

OVERCOMING NIGERIA'S ENERGY CRISIS

Towards Effective Utilisation of Associated Gas and Renewable Energy Resources in the Niger Delta

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The abundant natural gas and renewable energy resources in the country are either wasting or grossly under-utilised

While the Nigerian economy is being crippled by factors including poor energy infrastructure, the abundant natural gas and renewable energy resources in the country are either wasting or grossly under-utilised. Nigeria's crude oil deposits exist mainly in the Niger Delta region of the country where the hydrocarbon is extracted with substantial volumes of 'associated gas', which is then routinely flared by oil companies who operate in partnership with the Nigerian government. This practice of gas flaring has become the norm in oil producing sites in Nigeria with the country flaring more gas than any other in the world.¹ This trend results in avoidable wastage energy resources in addition to contributing to local pollution. The greenhouse emissions from flaring in the Niger Delta are also significant contributor to global warming. This is absurd especially in a country that is faced with the challenge of overcoming a complex energy crisis, characterized by inadequate electricity generation to meet local consumption demands. It is therefore imperative for the Nigerian government and its joint venture partners to support alternative that will contribute to stopping routine gas flaring while using associated gas for the provision of the much needed energy to drive the effort at eradicating poverty. Also, Nigerian citizens must not be denied the benefits that could be derived from the maximum utilization of clean and renewable energy resources.

Nigeria flares more gas than any other country in the world

With increasing global energy demand, the Nigerian government and its partners in the petroleum industry have indicated that they want to double crude oil production capacity to as much as 4.5 million barrels per day in 2010². While that target may not be met, there is no denying government's desire to reap increasing revenues from an expected rise in global oil demands. Part of the reason why government may not meet that target is the resistance from communities of the Niger Delta who have borne the social and environmental costs of over fifty years of petroleum exploitation. With government's energy policies historically privileging export of crude oil, communities in the Niger Delta have not been provided with access to regular electricity and other social infrastructure. Schemes for the development of environmentally safe and affordable energy must be put in place as one of the conditions necessary to guarantee peace in the area. Such schemes must recognize the need to reduce greenhouse gas emissions, and should be organized to guarantee local sovereignty on energy development.

This briefing aims at providing an understanding of Nigeria's energy policy with an emphasis on identifying options for utilising associated gas and renewable energy resources. We show how readily available energy resources can be utilised towards addressing the needs of Nigerian citizens and their productive enterprises.

¹ World Bank, Global Gas Flaring Reduction Partnership: Towards a World Free of Flares. <http://siteresources.worldbank.org/EXTGGFR/Resources/GGFRbrochure%28updatedNov08%29.pdf?resourceurlname=GGFRbrochure%28updatedNov08%29.pdf>

² F. M. Kupolokun (Group Managing Director, Nigeria National Petroleum Corporation), "Nigeria and the Future Global Gas Market". Presentation at the Baker Institute Energy Forum, Houston US. May 2006. http://www.rice.edu/energy/publications/docs/NIGERIA_FutureGlobalGas_Speech.pdf

NIGERIA'S ENERGY CHALLENGES

One of the effects of policy implementation failures is that despite the abundance of natural gas and renewable energy resources in the country, Nigeria has become notorious for its epileptic power supply. In fact while most communities do not have access to this basic social infrastructure, those that have it cannot rely on the very poor supply from the Power Holding Company of Nigeria. This lack of access to efficient energy resources has had adverse impacts on manufacturing, commerce, industry, agriculture, etc.

Agriculture has not developed beyond the small holder subsistent level, as farmers cannot increase production without energy, while harvests are mostly lost due to lack of storage. Producers and farmers are left with dwindling options. Artisans, small scale enterprises and larger productive enterprises are collapsing due to lack of accessible electricity. The overall result is the loss of jobs and the impoverishment of many.

It has been observed that Nigeria's per capita electricity consumption is very low as the country lags behind other African countries in providing energy access to its citizens. Electricity generation is put at about 20 watts per person.³ Indeed Nigeria's per capita energy consumption is 4 times less than the African average and about 19 times less than the world average.⁴

The World Conventional Energy Supply in 2004 showed Africa's highest supply in descending order of magnitude as follows: South Africa - 30,020MW; Egypt - 14,250MW; Algeria - 6,188MW; Libya - 4,710 MW; Morocco - 3,592MW and Nigeria - 3,500MW.⁵ But between 2005 and 2009, power generating capacity in Nigeria oscillated between 2,600MW and 3,000MW⁶. This means that the 44.3 million members of South Africa's population have electricity 12 times more than the over 140 million Nigerians. Egypt which is second with a 14,250 MW capacity and a population of about 77.5 million is approximately 6 times higher than Nigeria in conventional energy output.

