

Post-2015 Development Agenda

Nigeria Perspectives



Energy

SPEAKERS

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Summary: White Paper Report by Isabel Galiana

Nigeria has a rapidly growing economy, fuelled by oil revenues, and is the most populous country in Africa. It was ranked number 39 globally in terms of GDP in 2012; the economy is expected to grow 20-fold by 2050, with Nigeria then reaching 13th place. However, over 68% of Nigerians live on less than \$1.25 a day, compared with a sub-Saharan African average of 40%, so poverty and inequality remain big issues.

Economic growth is hampered by a huge deficit in electricity supplies, despite the country being rich in oil and gas reserves and having tremendous renewable energy potential. The large but under-performing manufacturing sector suffers from regular power outages and load shedding, and small- and medium-sized businesses spend on average 40% of their running costs on self-generation of power. The government has undertaken significant power sector reform and is promoting renewable energy in efforts to improve the situation.

One key potential post-2015 energy target for the country is the removal of energy subsidies, which in 2012 exceeded the national budget for education, health, power and transport. Reform would free up public funds for investment in healthcare, education and energy infrastructure.

Despite being Africa's largest oil producer, Nigeria relies heavily on imported fuels, largely from the European Union. Refineries operate far below capacity because of operational failures, poor maintenance, sabotage and theft and only supply about a quarter of domestic demand even in relatively good years. Subsidies aim to alleviate poverty and maintain price stability, but are a big drain on the economy.

In 2012, the government tried to reform the subsidies for transport fuels, which cost \$8 billion a year, benefitted mainly oil-importing companies and created opportunities for fraud. Embezzlement and mismanagement was reckoned to cause revenue losses of \$1.1 billion a year. However, public disorder and strikes led to reintroduction of partial subsidies, so further reform will not necessarily be easy.

Removal of subsidies would eliminate economic inefficiencies estimated to cost at least \$10 billion. This includes embezzlement and about \$4 billion in subsidised oil products smuggled out of the country and sold at a profit. Total removal of subsidies would boost economic growth by 0.18%, but household incomes would decline. However, removal of half the subsidies and appropriate social transfers to protect the poor would increase rural incomes in the range 2.3-7.6%. Spending one Naira on social protection would pay back over two Naira in the form of subsidy avoided plus increased household incomes. The subsidy avoided could be used to meet two other targets.

The first target is improving access to electricity. Currently, only 45% of Nigerians have access to electricity and the country has one of the lowest rates of electricity generation per capita in the world. In 2012, the Presidential Task Force on Power estimated electricity demand as 12,800MW, with the country only being able to produce 3,400MW. Most businesses use expensive back-up generators and most households use wood, charcoal or animal dung for cooking and heating.

The International Energy Agency estimated that the annual value of the estimated 150,000 barrels of oil lost to theft each day – more than \$5 billion – would be enough to provide all Nigerians with electricity by 2030. But to provide electricity to 93% of the population by 2040 would cost only \$1.6 billion each year and the benefits in terms of household lighting alone would be huge. Overall, benefits of electrification would be worth nearly 30 Naira for each one spent.

The second target is improved access to modern cooking fuels. 115 million Nigerians – 68% of the population – use solid fuels (mainly firewood) burned on inefficient indoor stoves. The indoor air pollution kills 69,000 people each year (4.3 million worldwide) and contributes to millions of days lost to ill-health. Providing improved cooking stoves would save lives and illness, as well as saving time and fuel. On average, a Naira spent on this would give benefits worth over 35 Naira.

For these targets to be met, it is important that the government is able to deal effectively with both corruption and political unrest.

White Paper Report by Isabel Galiana

Nigeria is a 'MINT' country, a member of the new emerging economic giants, along with Mexico, Indonesia and Turkey. Its global rank in terms of nominal GDP in 2012 was 39th and is expected to increase almost 20 fold to 2050 to reach 13th. Nigeria is the only West African member of OPEC and is the sixth largest exporter of oil in the world. It is the most populous country in Africa with over 173 million inhabitants and has a rapidly growing economy largely fueled by oil revenues. Moreover, between 1970 and 2005 petroleum sales contributed about 75 percent of government revenue (Adenikinju, 2009).

It is ranked 20th in the world in terms of GDP at purchasing power parity (ppp) as of 2015, and largest within Africa, on track to become one of the 20 largest economies in the world in terms of Nominal GDP by 2020.

