



Low-carbon energy development in Nigeria

Challenges and opportunities



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The SUNGAS project

The SUNGAS project aims to catalyse development of Nigeria's natural gas and renewable energy markets through innovation, demonstration, policy dialogue and advocacy. Small demonstration projects for both renewables and gas-to-power will show that community-based energy facilities are technically viable, financially sustainable, and can ensure better access to modern energy services for rural communities. The project is funded by the European Union and is being implemented by the International Institute for Environment and Development (IIED), the Niger Delta Wetlands Centre (NDWC) and the Living Earth Foundation (LEF).

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Cover photo: Brian Shaad, Gas flare in the Niger Delta



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Introduction

As a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, Nigeria has made international commitments to promoting low-carbon development, including meeting its reporting obligations to the UNFCCC, reducing emissions of greenhouse gases consistent with its national circumstances and within the context of poverty reduction and economic growth.

The UNFCCC, the Kyoto Protocol and other international institutions and processes also provide a range of financial incentives to embark on low-carbon projects. These include the Clean Development Mechanism and REDD (Reduced Emissions from Deforestation and Degradation). Nigeria's first REDD+ project was approved in October 2011. Others, such as the Green Climate Fund, are currently in the development stage.

Nigerians also have access to funds and incentives established outside the UNFCCC process, but with the aim of promoting low-carbon development (LCD), including the Clean Technology Fund, of which the World Bank is trustee, and the Global Energy Efficiency and Renewable Energy Fund, established by the European Union.

Currently in Nigeria, international agencies such as the United Nations Development Programme (UNDP), the World Bank and the Global Environment Facility (GEF) have been promoting low-carbon projects through their in-country programmes. For example, UNDP sponsored the Nigerian Renewable Energy Master Plan, while the World Bank is developing a programme under its Clean Technology Fund.

At the same time, the Nigerian policy framework to support and promote low-carbon development has been evolving, partly in response to international obligations and incentives, and partly due to internal drivers, such as the need to develop more options for power generation.

This paper provides a broad overview of the state of low-carbon development in Nigeria and its relevance to the 'access to energy' agenda. The paper identifies key elements of climate compatible development, enabling policies, emerging investments, existing local level implementation efforts, and the role of international

partnerships. It offers insights into how the low-carbon development agenda can help to promote access to energy for poor and isolated communities in Nigeria.

At the same time the paper argues that the low-carbon agenda alone will not transform Nigeria's energy sector for climate adaptation and mitigation, or to support pro-poor development. More traditional economic incentives are required to attract investments into the sector, to enforce efficiency measures, establish sustainable tariff practices, demonstrate the feasibility of renewable energy technologies, and ensure responsible use of energy resources.

Energy and poverty in Nigeria

Nigeria is Africa's largest exporter of crude oil, but of a population of about 167 million people (National Population Commission 2012), 70 per cent live in poverty (indexmundi 2012). A myriad of factors drive the growth in poverty in Nigeria, and these include a rent-seeking economy, weak institutions of government, and inadequate levels of investment in human capital and infrastructure, especially in providing energy services.

Access to energy services is critical to fuelling economic growth and in making progress against poverty. However, about 60 per cent of Nigerians live literally in the dark without electricity (Nigeria Vision 20: 2020). About 72 per cent of the population depends on the traditional 'three-stone fire' (UNDP and WHO 2009). According to the World Health Organization (WHO), an estimated 95,300 Nigerians die annually from smoke from the inefficient use of biomass energy (WHO 2007). After malaria and HIV/AIDS, this is the third biggest killer in the country.

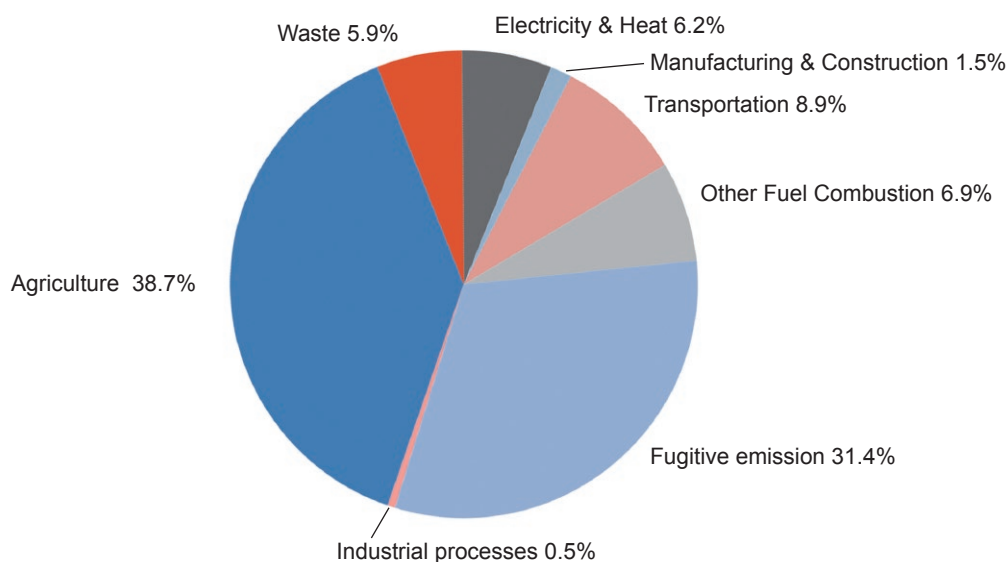
Contrary to the expectations of the National Energy Policy, deepening poverty has forced a reversal in the transition to more modern and efficient energy forms. Today, more Nigerians are climbing down the energy ladder – moving from electricity, gas and kerosene to traditional use of wood in open fires.