The costliest energy need in Nigeria is lighting - similar to the pattern in other African countries where nearly 10-15 percent of the poorest households' income may be spent on kerosene lamps, stoves or candles. The case is not different in Nigeria where the poorest households earn about 1-2 US dollars per day and spend about 0.4 dollars per day on energy needs. Kerosene lamps provide poor lighting and are expensive, inefficient, highly polluting and dangerous⁷.

With government's energy policies historically privileging export of crude oil, communities in the Niger Delta area have not been provided with access to regular to electricity and other social infrastructure

³ <http://news.bbc.co.uk/1/hi/business/4650924.stm>

⁴ A. S. Sambo, Director General of Nigeria Energy Commission in a Paper Presented to the Nigerian Society of Engineers Forum, 2 April, 2009, Shehu Yar'Adua Centre, Abuja.
http://www.energy.gov.ng/index.php?option=com_docman&task=cat_view&Itemid=&gid=21&order_by=dmdate_published&ascdesc=DESC

⁵ Uduma Okeh, "Nigeria: The Country's Electricity Dilemma", *ThisDay*, -21 August 2007. Accessed from allafrica.com/stories/200708220370.html

⁶ <http://www.thisdayonline.com/nview.php?id=158180>

⁷ www.independent.co.uk/news/world/africa/lighting-up-africa-why-todays-residents-are-still-making-do-with-wax-and-wicks-463266.html

Adulterated and low quality kerosene is widely available on the black market and has been recorded as being responsible for several explosions that have resulted in severe injuries and deaths in Nigeria. Its prices fluctuate with that of crude oil in the international market, and supply has been unreliable with Nigerians forced to depend on expensive black market sources for basic needs. Small petrol and diesel powered generators are options for those with sufficient cash, but these carry high fuel and maintenance costs. They produce polluting fumes and noise and pose voltage management difficulties, which often result in the generation of either excess or inadequate power. For a small business, power generating costs can represent a major portion of overheads; which is one of the major reasons for the collapse of small-scale enterprise in the country.

The poor power situation in the country has been blamed on the political leadership, which has so far failed to produce and implement effective programmes for the development of national and localized energy infrastructure. Corruption, poor maintenance and non-completion of projects are some of the factors militating against Nigeria's quest for energy sustainability. In 2008, there were reports that an amount of over 16 billion US dollars was expended by the federal government during the eight years of President Olusegun Obasanjo's civilian regime, but did not contribute to any recorded improvement in energy generation and distribution in the country. A widely publicized probe in the national assembly did not yield any results, though former President Olusegun Obasanjo and other senior officials that served in his regime were indicted by the panel.⁸

Nigeria's demand for energy is estimated to be 7,600 (MW). However, the country only has a total installed generating capacity of 6,000MW, which is far from being optimized as the country is only able to achieve 3,000MW output⁹. A highly-placed government official responsible for the Power Ministry has blamed their inability to utilise fully the installed generating capacity on the shortage of gas of which they currently get a supply of 230mmscf/d. An additional supply of 600mmscf/d is needed to be able to utilise the maximum capacity at 6,000MW¹⁰. It is ironic that a country where gas is wasted through flaring is blaming lack of gas supply for its power problems.

In her seven-point agenda, the present government of Nigeria set a target of achieving additional 6,000MW generating capacity by mid-2009, but has failed in this bid. A target of 20,000MW is now set for 2011.¹¹ A recent report by the Vision 20-20 Committee which was set up by the Yar'Adua administration has stated that for Nigeria to achieve its goal of being among the 20 largest economies in the world by the year 2020, it would have to generate up to 60,000MW before then.