However, economic development is not possible without an energy system that can support it. Moreover, amidst the indicators of progress, the country is still troubled by myriad socioeconomic problems. Over 68 percent of the Nigerian population lives on less than US\$ 1.25 per day as compared with 48 percent in sub-Saharan Africa. Poverty and inequality thus remain significant issues in Nigeria (World Bank, 2013).

Over the years Nigeria's electricity supply capacity has not kept pace with population and industrial growth. The result is a huge power supply deficit. Nearly all residents in urban areas are connected to the national grid. In addition its re-emergent, though currently under-performing, manufacturing sector, the third-largest on the continent, and producing a large proportion of goods and services for the West African region, is negatively affected by outages and load shedding. Nigeria is rich in hydrocarbons and has tremendous renewable power potentials; its biggest challenge is in providing electric power to its teeming population and economy. The lack of grid power has been a setback to the growth of Nigerian businesses as an average of 40% of running costs of small and medium scale businesses is on self-generation of power. This lack of grid power has hindered Nigeria's economic growth.

The Nigerian government has undertaken significant power sector reform and is promoting renewable energy use with a feed-in-tariff program in order to tackle the gap in power generation created by insufficient infrastructure for generating and distributing power from conventional sources of energy. In addition the government has set a 10% and 20% target for renewable power usage in the country until the year 2017 and 2020 respectively. In addition, it has established a "Light up Rural Nigeria Project" which aims to electrify rural areas with renewable energy.

Nigeria's oil production is hampered by instability and supply disruptions, while the natural gas sector is restricted by the lack of infrastructure to monetize natural gas that is currently flared (burned off). Rising security problems coupled with regulatory uncertainty have contributed to decreased exploration. Crude oil production began to decline significantly as violence from militant groups surged, forcing many companies to withdraw staff and shut in production. An example of the consequences of this unrest is the trans-Saharan pipeline. Currently large exports to Europe require the liquefaction and export by more expensive ship. A solution such as the trans-Saharan gas pipeline is compromised due to political instability associated with MEND, Boko Haram and other armed groups. The instability in the area, along with poorly maintained, aging pipelines and pipeline sabotage has resulted in failure to export production, oil spills, and decreased revenues. The Minister of Power, Prof. Chinedu Nebo, warns that gas pipelines are extremely vulnerable to 'vandalism' and recommends using alternatives to traditional electricity

supply chain¹. Greater dependence on minigrid and isolated off-grid solutions including small and medium sized hydro, biomass, wind, and solar power should be used to accelerate development and improve access to energy.

Post 2015 targets – The Nigerian context

Removing energy subsidies

Nigeria has significant opportunities to improve access to energy both in terms of a transition away from solid fuels and by providing electricity access to a larger segment of its population. The fuel subsidy reported for 2012 exceeds the total allocation to other critical sectors in the 2012 budget such as education (N400.15 billion), Health (N282.77 billion), power (N161.42 billion) and transport (N54.83 billion). Reform is most effective when revenue is recycled into health care, education and investment in energy infrastructure (Ekong, 2014). Despite being Africa's largest petroleum producer, Nigeria relies heavily on imported petroleum products, principally fuels, which are primarily imported from the European Union (Narayanan et al., 2012). Refineries operate far below capacity due to operational failures, poor maintenance, sabotage on petroleum pipelines feeding refineries, theft, and fire and some estimates (Rice, 2012) suggest that even in 'good' years, domestic refineries have satisfied only 25 percent (maximum) of domestic consumption. These subsidies exist with the aim of alleviating poverty and maintaining price stability, however the fuel subsidy contributes strongly to the deterioration of Nigeria's government balance (IMF 2013).