Poor access to electric power is the main reason behind the current de-industrialisation in Nigeria. Power plant closure and widespread under-utilisation of available capacity has become commonplace in Nigeria's

Table 1: Nigeria: Socio-economic indicators

Socio-economic indicators	Value
Population (2011)	167 million
Population living in poverty (1980)	17 million
Population living in poverty (2010)	112 million
Population with access to electricity	47%
Number of households without electricity	15.3 million
Number of black-outs per day	28
Electricity consumption per capita	150kwh
% of pop. dependent on biomass fuel	72%
Per capita CO2 emission (2007)	0.7 tonnes

Sources: Nigeria Poverty Profile 2010 (National Bureau of Statistics); World Development Indicators Database December 2010; Little Green Data Book 2011; National Population Commission – <http://www.population.gov.ng/>; Central Bank of Nigeria website.

Figure 1: GHG Emission for Nigeria by Sector in 2005 (excludes land use change)

Source: Dayo, Gilau & Samec, 2009

industrial landscape. Companies resort to the use of diesel generators to provide their own electricity. The millions of generators in the country are a major source of local pollution and emissions of harmful gases that cause climate change. Meanwhile, the nation is missing out on the opportunities to use natural gas to generate power for these industries.

Nigeria produces large amounts of natural and associated gas¹ every year in the Niger Delta yet very little of this gas is used, particularly for households and institutions. In 2010, the nation produced about 2,393 million standard cubic feet (scf) of gas. Of this

¹ Associated gas is a form of gas produced as a by-product of oil production activity. It is also known as flare gas.

amount, about 1,811 million scf, representing 75 per cent of total production, was utilised while about 582 million scf, representing 25 per cent, was flared into the atmosphere (Nigerian National Petroleum Corporation 2010). This represents Nigeria's single largest source of greenhouse gas emissions and an energy loss that could have closed the current national energy demand and supply gap.

Today, Nigeria lacks a clear agenda for expanding access to electricity services for the urban and rural poor. There are no concrete plans for opening up the emerging electricity industry to public scrutiny, enhancing transparency and accountability of the sector. Furthermore, no frameworks exist for a transition to a low-carbon energy economy where growth, poverty reduction and lower emissions of harmful gases will be achieved.

Low-carbon development – the pursuit of poverty-reducing economic growth and greenhouse gas emission mitigation – provides a pathway to addressing the energy poverty and environmental decline in Nigeria. A toolkit on how the low-carbon agenda can facilitate poverty reduction and growth would be beneficial. Guidance on how these approaches can be anchored in policy frameworks and reflected in investments, and how influential actors at national, state and local levels buy into it is clearly needed.

What is low-carbon development in Nigeria?

The term 'low-carbon development' has permeated development literature in recent years. Even in Nigeria, the use of the term is increasingly gaining currency (Eleri *et al.* 2011). There is nevertheless little consensus on the exact elements of this development paradigm. Governments, businesses, donors and think-tanks openly endorse the idea and principle of mainstreaming climate change in development practice.

Since the Earth Summit in 1992, sustainable development has been major goal for most countries. While climate change has added extra momentum to the sustainable development agenda, in some cases it has been treated as a separate issue and not mainstreamed into sustainable development (IGES 2008). A low-carbon development pathway offers one way for climate change responses and sustainable development to find a mutually reinforcing synergy. In that context, an LCD pathway should be viewed

as part of, but not synonymous with, sustainable development.²

Low-carbon development has been defined in a number of ways, including the following:

- A development path that simultaneously restrains energy demand growth, drives new production towards low-carbon sources, and provides sufficient, secure energy supply for global economic growth (REEEP 2007);
- Using low-carbon substitutes to fossil fuels to reduce emissions of GHGs significantly, while at the same time ensuring economic growth and development and enhancement of human welfare; and
- Sustainable growth which helps reduce GHG emissions and environmental pollution (Cho 2008).

The UK Government's White Paper on Energy in 2003 is one of the first national government references to a low-carbon economy. According to the policy document, low-carbon development is a development path where 'higher resource productivity³ contributes to higher living standards and better quality of life'.

The Japan-UK Low Carbon Society project identifies strands of action in LCD to include the following:

- Take actions that are compatible with the principles of sustainable development, ensuring that the development needs of all groups within society are met;
- Make an equitable contribution towards the global effort to stabilise the atmospheric concentration of CO₂ and other GHGs at a level that will avoid dangerous climate change, through deep cuts in global emissions;
- Demonstrate a high level of energy efficiency and use low-carbon energy sources and production technologies; and
- Adopt patterns of consumption and behaviour that are consistent with low levels of GHG emissions (Skea & Nishioka 2008).

² Sustainable development includes a broader agenda than energy and climate change, as outlined in Agenda 21 (<http://www.un.org/esa/sustdev/documents/agenda21/index.htm>)

³ Producing more with fewer natural resources and less pollution

Low-carbon development explores alternatives to an unsustainable business-as-usual approach to economic growth and the potential and implications for a sustainable 'green' economy based on climate-friendly low-carbon energy (IDS 2009). It seeks to increase the resilience of poor and vulnerable groups to climate change as well as enabling them to develop sustainably through low-carbon pathways. This requires assessing the opportunities and barriers for low-carbon growth pathways in a carbon-constrained world. It challenges how development has been done so far, calls for not only a serious rethink of old practices but also contests entrenched value systems. A country's low-carbon development pathway should emerge from within its own national reality, anchored in its development prospects, aspirations and capacities.

Nigeria has set a clear growth and development agenda in its Vision 2020. It seeks to become one of the 20 largest economies in the world, raise living standards, expand access to electricity to 75 per cent of the population and decouple growth from dependence on petroleum. Critical elements of low-carbon development are consistent with this vision.

