory framework that sets out the policy, laws as well as institutional mechanisms for concretizing the gains that will flow from rural applications of renewable energy.

CONCLUSION (Cont'd)

Furthermore, the sustainability of a national GHG emissions inventory and climate change mitigation measures require the following, among others: -

- the determination of future emissions and to establish the extent of mitigation measures needed to lower emissions without compromising sustainable development;
- provision of local financial resource commitments and budget for GHG inventories and mitigation options assessment by the Government to support the activities of institutions working in this field;
- the identification of relevant projects and activities needed in the short-to-medium term to improve current national data on emissions inventories and mitigation analysis in Nigeria;
- use as many adaptation strategies as possible to mitigate the adverse effects of climate change on, particularly, the energy, industrial and agricultural sectors of the Nigerian economy as well as on the rural populace and urban poor;
- not one, but a creative range or mix of policy instruments to deal effectively with the issues involved in adapting to climate change in Nigeria.

THANK YOU