Most of Nigeria's public power generation comes from three conventional sources: hydropower, coal (thermal) and diesel or gas- powered plants. Electricity transmission has been a major problem in Nigeria. The centralized grid system is dependent on large-scale generation, and considerable amount of energy is lost in transmission.¹²

⁸ *Daily Trust*, "Power Probe – Reps Committee Indicts Obasanjo, Imoke", 5 August 2008. Accessed from <http://allafrica.com/stories/200808050723.html>

⁹ allafrica.com/stories/200708220370.html

¹⁰ <http://www.thisdayonline.com/nview.php?id=158180>

¹¹ *This Day* newspaper, Tuesday 25th November 2008.

¹² <http://news.bbc.co.uk/1/hi/business/4650924.stm>.

ASSOCIATED GAS: NEED TO END FLARING AND INCREASE UTILIZATION

Nigeria's proven natural gas reserve is known to be substantially larger than her oil reserve in energy terms. Gas discoveries in Nigeria are incidental to oil exploration and production activities. As at 2001, over 50% of the gas produced (mainly associated gas) was flared.¹³ Some independent estimates suggest that over 90% of all associated gas is routinely flared at production sites.¹⁴

Gas flaring which contains carbon dioxide (CO₂), sulphur dioxide (SO₂), Methane (CH₄), nitrous oxide (N₂O) has been shown to cause acid rain formation and change in the physiochemical properties of soil. These pollutants dissolved in rain water to form acid rain which damages roofing sheets, leaves, ecosystem and soil. Gas flares have been shown to cause heat and noxious gases which are harmful to health.¹⁵

A Federal High Court sitting in Benin ruled against gas flaring in November 2005, interpreting the practice as a violation of citizens' right to life. Before then, environmental regulations had in general, prohibited gas flaring since January 1984, excepting when a ministerial consent had been lawfully issued and conditions fully complied with, as provided for under Section 3 of the Associated Gas Reinjection Act 1979.¹⁶ Though oil companies claim that they have not been able to end gas flaring because of lack of profitable domestic gas pricing policy in Nigeria and the technological and security challenges of gas capture and transportation in isolated areas, with effect from January 2008, companies have been required to pay a fine of \$3.5 for every 1000 standard cub feet of gas flared. Under this policy, December 31, 2008 was set as deadline for the actualization of total 'flares out'. However, a lack of commitment and political will made it impossible to achieve that target. The target has now been shifted to December 31, 2011.¹⁷

Apart from the environmental imperative to end flaring of associated gas, and judicial order against the practice, there are economic and strategic considerations to support its use for local energy generation. In view of the increasing domestic oil consumption, an economically optimal strategy to replace oil with gas and gas derivatives will ensure the conservation of the oil reserves. Apart from the economic advantage, fuel substitution from oil to gas is more environmentally friendly because gas is a cleaner fuel than oil, producing fewer amounts of greenhouse gasses.

Given the current reserves and rate of exploitation, the expected life-span of Nigeria's crude oil is about 44 years, based on about 2mb/d production, while that for natural gas is over 100 years, based on the 2001 production rate of 1850 bscf¹⁸. The continued flaring of natural gas has resulted in a monumental waste of energy resources, in addition to contributing to environmental pollution. It is therefore imperative to take effective measures to stop gas flaring, in compliance with Nigerian judicial rulings, meeting government's objectives and of course contributing to solving the problems of global warming. There are enormous environmental and economic advantages that can be derived from investments aimed at utilizing currently flared associated-gas for energy generation, as substitute for fuel wood, kerosene, petrol and diesel which are now used in homes and industries.

¹³ National Energy Policy Accessed from www.energy.gov.ng/index.php?option=com_docman&task...

¹⁴ Social Development Integrated Centre (Social Action), "Flames of Hell: Gas Flaring in the Niger Delta", 2009

¹⁵ http://lejpt.utcluj.ro/A06/29_42.htm

¹⁶ http://www.foe.co.uk/resource/press_releases/court_case_result_oil_comp_14112005.html

¹⁷ *Vanguard*, "FG Shifts Gas Flare-Out Deadline to 2011 6 May 2009. Accessed from <http://allafrica.com/stories/200905060528.html>

¹⁸ This Day newspaper, Tuesday 25th November 2008.