This research identifies seven elements of low-carbon development in Nigeria: 1) economic growth, 2) poverty reduction, 3) expanding access to energy services for the poor, 4) transition away from carbon-intensive fossil fuels, 5) expanding the diversity of energy sources to include the use of renewable energy, 6) improving the efficiency of energy use, and 7) ending gas flaring. Energy strategies that strengthen these seven pillars will be consistent with low-carbon energy options for the country.

International framework for low-carbon development

Nigeria is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. As a non-Annex 1⁴ developing country party, the country does not have a binding obligation to reduce emissions of greenhouse gases under the convention. Developing countries like Nigeria are eligible for financial assistance and technology transfer to support national actions for mitigation and adaptation purposes.

In response to the Copenhagen Accord, Nigeria forwarded a letter to the UNFCCC engaging with the Accord. However, it failed to outline domestic measures to support international efforts in reducing emissions of these harmful gases, even though a number of actions are already being carried out to improve the country's response to climate change.

In 2003, Nigeria published its First National Communication to the UNFCCC identifying the vulnerability and impacts of climate change as well as national sources of emissions of greenhouse gases and response measures. Work is currently ongoing on the Second National Communication, which when published will update current national actions.

The National Adaptation Strategy and Action Plan has been approved. The Federal Ministry of Environment has made adaptation a priority of the Federal Government. Other important reporting obligations such as the Mitigation Strategy or Nationally Appropriate Mitigation Actions, the Technology Needs Assessment and Finance Needs Assessment have yet to be completed. When finalised, these action plans

will provide a broader overview of Nigeria's strategies to respond to the challenges and opportunities that climate change brings.

Nigeria participates actively in UNFCCC processes, especially the annual Conference of Parties. The country is a leading member of the African Group. It continues to draw the world's attention to the continent's unique situation of having contributed the least to the buildup of these harmful gases, yet it will suffer the most from the impacts of global warming. It seeks a special status for the continent in the provision of climate change finance and technology (Federal Republic of Nigeria 2009).

As a major oil exporting country, Nigeria is a member of the Organization of Petroleum Exporting Countries (OPEC). OPEC seeks a 'just transition' for countries whose national incomes are heavily dependent on the export of fossil fuels. Nigeria has remained a progressive member of the group compared to some member states such as Saudi Arabia that are considered 'hardliners'. Nigeria also participates actively within the G77+China – a negotiating block consisting of developing countries.

Despite Nigeria's active participation in various international negotiations, the country has not had a clear and coordinated national position on key issues on the negotiating agenda. However, several of these issues are strongly linked to domestic reform processes, such as gas flaring, power sector reforms, transportation and agricultural policies. While the Federal Ministry of Environment officially leads Nigeria's negotiating efforts, it apparently lacks the authority to commit the country to actions on these vital sectors. The result is that Nigeria consistently 'punches below its weight' in international negotiations.

There is an increasing awareness among the Nigerian public about the international issues on the climate change negotiating agenda. This has been made possible by an active media interest and participation of civil society organisations in the negotiations.

⁴ Non-Annex 1 parties are mostly developing countries. Certain groups of developing countries are recognised by the Convention as being especially vulnerable to the adverse impacts of climate change, including countries with low-lying coastal areas and those prone to desertification and drought. Others (such as countries that rely heavily on income from fossil fuel production and commerce) feel more vulnerable to the potential economic impacts of climate change response measures. The Convention emphasises activities that promise to answer the special needs and concerns of these vulnerable countries, such as investment, insurance and technology transfer (UNFCCC).

Table 2: Projects in Nigeria registered by the CDM Executive Board (as at August 2011)

Category	Project description	Estimated annual emission reductions (1,000 t CO ₂ e)
Oil field flaring reduction	Pan Ocean Gas Utilization Project	2,627
Oil field flaring reduction	Recovery of associated gas at Kwale oil-gas processing plant	1,497
Landfill gas	Municipal Solid Waste Composting Facility, Lagos, Earth Core Nigeria Ltd. (ENL)	282
Oil field flaring reduction	Recovery and marketing of gas at the Asuokpu/Umutu Marginal Field	257
Energy efficiency in households	Efficient Fuel Wood Stoves for Nigeria	31
Total	5	4,694

Source: UNFCCC, UNEP Risoe Centre

However, the interest of non-state actors has not necessarily translated to more action by influential agencies to respond to these issues.

Despite the disappointing results from international negotiations, a number of incentives have emerged. The Convention, the Protocol and other international institutions provide financial resources for low-carbon development projects.

Some of these financing mechanisms are described below.

Clean Development Mechanism

The Clean Development Mechanism (CDM) is a project-based mechanism which allows a country with an emission-reduction commitment under the Kyoto Protocol to implement an emission-reduction project in developing countries. Such projects can earn Certified Emission Reduction credits (CERs), each equivalent to one tonne of CO₂, which can be counted towards meeting Kyoto targets. A CDM project must deliver sustainable development benefits to the host country, while giving industrialised countries some flexibility in meeting their emission reduction targets.

The CDM represents a source of investment finance for low-carbon development in Nigeria. As at August 2011, five projects in Nigeria were registered with the

CDM Executive Board.⁵ Three are in the recovery and conversion of associated gas. The fourth is on efficient household fuel wood stoves and the fifth is on electricity generation from landfill gas in Lagos. These projects have the potential to generate about \$80 million worth of revenue annually⁶. Other projects are in the pipeline.

The CDM covers the additional cost that these low-carbon projects may face as a result of technology, policy or market risks. Should these portfolio of projects expand in Nigeria, more revenues will be generated for renewable energy, energy efficiency and lower carbon energy sources such as gas.