On January 1, 2012, Nigeria attempted to reform its subsidies for transportation fuels, which cost the government \$8 billion per year (Brookings 2014) stating that it caused market distortions, encumbered investment in the downstream sector, supported economic inequalities (as rich fuel-importing companies were the main beneficiaries), and created a nebulous channel for fraud. In addition, a report by a Presidential Commission put the revenue losses associated with embezzlement and mismanagement of the fuel subsidy program at about \$1.1 billion.² After the government ended the fuel subsidies, prices for gasoline and other goods more than doubled, with gasoline jumping from \$1.70 per gallon to \$3.50 per gallon. In response, the country's labor unions organized strikes across Nigeria, and tens of thousands of protesters marched in opposition to the price increases. People died, the country was paralyzed, and the government restored the subsidies in short order.³ However, the government quickly reversed course about two weeks later and reinstated a partial subsidy as public outcry and massive strikes organized by oil and non-oil unions threatened to shut down oil production. The biggest beneficiaries of the subsidies have been importing companies and local wholesalers that smuggle some of the subsidized fuel into neighbouring countries selling it at higher prices. The share of poor households in total fuel consumption, and thus the total subsidy volume, is lower than the share of rich households. Umar and Umar (2013) find the richest 20 percent of households in Nigeria benefitting more than four times as much from the fuel subsidy in Nigeria than the poorest 20 percent. The predominant view in Nigeria is that any petroleum product price increase will cause inflation and reduce economic welfare (Adenikinju, 2009). Low fuel prices are considered the only benefit of the subsidy to the people of Nigeria, where more than half its population is living under poverty in this oil-rich country.

¹ <http://allafrica.com/stories/201505060646.html>

² <http://www.brookings.edu/research/opinions/2012/01/10-fuel-subsidies-nigeria-songwe>

³ <https://www.americanprogress.org/issues/green/news/2015/03/12/108382/making-subsidy-reform-stick/>

The economic inefficiency associated with fuel subsidies, represents the benefits of the subsidy removal. The estimated direct cost of revenue losses associated with embezzlement and mismanagement of the fuel subsidy program at about \$1.1 billion. In addition, large quantities of oil products are smuggled across Nigeria's borders and sold for a profit in neighbouring countries valued at ~\$4 billion (IISD 2012). The central bank of Nigeria estimates losses related to the opportunity costs of fuel subsidies in 2011 at over \$12.4 billion (Iba & Otti, 2011). In the power sector alone, Vagliasindi, (2013) finds that the hidden costs associated with underpricing amount to 1.25% of GDP. Total economic inefficiency associated with the subsidies is estimated at a conservative \$10 billion.

Costs are based on the impacts of the fuel subsidy on the poorest segments of Nigeria society. Siggig (2014) finds that with appropriate transfers after a 50% reduction of subsidies on imports, real income increases for all rural households ranging from 2.3% percent to 7.6%. In the case of Siggig's 50% reduction with social assistance transfers, the net benefits in terms household income increases are greater than the costs of the social protection program. For a total removal of subsidies and without transfers, GDP increase 0.18% and overall economic efficiency improves, however household income declines by 1.5%. This represents a loss of ~7.8 \$billion.

Total subsidy removal – no social assistance

Benefits: 10 \$billion

Costs: 7.8 \$billion

BCR: 1.3

50% subsidy removal with social assistance program for low-income households

Benefits: 5 (1/2 the cost of the subsidy)+2.36 to 7.81 \$billion (increase in rural income)

Costs: 4.55 \$billion (Social protection programme)

BCR: 1.6-2.8

Improve access to Electricity

Nigeria's power sector suffers from poor maintenance of electricity facilities, natural gas supply shortages, and an inadequate transmission and distribution network. Only 45% of Nigerians have access to electricity. Nigeria has one of the lowest rates of net electricity generation per capita in the world. Those with access to electricity face load shedding, blackouts, and a reliance on private generators⁴.

⁴ <http://www.eia.gov/countries/country-data.cfm?fips=NI>

	Population without electricity millions	National electrification rate %	Urban electrification rate %	Rural electrification rate %
Africa	622	43%	68%	26%
Sub-Saharan Africa	621	32%	59%	16%
Nigeria	93	45%	55%	35%

Nigeria's generation capacity was 6,090 megawatts (MW) in 2012, of which 3,960 MW (65%) was from fossil fuel sources, 2,040 MW (33%) was from hydro sources, 88 MW from biomass and waste (1%), and 2 MW (<1%) from wind. Net electricity generation falls well below capacity and was 27 billion kilowatthours (3,080 MW) in 2012, or nearly half of capacity. On 7 July 2014, Nigeria's Presidential Task Force on Power estimated that electricity demand in Nigeria stood at 12,800 MW, while the country was only able to produce 3,400 MW⁶. Businesses often purchase costly generators to use as back-up power supply during outages. Most Nigerians use off-grid traditional biomass and waste, such as wood, charcoal, and animal dung, to fulfill household energy needs, such as cooking and heating. Nigeria has set ambitious goals to increase generation capacity. Nigeria plans to increase generation from fossil-fuel sources to more than 20,000 MW by 2020. Nigeria plans to increase hydroelectricity generation capacity to 5,690 MW by 2020, almost tripling the capacity from the 2012 level.