Though Nigeria is conventionally a producer of oil, it is now thought that natural gas will play a defining role in the near future. This is because new interest has been spurred in Nigerian gas reserves by the increasing global demand for liquefied natural gas (LNG). These gas reserves were previously considered to be stranded or difficult to transport to global markets. Reserves of associated and non-associated gas are estimated to be over 160 trillion cubic feet - among the 7th largest in the world.¹⁹

The domestic consumption of Nigeria's natural gas resources is far less than the export figures. The US Energy Information Administration reported that, 800 billion cubic feet of natural gas was produced by Nigeria in 2004. However, the country consumed 325 billion cubic feet, and exported 475 cubic feet. Virtually all gas exported and consumed within the country have been non-associated gas, which is not flared and the production or use of which does not contribute to reduction in flaring of associated gas. Presently, Nigeria exports approximately 3 billion cubic feet per day of gas, flares over 2.5 billion cubic feet per day, and supplies only an infinitesimal 0.5 billion cubic feet per day to the domestic power sector. According to an IIED Report, "with so much gas being flared, Nigeria is missing out on significant revenue, while valuable resources are being wasted that could be used by communities for power generation if the appropriate infrastructure were in place".²⁰ In response to calls for greater gas use, the transnational oil companies currently favour high return export options – Liquefied Natural Gas (LNG) and Gas-To-Liquids (GTL). In February 2008, the federal government of Nigeria approved a new gas policy and gas pricing regime aimed at increasing the supply of gas for domestic use. Under the new policy, oil and gas companies are expected to allocate to the strategic domestic sector (which provides electricity for residential and industrial consumption) a specified volume of gas from their reserves at the lowest commercially sustainable prices.²¹ This puts pressure on companies to find locally oriented solutions.

The Russian state company, Gazprom is proposing to support the flare-out technology and harnessing of associated gas for domestic energy generation in return for access to Nigeria's oil and gas blocks. This may raise the bar for other oil and gas companies in the Niger Delta region.

However, the new gas policy has yet to make any meaningful impact on associated gas flaring because it focuses essentially on supplies from the non-associated gas reserves and production. This requires a very high infrastructural cost to gather, process and transport to existing big power plants under the National Integrated Power Project (NIPP). The power plants are either lying fallow or operating at sub-optimal levels, crying of gas shortage with a paltry 230mmscf daily national supply. Rivers and Bayelsa State owned gas turbines fall into this category. This problem can only be solved if small to medium scale power plants are sited very close to flow stations to use up flare bound gas instead of waiting for gas gathering for long distance distribution. That way, some of the problems of environmental degradation and gas wastage would have been solved, while the energy needs of communities in the oil producing region would also be met. To achieve this, the federal and state governments and their parastatals should, more than ever before, be willing to confront the traditional barriers to the utilization of associated gas which include the following:²²

¹⁹ "Nigeria and the Future Global Gas Market", Baker Institute Forum, Houston, May 2006, Accessed from http://www.africaresources.net/ARDCO_Nigerian.pdf

²⁰ <http://www.iied.org/pubs/pdfs/16022IIED.pdf>

²¹ *ThisDay*, "Yar'Adua Approves New Gas Policy" 8 February 2008. Accessed from <http://allafrica.com/stories/200802080607.html>

²² http://www.africancnl.org/downloads/Presentations/GasDevComm_Jacob.ppt

- **Lack of political will to address associated gas flaring and provision of energy for local consumption.**
- **Over concentration on the use of non-associated gas, hence a myopic gas policy.**
- **Weak institutional, legal and regulatory framework for flared (associated) gas.**
- **Unclear associated gas terms in existing oil development agreements.**
- **A weak fiscal system.**
- **Infrastructures needed for the sustainable utilization of associated gas are inadequate and in most cases absent.**
- **The constraints of funding.**

POLICY AND LEGISLATION CHANGES NEEDED

Following years of agitation by oil bearing communities and Nigerian civil society, the Nigerian senate in July 2009 passed the Gas Flaring (Prohibition and Punishment) Bill 2009, which extends deadline of flaring to December 2010 and provides for higher financial penalties and the possibility of shutting down oil fields that default. However, that bill is still stalled at the House of Representatives while the federal executive's preference for a longer deadline may scuttle efforts at progressive legislative changes.