In addition to CDM projects, Nigeria has been admitted as a member country of the UN-REDD. A REDD project worth \$4 million was approved for Cross River State in October 2011 (Henrich Boll Stiftung 2012a).

The prospects for increased international funding

The UNFCCC negotiations have led to pledges for the establishment of more robust financial mechanisms

⁵ The executive board is a responsible UN body for the international approval of CDM projects

⁶ Total CERs is 6,682,000 million tCO₂e and @ \$12.5 per tonne will yield this amount. <http://cdmnafrica.ning.com/profiles/blogs/cdm-potentials-in-nigeria>

to drive low-carbon development. These include Fast Start Finance, a commitment by developed countries to provide new and additional resources to the value of approximately \$30 billion between 2010 and 2012. This will be followed by the goal of providing long-term finance of \$100 billion annually from 2020. The Cancun Agreement established the Green Climate Fund. This fund will be an operating entity of the financial mechanism of the Convention to support projects, programmes, policies and other activities in developing countries related to mitigation including REDD+, adaptation, capacity-building, technology development and transfer (EU 2012).

In addition to the proposed incentives and mechanisms, regional governments and international donor agencies in developed countries have established a number of funds and incentives aimed at low-carbon development in developing countries. These include the Clean Technology Fund, of which the World Bank is the trustee (Henrich Boll Stiftung 2012b), and the Global Energy Efficiency and Renewable Energy Fund of the European Union (Geeref 2012).

There is growing interest in investments in low-carbon development in Nigeria. A good example includes the United States Trade and Development Agency (USTDA) project with the Nigerian Electricity Regulatory Commission (NERC) to develop a regulatory framework designed to provide investment incentives to independent power producers (IPPs) utilising renewable energy resources in Nigeria (USTDA 2010). A third example is the European Union Micro Projects Programme in the Nine Niger Delta States (MPP9).⁷ A number of innovative and unusual projects including solar powered school internet laboratories and waste management and recycling are being implemented in this programme, but doubts exist about their effectiveness (mpp9.org 2012).

The following is an overview of low-carbon investments in Nigeria according to technologies used.

Hydropower

Apart from government-owned large hydropower installations, some organisations and institutions have initiated small hydropower projects. Nigerian Electricity Supply Organization Ltd (NESCO) owns a group of small hydropower plants with a combined capacity of 25MW (NESCO 2009). The United Nations Industrial Development Organization (UNIDO)

completed two of four planned pilot projects intended to build awareness and create capacity for micro hydropower development in Nigeria. Projects in Enugu State (30KW) and Bauchi State (150KW) were undertaken through a public-private partnership. Concessions are being granted for a number of small hydro plants owned by the Federal Government.

Solar

The International Centre for Energy, Environment & Development (ICEED), in collaboration with the Federal Ministry of Power, has delivered solar electricity to about 300 households in three villages.

In addition to national and state level solar photovoltaic (PV) and thermal projects, a number of NGOs have invested in solar energy in the country. The Solar Electric Light Fund (SELF), in collaboration with the Jigawa State Government, carried out a solar-generated electricity (PV) project to power essential services in three villages of the state (SELF 2012).

The Niger Delta Wetlands Centre (NDWC) has also installed solar systems to support water pumping, lighting, medical refrigeration and communications systems in remote Niger Delta communities with a focus on scaling up and replicating successful pilot initiatives (NDWC 2012). In almost all of these projects, the sustainability of the systems remains uncertain as the cost of replacing batteries, and providing basic operation and maintenance services are often not provided for. Establishing payment systems for public services such as power and clean water (from solar water pumps) has also proved challenging, as the SUNGAS project has discovered.⁸

Gas-to-power

A number of independent power projects (IPPs), comprised mostly of foreign firms, have been initiated in recent years.⁹ Four independent power plants of Energy Company Nigeria Plc (ENCON) are now fully operational (Negris Group 2012). The plants include a 10MW gas-fired Industrial plant in Ikorodu, a Unipower 6MW gas-fired reciprocating power plant, a 3MW gas-fired inside-the-fence power plant and a

⁷ Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers

⁸ This is an EU-funded energy access project in the Niger Delta, implemented by IIED, NDWC and the Living Earth Foundation, along with other project partners including ICEED and Stakeholder Democracy Network: <http://www.sungas-nigeria.org/>

⁹ IPPs are granted permits by the legislation build their own decentralised power plants; it can be partnerships between the private sector and federal or local government.

1.32MW gas-fired captive power plant in Ilupeju, all in Lagos.

Exxon Mobil is setting up 500MW IPP to be located in Akwa Ibom State (Ijaw Monitor 2012)¹⁰. In addition, the Okpai Power Plant built by Nigerian Agip Oil Company (NAOC) is functioning at full capacity and sends 480MW to the national grid (The nationonline 2012).

The Afam Integrated Gas and Power Project by Shell Petroleum Development Company (SPDC) is designed to provide 650MW to the national grid, while the Eket Qua Iboe Terminal (QIT) IPP by Mobil Producing Nigeria Unlimited (MPNU) is at an advanced stage of construction. When completed, the project will generate a total of 500MW of electricity (234next 2012). These large-scale gas projects are intended to displace the ubiquitous use of diesel power generation.

As part of the SUNGAS project in the Niger Delta, the Living Earth Foundation is partnering with Shell Petroleum Development Corporation (SPDC) to set up a community-based utility delivering power to a community in the Niger Delta using associated gas (Living Earth 2012).

Biofuels

The Nigerian government is piloting large-scale biofuel production for use in automobiles, generators, and for bio-gas production. The Nigerian National Petroleum Corporation (NNPC) received a grant of 70,000 Euros from the Renewable Energy and Energy Efficiency Partnership (REEEP) to support a detailed feasibility study into high ethanol-yielding cassava varieties and other biofuel feedstocks for production of two types of automotive fuel: ethanol fuel and palm oil diesel (Biopact 2007). Tens of millions of dollars have since been spent on Nigeria's biofuels programme led by the NNPC with very little sustainable biofuels produced.