According to the IEA (2014c) the value of the estimated 150 thousand barrels lost to oil theft each day – amounting to more than \$5 billion per year – would be sufficient to fund universal access to electricity for all Nigerians by 2030. In the Africa Energy Outlook (IEA 2014c) African Century Case cumulative investments necessary to reduce the share of the population without access to electricity to 7% in 2040 is \$42.6 billion, 1.6 billion per year.

Current consumption is 24billion kWh but demand is closer to 108 billion kWh. Demand is expected to grow by ~80% to 2040⁷. The welfare gain associated with household lighting alone could be \$0.15-\$0.65 per kWh (IEG, 2013) in rural areas. Applying this range to the total net electricity requirement of 170 TWh results in benefits ranging from \$25 to \$110 billion. A more recent study found that the willingness to pay for electricity in Ghana was in the \$0.2734/kWh (Twerefou, 2014). Using this more modest value, the benefits attributable to universal electrification are \$46 billion per year once the target has been met.

Benefits: \$25 – 110 billion

Costs: \$1.6 billion

BCR: 15 - 69

⁵ initial threshold level of electricity consumption for rural households is assumed to be 250 kilowatt-hours (kWh) per year and for urban households it is 500 kWh per year.

⁶ <http://africacheck.org/reports/are-electricity-tariffs-in-nigeria-really-the-lowest-in-africa/#sthash.Zjbi9uQQ.dpuf>

⁷ https://www.iea.org/media/news/2014/press/141013_WEO_Africa_Energy_OutlookFactsheet2.pdf

Improve access to modern cooking fuels

Traditional use of biomass for cooking in Africa - 2012 (IEA 2014b)

Region	Population relying on traditional use of biomass millions	Percentage of population relying on traditional use of biomass %
Africa	728	67%
Sub-Saharan Africa	727	80%
<i>Nigeria</i>	<i>115</i>	<i>68%</i>

Sixty eight percent (115 million people) of Nigerians do not have access to modern cooking fuels slightly more than the African continental share but better than Sub-Saharan Africa. The three major cooking energy sources in Nigeria are fuelwood/charcoal/dung, kerosene and LPG, with fuelwood making up the largest share. In Nigeria, wood is gathered and processed in the rural areas and exported and sold in the urban areas but wood is now becoming scarce in Nigeria even in the rural areas. Traditional biomass (i.e., animal dung, leaves, grasses and firewood) burnt indoors for cooking leads to illness and death from the associated indoor air pollution, which causes respiratory diseases and lung cancer.

Globally, indoor air pollution (IAP) is the world's deadliest environmental problem – killing 4.3 million people per year. The impacts of the use of modern cooking fuels is measured in the years of life lost or illness suffered, adjusted for severity known as disability adjusted life years or DALYS⁸. The health benefits from modern fuel access results from the avoided morbidity and mortality that are currently attributable to indoor air pollution (IAP). The current 115 million people without access to clean cooking facilities (68%) lead to 69 000 deaths per year.⁹ In terms of avoided morbidity benefits, WHO (2009) estimates that over 4 million DALYS are attributable to negative health impacts of indoor air pollution. Using a low estimate of \$1,000 and a high value of \$5,000, the avoided health costs are \$4.1- \$20.5 billion per year.

If modern cooking stoves are provided, about a 30% reduction in DALYS are anticipated as modern stoves will not immediately and completely alleviate all IAP costs. This would result in an annual benefit of \$0.97

⁸ DALYS are disability adjusted life years--" One DALY can be thought of as one lost year of "healthy" life. The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced

⁹ <http://www.healthdata.org/search-gbd-data?s=Nigeria%20Household%20air%20pollution>

- \$4.9 billion. Additional benefits in terms of time savings (\$561 million)¹⁰ and fuel savings (\$772 million)¹¹ would also be incurred (Larsen 2014).