The present government of Nigeria promised at its inception in 2007 that it was going to declare a state of emergency in the power sector. However, as at December 2009, nothing has been done to convince citizens that this statement was more than rhetoric. It has been identified by constitutional experts²³ that one of the impediments to the development of the power industry in Nigeria is the constitutional provision that puts oil and gas matters on the Exclusive Legislative List. Such experts have advocated for the movement of all energy matters to the Concurrent Legislative List. The Exclusive Legislative List contains items identified by the Constitution as ones that only the federal government can legislate on, while the Concurrent Legislative List contains items that both the states and federal government can legislate on. Experts believe that such a constitutional move will make it easier for states and local governments to develop small scale to medium scale power plants near flare points without having to wait endlessly for approval from Abuja.

Traditional barriers to the utilization of associated gas could also be addressed if collaborations are established between relevant government parties and other key interest groups including local communities with the task of formulating, implementing and ensuring transparency in associated gas pricing and flare elimination policies in line with international standards. The government should be encouraged to develop and enforce the following policy options to achieve changes in associated gas use:

- **The '1999 Constitution' should be reviewed to provide for the movement of oil and gas matters from the Exclusive Legislative List to the Concurrent Legislative List to make it easier for states and local governments to generate and distribute electricity to communities under them by situating small scale power plants close to flow stations to utilize flare bound gas.**
- **The Governments at national and state levels, as well as agencies such as the Niger Delta Development Commission (NDDC) should integrate planning and include the setting up of power plants close to flare points for easier access to associated gas.**
- **This should be supported with a comprehensive Gas-to-Power reforms and the support for pilot projects.**
- **Provide financing solutions for gas trunk lines and main electricity transmission infrastructure, including government facilitation of financing.**

²³ Tony Nnadi (2007), Restructuring: A New Nigeria is Possible.

- There should be legislation that makes it mandatory for the nation's associated gas resources to be harnessed and optimally integrated into the national economy, energy mix and industrial processes.
- The nation should put in place necessary infrastructure and incentives to encourage indigenous and foreign companies to invest in utilizing associated gas for energy generation.
- Encourage the oil-producing companies to gather and utilize associated gas in order to eliminate flaring in compliance with judicial order and government goals.
- Encourage small to medium scale off-grid generation and supply of power in remote or isolated areas, including through regional pilot projects



RENEWABLE ENERGY (RE)

Examples of Renewable Energy are solar, wind, hydro, oceanic, geothermal, biomass and other sources of energy that are renewed indefinitely by naturally occurring processes.²⁴ According to the World Council for Renewable Energy (WCRE), the Renewable Energy gotten from non-fossil and non-nuclear sources in replenishing means that its collection, conversion and utilization occur in a sustainable manner that does not have negative impact on the productivity and rights of local communities and natural ecosystems.²⁵

The production and provision of electric power from renewable energy sources is the new global focus with massive advocacy for increased investment in the Research and Development (R&D) of Renewable Energy (RE) technologies. The government of Nigeria has done very little to suggest an understanding of the need for action on developing renewable. The National Energy Policy on Renewable Energy provides for the development and harnessing of the RE resources of the country and the use of same to promote decentralized energy supply. The development and promotion of RE technologies in the country today is the responsibility of the Energy Commission of Nigeria. It is expected that the Commission will use Renewable Energy or Variable Output Technologies to pursue environmental sustainability agenda. Sadly, inadequate funding has affected the few RE trainings, information dissemination, pilot and demonstration projects that the Energy Commission of Nigeria embarked upon in the past few years. The result is that we are still where we were in RE advancement before the Commission was established.

A review of Nigeria's grossly under-utilized Renewable Energy resources, in terms of its potentials, capacity, and development reveals an abundance of resources that can be harnessed to make Nigeria one of the most industrialized countries in the world.



Solar Panel

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http://www.renewablenigeria.org/Status_of_Renewable_Energy_in_Nigeria%5B1%5D.pdf

²⁵ <http://www.wcre.de/en/index.php>

GOVERNMENT INSTITUTIONS RESPONSIBLE FOR GAS AND ENERGY POLICY

Government institutions responsible for gas and energy policy include the Federal Ministry of Energy, Nigeria Electricity Regulatory Commission (NERC), Rural Electrification Agency (REA), Energy Commission of Nigeria (ECN) and the Department of Petroleum Resources (DPR).