Energy efficiency

Stoves

Envirofit, one of the world's leading manufacturers of efficient biomass stoves, is partnering with Tower Aluminium, Nigeria's largest manufacturer and distributor of household wares, to expand the clean cookstoves market in Nigeria. Both firms now co-brand their biomass stoves.

In Kaduna State, the Development Association for Renewable Energies (DARE) in collaboration with German NGO Lernen-Helfen-Leben e.V. and the German carbon offset organisation Atmosfair GmbH has distributed over 3,000 efficient household woodstoves with support from the carbon market (PCIA undated).

Oando has launched its 3kg liquefied petroleum gas (LPG) stoves in Lagos, Abuja and Delta state. They plan to sell 5 million stoves by 2016 and are currently exploring possibilities of tapping into the carbon market to bring down the cost of the stoves (Opara 2012). Techno Oil like Oando is carrying out a project tagged 'Going Green Revolution'. The project has so far deployed over 20,000 gas cylinders of 3kg, 5kg and 12.5kg at a discounted price to stimulate local consumption and allow poor families to access liquid petroleum gas (LPG) (The Guardian Nigeria 2012a).

The Nigerian Alliance for Clean Cookstoves was launched on March 2012 to provide a coordinated platform for promotion of clean and efficient cookstoves. This public-private partnership seeks to introduce 10 million clean cookstoves to Nigerian homes and institutions by 2020 (www.NigeriaCookStoves.org).

The World Bank funded the Lagos Urban Transport Project which includes the development of a transport authority for the city (LAMATA) and the development of the Bus Rapid Transit (BRT) system, which has been in operation since March 2008 (World Bank undated). The project has helped reduce ambient concentrations of pollutants that pose dangers to human health along the corridor as well as reduced traffic congestion.

Compact fluorescent lamps (CFLs)

The Global Environment Facility (GEF) in collaboration with UNDP and the Federal Ministry of Environment has finalised arrangements to distribute 1 million CFLs (Oson 2011). This is in addition to existing government-funded pilot projects and private initiatives.

Waste-to-power

A 30MW waste-to-power project has taken off in Lagos (UPI News 2008). This will benefit from carbon market funds. Approval has been given for another 200MW plant, also in Lagos (Aderinokun 2010).

Review of existing national initiatives for low-carbon development

To incentivise the flow of international finance to low-carbon development projects in Nigeria, domestic policies and institutions must be properly aligned. The Federal Government and various states have over the years developed a number of policy documents to promote sustainable utilisation of available energy resources. This section looks at existing policies, their implementation and challenges.

National policies and programmes to promote low-carbon development

The National Electric Power Policy of 2001 recognised the need to diversify the nation's electricity supply with the expansion of renewable energy supply. It proposed the development of a Rural Electrification Policy and establishment of a Rural Electrification Fund for this purpose. It also recognised the need to use natural gas for power generation and proposed a joint electricity and natural gas capacity expansion. The rural electrification programme aimed to extend power to all the nation's 774 local government areas, however, it failed to promote the use of decentralised sources of energy (Eleri 2002).

The Electric Power Sector Reform Act of 2005 was formulated based on some of the recommendations of the National Electric Power Policy. This Act emphasises the role of renewable electricity in the overall energy mix, especially for expanding access to rural and remote areas. Relevant sections of the Act stipulate the development of isolated and mini-grid systems and renewable energy power generation. On the establishment of the Rural Electrification Agency (REA), the main focus shifted to the use of renewable energy, especially solar PV systems and small hydropower. However, little was achieved before the Agency was scrapped by the Federal Government in 2009. A new REA board and management is now in place. The Agency is currently planning to launch a new rural electrification programme focusing on both grid and decentralised energy options.

The Act that established the REA also set up the Nigeria Electricity Regulatory Commission (NERC). The Commission has finalised and launched feed-in tariffs for renewable electricity (The Guardian Nigeria 2012b).

The Energy Commission of Nigeria (ECN) developed the National Energy Policy in 2003. The policy, among other things, provided for optimum utilisation of the nation's conventional and renewable energy resources. Since the launching of this policy, no agency of government has taken active steps to implement it.

In 2004 the Bureau for Public Enterprises produced the National Oil and Gas Policy. This policy provides for establishment of a National Gas Grid; promotion and use of gas for industrial processes as well as power generation; and provision of fiscal incentives, among others. The policy also provided for investments in the use of non-fossil based energy sources such as solar, hydro and biomass including the requisite research and development. It is uncertain how much this document has informed the action of subsequent governments.

With support from UNDP, ECN in 2005 developed the Renewable Energy Master Plan (REMP). This plan articulates a national vision, targets and a road map for addressing key development challenges facing Nigeria through the accelerated development and exploitation of renewable energy. It puts in place a comprehensive framework for developing renewable energy policies, legal instruments, technologies, manpower, infrastructure and markets to ensure that the visions and targets are realised. The REMP was never endorsed by the Federal Executive Council or passed into law by the National Assembly. Even though the plan is credited with some of the growth in interest for renewable energy, it never formed a basis for government action.

In 2006 the Federal Ministry of Power produced the National Policy and Guidelines on Renewable Electricity and Renewable Electricity Action

Programme. These policy documents aim to expand the fuel mix for electricity generation in the country. The policy stipulates that the Federal Government shall expand the market for renewable electricity to at least 5 per cent of total electricity generation and a minimum of 5TWh of electric power production, excluding large hydropower, by 2016. The Federal Government commissioned a number of projects as a result of the guidelines, but few of the milestones of the policy and guidelines have been realised.

The Federal Government enacted the National Biofuels Policy in 2007. The policy seeks to establish a thriving bio-fuel industry and improve the quality of automotive fossil-based fuels in Nigeria. The policy aimed to link the agriculture and the energy sectors, with the underlying aim of stimulating development in the agricultural sector. The policy stipulated a blending of up to 10 per cent of fuel ethanol with gasoline to achieve a blend to be known as E-10, and a blending of 20 per cent of biodiesel with conventional diesel by 2020. The Nigeria National Petroleum Cooperation (NNPC) was charged with carrying out the objectives of the policy. Despite significant investments in developing the carbon assets of this programme and funding pilot projects, this project has not resulted in tangible results.

The Federal Government developed the Petroleum Industry Bill (PIB). The bill, which was presented to the National Assembly in 2012, seeks to protect health, safety and environment, among other things. The bill stipulates that government shall introduce and enforce integrated health, safety and environmental quality management systems in oil and gas explorations in order to ensure compliance with international standards. The PIB seeks a comprehensive overhaul of the industry. But the bill has become very contentious and appears to face an uncertain future following the stand-off between the government and labour unions over deregulation of fuel pricing.

The National Gas Master Plan (NNPC undated) approved by the Federal Executive Council in 2008 focuses on three critical elements which were identified as barriers to natural gas development: gas pricing policy, domestic gas supply obligation and gas infrastructure blueprint. Among other things, the plan seeks to establish central processing facilities, gas transmission pipelines, LPG supply and storage facilities among others. It aims to grow the Nigerian economy through gas by pursuing three key strategies – stimulating the multiplier effect of gas in the domestic economy, repositioning Nigeria competitively in high-

value export markets, and guaranteeing the long-term energy security of Nigeria (Adefulu 2009). The Federal Government has approved a new market-reflective pricing regime for gas. Although gas supply obligation is currently an official policy it remains to be seen to what extent the international oil companies will comply. Expanding gas processing facilities and transmission pipelines remains a daunting prospect for the Federal Government. This is compounded by the lack of an effective regulator for the gas mid- and downstream.

In August 2010, the Federal Government launched the Roadmap for Power Sector Reforms (Federal Republic of Nigeria 2010). This roadmap acknowledged the importance of gas and hydro in expanding Nigeria's electricity generation and utilisation. It states that natural gas, in particular, will be prioritised and incentives provided to investors to exploit this resource to its fullest potential. It also noted the need to promote hydropower and other alternative fuels. Despite the pledge of the Federal Government's full commitment to the roadmap, major milestones have been missed, and there are significant doubts about the future of the reform process. Moreover, there is no single mention of rural electrification and the use of decentralised energy options in the programme. If this trend continues the power sector roadmap will bypass Nigeria's poor.

Vision 2020 articulates the long-term intention of the Federal Government to launch Nigeria as a top 20 economy by 2020. It seeks to achieve a minimum GDP of \$900 billion and a per capita income of no less than \$4,000 per annum. The Vision listed strategic initiatives which will be implemented to facilitate the development of a competitive and sustainable energy sector, including provision of incentives to facilitate the utilisation of alternative energy resources; reducing the country's reliance on oil and gas and ensuring security of supply; introduction of demand-side management principles targeted at ensuring efficiency in energy consumption in the electricity industry; provision of incentives to encourage local manufacturing and production of consumables used in the power sector; extension and optimisation of the gas infrastructure grid network to support and facilitate the construction of gas-fired power plants across the country; and development and mass deployment of appropriate renewable-energy technologies for rural, semi-urban and selective urban electrifications and heating, among other things. Despite these proposed initiatives, it is not clear if this vision is being implemented.

There is a general lack of capacity or political will to implement the above outlined policies and

programmes. Some of the policy documents like the REMP and the National Energy Policy are yet to receive legislative attention or presidential endorsement. Even the Electric Power Sector Reform Act passed in 2005 has not been fully implemented.

National institutional framework for low-carbon development

There is no nationally recognised institutional framework or champion for the implementation of low-carbon development in Nigeria. Although the National Assembly has passed a bill to establish a National Climate Change Commission, this has not been signed into law. However, other agencies of government such as the Energy Commission of Nigeria, Federal Ministry of Environment, Federal Ministry of Power, and the Renewable Energy Department of the Nigeria National Petroleum Corporation (NNPC), have a number of isolated activities seeking to promote low-carbon energy development in the country.

The Energy Commission of Nigeria (ECN) has the statutory mandate for planning and coordination of national policies in the field of energy. The commission promotes the diversification of the nation's energy sources as well as the development and optimal utilisation of these resources. It prepares periodic master plans for the balanced and coordinated development of energy in Nigeria in consultation with other relevant government agencies. The Commission has developed a number of policy documents including the National Energy Policy and the Renewable Energy Master Plan. Together with its various centres,¹¹ it has carried out renewable energy pilot projects around the country. However, the influence of the ECN on major energy sector institutions in petroleum and power is considerably limited, and this compounds implementation challenges that many of the national energy plans have.

The primary mandate of the Federal Ministry of Environment is to protect and improve water, air, land, forest and wildlife in Nigeria. The Ministry is also mandated to ensure the sustainable utilisation of the environment and its resources, including energy resources, by evolving tools for poverty alleviation, ensuring food security, foreign policy and international

development as well as good governance. The Ministry recently produced the National Policy and Guidelines on Renewable Energy. It has initiated a number of low-carbon projects around the country. The Ministry lacks the influence in government to provide strong leadership in the transition to low-carbon climate resilient development.