Federal Ministry of Energy

The Federal Ministry of Energy formulates policies for oil, gas, electric power, including the policy on renewable electricity. They also monitor and evaluate policy implementation and performance. It is also supposed to be their function to promote and assess the performance of renewable electricity policy locally and to ensure that it is consistent with national responsibilities in international organizations.²⁶ The gas department of the Ministry has not come out firmly against associated gas wastage and the use of same for the setting up of small to medium scale off-grid power plants

Nigerian Electricity Regulatory Commission

The Nigerian Electricity Regulatory Commission (NERC) was established by the EPSR Act 2005 to regulate all activities and practices associated with electricity installation, generation, transmission and distribution in addition to facilitating an efficient industry and market to ensure the full use of resources to provide electricity services.

Rural Electrification Agency

The Rural Electrification Agency was established by the EPSR Act 2005 for the purpose of extending the national grid, facilitating independent off-grid systems, generating renewable energy power and coordinating renewable electricity activities among state and federal agencies.

Energy Commission of Nigeria

Energy Commission of Nigeria was established by Act 62 of 1979 as amended by Acts 32 of 1988 and 19 of 1989 to conduct strategic planning and coordinate all national policies in the energy field with a view to making sure that the sector benefits the government, citizens and private enterprises in an environmentally responsible manner. It has not gone beyond organizing a few pilot and demonstration projects.

Department of Petroleum Resources

The Department of Petroleum Resources was set up primarily to be the overall regulator of the oil and gas industry in Nigeria but its viability as an industry monitor has not manifested after several decades of its existence.

However, these institutions of government have been characterized by a tradition of brazen display of unpatriotic acts, unnecessary partisanship, politicking, widespread corruption and embezzlement. Members of NERC, for example, are currently facing prosecution for embezzlement of the Commission's fund.²⁷

²⁶ http://www.iceednigeria.org/Policy_Guidelines_postconference.pdf

²⁷ <http://allafrica.com/stories/200909220510.html>

RENEWABLE ENERGY UTILISATION

Urgent steps are needed to realize the massive potentials of RE in Nigeria, as part of efforts to achieve energy and development goals. Key barriers to Renewable Energy utilization in Nigeria as identified by Akinbami (2001) include technological incapability, high cost of energy infrastructure, financial constraints, low level of public awareness and inadequate implementation of national energy policy.²⁸ The United Nations Industrial Development Organization (UNIDO) organized a National Stakeholders Forum on Renewable Energy for Rural Industrialization in 2002 with the objective of developing strategies for the generation of employment through rural industrialization, by providing rural people access to clean and reliable energy services. Key priorities for actions for the effective dissemination of RE as recommended during the UNIDO forum include:²⁹

- formulation of a comprehensive energy policy that emphasizes the development of RE resources and technologies.
- conduct of a resource survey and assessment to determine the total RE potential in the country.
- establishment of demonstration projects on various energy forms.
- establishment of a testing and standards laboratory for RE technologies in Nigeria.
- establishment of Renewable Energy funding/financing agency
- strengthening of existing R & D centres and technology development institutions in the country.
- plans for the development of RE applications in their respective jurisdiction should be initiated by concerned agencies of government.

CONCLUSION

The fixing of Nigeria's energy problem should be number one priority of all the tiers government. It must begin with the governments realizing that the way Nigeria can exit mass poverty for it to stop forthwith, the wastage of associated gas in the form of flares and use same for electricity generation and meeting of other energy needs. Gas is cheaper and cleaner than crude oil. The abundance of solar energy and other renewable energy resources also places us at some advantage of being able to utilize renewable energy technologies for rural industrialization by providing rural people access to clean and reliable energy services, which will ultimately lead to the creation of jobs. Over 70% percent of the population of Nigeria lives in the rural areas.²³

As a way forward towards promoting the developmental objectives of the federal, states and local governments for the Niger Delta is to create conditions that encourage collaboration with communities and investors towards developing infrastructure such as small power plants that utilise associated gas and renewable energy sources. These plants should be situated near all the flow stations in the Niger Delta to make use of currently flared associated gas to provide off-grid electricity to communities in the Niger Delta. The advantages of this are that wastage of gas through flaring and environmental degradation arising from that is stopped. Also, energy is provided for the genuine socio-economic development of the region and those flames of hell that fuel discord in the Niger Delta will be put out forever. History has shown that with electricity come industrialization, mass employment, high productivity, wealth and less restiveness.

²⁸ http://www.renewablenigeria.org/Status_of_Renewable_Energy_in_Nigeria%5B1%5D.pdf

²⁹ http://www.unido.org/file-storage/download/?file_id=8605

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