The Federal Ministry of Power is mandated to make policies on generation, transmission and distribution of electricity from the national grid as well as off-grid systems. The Ministry, among other things formulates and monitors the implementation of policies, and coordinates the activities of its parastatals such as Power Holding Company of Nigeria, etc. The Ministry has developed a number of policy documents aimed at promoting renewable electricity. It has also initiated a number of gas-to-power, hydropower and other renewable electricity projects.

The Renewable Energy Division of the Nigerian National Petroleum Corporation has the mandate of linking the agricultural sector with the oil and gas industry by the domestic production of biofuels, while fostering the use of other renewable energy sources. The Division developed the National Biofuels Policy. This seeks to expand the biofuels industry in Nigeria. The Corporation has also initiated three sugarcane-to-ethanol projects, two cassava-to-ethanol projects and two oil palm-to-biodiesel projects in addition to five feasibility studies (NNPC 2011). Despite significant resources committed to these projects, the results have been negligible.

Private sector participation in delivering low-carbon energy in Nigeria

Private sector participation in low-carbon energy development in Nigeria has been minimal. Some of the multinational oil companies like Shell and Agip own or operate one or more gas power plant and other gas capture infrastructure. The Nigeria Electricity Supply Company (NESCO) in Jos, Plateau State, owns a group of small hydropower dams with a combined capacity of 25MW which has been in operation since 1929. Apart from these developments, some state governments are partnering with the private sector to implement low-carbon projects.

Some non-governmental organisations have also been involved in policy, advocacy and public awareness or actual execution of low-carbon energy projects. Likewise, a number of bilateral and multilateral institutions like UNIDO, UNDP, World Bank, and so

¹¹ These centres include Centre for Energy Conservation and Energy Efficiency, Lagos; Centre for Hydropower Research, Ilorin; Centre for Energy Environment Research, Benin City; National Centre for Energy Research and Development (NCERD), Nsukka; and Sokoto Energy Research Centre, (SERC), Sokoto

on, have supported low-carbon development in the country.¹²

Energy projects, especially gas-to-power projects, have drawn the attention of some financial institutions. Recently, a \$25 million IPP gas plant generating 12.5MW of electricity was financed by Fidelity Bank in partnership with Lagos State Government.¹³ First Bank of Nigeria recently signed an MOU with a Chinese firm to build a 3,000MW gas turbine power plant estimated to cost \$2.4 billion (First Bank Nigeria undated). United Bank for Africa Plc has financed a number of low-carbon energy projects in recent years including Ibom gas power plant.¹⁴

Private sector participation in delivering low-carbon energy is impeded by unsupportive policy frameworks. Lack of political will to fully implement the power sector reforms stymie efforts to expand investments in the sector. Without the full liberalisation of the sector and the emergence of cost-reflective tariffs, renewable energy projects are unlikely to increase significantly. As no clear guarantees for a good return on invested capital exist, few companies and financial institutions embark on these projects.

¹² <http://www.nigeriaatcancun.com>

¹³ <http://nigeriancommentaries.blogspot.com/2011/02/fidelity-banks-new-industrial-financing.html>

¹⁴ www.africacncl.org/.../Nigeria.../The_Nigeria_Investment_Forum_on_Power_UBA.ppt

Making progress towards low-carbon development

Several of Nigeria's national ambitions and action plans have far reaching consequences for the future of low-carbon development. Action on these already agreed formal national policies and plans, if implemented, will radically transform the country from a laggard to a leader in low-carbon energy development. The challenge is to tackle current implementation barriers on a number of policy fronts.

First, the Vision 2020 presents an ambitious plan to turn Nigeria into a top 20 economy by 2020. It singles out the expansion of electric power production from gas and hydropower as a key driver of growth, and outlines measures to transform transportation and agriculture – all three sectors representing nearly 90 per cent of Nigeria's total emissions of greenhouse gases. Despite the pledge to implement this national vision, there are no measures in place to realise this ambition.

Second, one of the important barriers to the growth of greener electricity supply has been the monolithic government-controlled power sector. Current power sector reform processes will lead to cost-reflective tariffs, providing incentives for increased gas supply to existing and new power plants. Associated and non-associated gas will increasingly replace the predominantly diesel-generating sets ubiquitous in companies and homes. As gas prices rise and regulation improves, more of the currently flared natural gas will find its way into power production. Flaring of natural gas and other energy related emissions represent about one-quarter of total Nigerian emissions of greenhouse gases. Over the years, Nigeria has set several deadlines for ending gas flaring – none of which has been kept.

Transportation accounts for nearly one-tenth of total Nigerian emissions. The national transport policy seeks to expand rail infrastructure, improve road construction and maintenance as well expand urban collective transportation, among other things. These are all important elements in a green transportation strategy. Progress towards these goals has been painfully slow. Despite huge investments, the roads are dilapidated, while rail transportation has virtually disappeared.

More than one-third of Nigeria's emissions of greenhouse gases originate from agriculture, mostly from crop production. The Vision 2020 seeks to improve agricultural productivity by enhancing yield per hectare, reducing post-harvest losses, and increasing processing and integration with an industrial value chain. This departs from the business-as-usual scenario where more land will be cleared to expand primary production – a key source of current emissions (Federal Republic of Nigeria 2009). Despite the promise of modernising agriculture and transforming it into an engine of growth and job creation, little progress has been achieved.

While international incentives such as the carbon market, bilateral and multilateral donor support as well as agreements within the UNFCCC are important, it is clear that implementing already existing domestic policy commitments hold the key to unlocking Nigeria's low-carbon potential. The Federal Government's own programmes in power, transportation and agriculture, if implemented, will lead to unprecedented growth in incomes and a departure in the carbon trajectory of current economic development.

The lack of progress towards low-carbon energy development may also be a result of a dysfunctional institutional framework. Present climate change policy space is dominated by the Federal Ministry of Environment, donors and NGOs. In the past few years, there has been a growing interest from the National Assembly, especially the House of Representatives Committee on Climate Change. Since none of these actors has significant influence on the power sector reforms, gas investment policies and implementation of reforms in transportation and agriculture – areas where action on climate change really matters – little progress is being made in Nigeria's transition to low-carbon development.

Influential institutions such as the Presidency, the Federal Ministry of Power, the Federal Ministry of Petroleum, the Federal Ministry of Transportation, the Federal Ministry of Finance, especially under the Coordinating Minister of the Economy, international

oil companies as well as domestic financial institutions are crucial to the implementation of sectoral reform policies that enable progress in green energy development. At present these institutions are disconnected from the climate change policy space.

While donors, NGOs and the Federal Ministry of Environment often tend to set the agenda for official policies on climate change and generate significant public awareness on sustainable development, they have had little influence in the sectors that

matter most in the transition to low-carbon energy development. The political economy of low-carbon energy development in Nigeria therefore requires a new narrative that maps out the interests, influence, institutions and choice opportunities in sectors such as gas, power, transportation and agriculture. Improving the understanding of the political and economic conditions for effective implementation of already agreed policies will be crucial in efforts to make progress on low-carbon energy development in Nigeria.

An agenda for action

A number of measures must be in place for progress to be made on low-carbon energy development in Nigeria. These measures include the following:

Establish a national agenda for energy access: A key driver for the greening of energy in Nigeria is the urgency of expanding access to energy services for the vast majority. The lack of access to energy constitutes a major roadblock in tackling poverty. Sustainable energy is crucial for expanding enterprises, and providing lighting and cooking for millions of Nigerians. Not only is electricity access low in Nigeria, but the proportion of the population with access is declining. The majority of families continue to use wood for household cooking.

Despite the aspiration of the Vision 2020 to increase electricity access from 40 per cent to 75 per cent in 2020, there is no programme in place to achieve this goal. The only agency established by the Electric Power Sector Reform Act to expand access to rural electrification has only recently been reconstituted.

A national energy access programme will set an achievable target for electricity access. Large-scale expansion of access will not be technically or economically efficient with grid power alone. It will be met through a combination of grid and decentralised energy options. Renewable energy will play a key role in meeting the targets of this national programme, especially for remote areas.

Today there is need for a national institutional framework to drive energy access for the poor. This framework has to specify institutions and agencies that will champion the development of low-carbon energy. A strong institutional design will enhance inter-agency collaboration in delivering low-carbon energy development.

Implement and scale up current reforms:

Expanding access to clean energy does not in all instances require a total shift in the policy focus of the government. Several of Nigeria's national macroeconomic and energy sector specific action plans will lead to the increased use of lower-carbon forms of energy. This is particularly so for gas and power sector strategies. Building a coalition to ensure the successful

implementation of already agreed national policies is needed. This will assist in countering possible vested interests within the political economy of the current energy sector.

Set the right energy prices: As the government delays in completing ongoing energy sector reforms in power and petroleum, prices for conventional energy still do not reflect the full cost of production and do not internalise environmental costs. Artificially low prices for conventional energy make investments in lower carbon energy resources less competitive.

Nigerian prices for renewable energy technologies such as solar energy components and small hydropower projects are higher than world averages. A combination of market distortion as a result of inflated prices for government projects, and tariff and non-tariff barriers at the port help keep prices high. The government can bring Nigerian renewable energy technology prices to international levels by reducing tariff and non-tariff barriers, and especially tackling corruption at the ports. Smart subsidies that encourage renewable energy investments by companies, communities and families will be needed. These subsidies will support green energy production and will be time-bound. Ensuring that the NERC implements already agreed feed-in tariffs will also be a step in the right direction.

Expand access to domestic and international

finance: Interest in renewable energy technologies in Nigeria has changed according to the fiscal conditions in various states and federal agencies. In periods of high oil prices and high inflows from the federal accounts, states have embarked on solar energy deployments, especially for street and community lighting, as well as health and water provision in communities. As government finances reduce, these investments are often scaled down or abandoned. Sustainable sources of domestic and international funding are required to broaden state, private sector and community projects.

Government can incentivise more investments by offering equity investments, guarantee schemes, low interest funding, tax incentives, concessions or private or community management of publicly owned assets. By incentivising private sector investments, several

projects that would otherwise have been challenging for private or public institutions could be realised. This will further drive down prices and make low-carbon energy technologies more affordable to the poor.

A clean energy finance initiative is required to de-risk domestic lending to the sector and support the opening up of international funding opportunities. Government needs to put in place the necessary fiscal and market incentives to stimulate investments especially by the private sector. Some of these incentives include provision of subsidies, removal of import duties, tax relief, tax credits, liberalising energy prices, developing feed-in tariffs for renewable electricity, among other things.

Increase access to low-carbon energy information:

Information empowers communities, companies and civil society groups to make choices and demand changes in government action. Access to information on available technologies, costs, benefits, government programmes and international support mechanisms are inadequate. Providing access to low-carbon energy information through local media such as radio, TV, newspapers and the internet are important in expanding the choices available to people and ultimately growing the market for these technologies.

Strengthen the voice of CSOs to demand

government accountability: Civil society groups, including community- and faith-based organisations are important in holding governments to account on their commitment to providing services such as energy. While Nigerian civil society has been strong in promoting civil rights and deepening the democratic experience, these organisations are weak in pursuing the right to development, especially the right to energy.

Increase research and development capacity

building: There is need for a strong national research and development policy on emerging clean energy technologies. Nigeria already has a number of research and development centres on clean energy technologies. Increasing funding for research and training is needed. Efforts are also required to bring the products of their research to the marketplace.

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