In the Africa Energy Outlook (IEA 2014c) African Century Case, cumulative investments necessary to reduce the share of the population without access to clean cooking facilities to 16% in 2040 is \$2.6 billion, approximately \$100 million/year. Larsen (2014) estimates are closer to \$200 million/year.

Benefits: \$2.3 - \$6.2 billion

Costs: \$100 - 200 million

BCR: 11.5 - 62

Conclusion

Nigeria is an energy giant with significant challenges in terms of infrastructure and political instability. Eliminating fossil fuel subsidies and reallocating these funds to electrification and modern cooking fuels will have enormous benefits both in terms of development in the poorest regions but also in growth of the already significant manufacturing sector. The greatest caveat will be the government's ability to deal with corruption and political unrest.

Target	Benefit-Cost	Revised target	Comments
Eliminate fuel subsidies	1.3 1.6-2.8 (revised)	Reduce fossil fuel subsidies by half and provide social assistance	Elimination of fuel subsidies without compensating transfers negatively affects the poorest.
University access to electricity	15-69 (revised)	Provide access to electricity to 93% of the population	Due to political instability mini-grid and off-grid solutions should be considered.
Universal Access to Modern Cooking Fuels	11.5 - 62 (revised)	Access to Modern Cooking Fuels to 84% of the population	This new target is consistent with the IEA African Century Case

¹⁰ Avoided illness, reduced biomass collection, and improved cooking efficiency

¹¹ Improved cookstoves and modern fuel stoves provide fuel savings

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Post-2015 Development Goals

Energy in Nigeria
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Current State of Affairs: Energy supply



- Only West African OPEC member
- Sixth largest exporter of oil in the world
- Significant natural gas resources exported as LNG, primarily to Europe
- Weak refining capacity – results in need to import fuel
- In 2014, Nigeria produced 2.4 million bbl/d of petroleum and other liquids
- The country's oil and natural gas industry typically accounts for 75% of government revenue and 95% of total export revenue

Current State of Affairs: Oil

- Four oil refineries with a combined crude oil distillation capacity of 445,000 bbl/d
- Combined refinery utilization rate was 22%
- As a result, the country must import petroleum, although its refinery nameplate capacity exceeds domestic demand. Nigeria imported 164,000 bbl/d of petroleum products in 2013
- Nigeria is the leading oil producer in Africa, production suffers from supply disruptions, which have resulted in unplanned outages as high as 500,000 barrels per day (bbl/d)

Issues in oil

- Local groups seeking a share of the wealth often attack the oil infrastructure
- Oil theft leads to pipeline damage that is often severe
- Natural gas flaring, the burning of associated natural gas that is produced with oil, has contributed to environmental pollution
- Lack of discoveries and the presence of the militant group Boko Haram put exploration at a standstill

Current State of Affairs: Natural gas

- Ranked among the world's top 30 largest natural gas producers ... exported about 800 Bcf of LNG in 2013, ranking Nigeria among the world's top five LNG exporters
- An estimated 180 trillion cubic feet (Tcf) of proved natural gas reserves as of January 2015
- Natural gas production is constrained by the lack of infrastructure to monetize natural gas that is currently being flared.
- Affected by the same security and regulatory issues that affect the oil industry
- A significant amount of Nigeria's gross natural gas production is flared (burned off) because some of Nigeria's oil fields lack the infrastructure needed to capture the natural gas produced with oil, known as associated gas.

Current State of Affairs: Energy access

- Over 68 percent of the Nigerian population lives on less than US\$ 1.25 per day
- Fuel subsidies exist with the aim of alleviating poverty and maintaining price stability
- Only 45% of Nigerians have access to electricity, one of the lowest rates of net electricity generation per capita in the world
- Sixty eight percent (115 million people) of Nigerians do not have access to modern cooking fuels

Current State of Affairs: Energy consumption

- 2012 total primary energy consumption in Nigeria was about 4.5 quadrillion British thermal unit (Btu). Of this amount, traditional biomass and waste (typically consisting of wood, charcoal, manure, and crop residues) accounted for 80%.
- This high share represents the use of biomass to meet off-grid heating and cooking needs, mainly in rural areas.
- Nigeria's generation capacity was 6,090 megawatts (MW) in 2012 (of which 3,960 MW (65%) was from fossil fuel sources) and plans to increase generation from fossil-fuel sources to more than 20,000 MW by 2020.

Removing energy subsidies

- Cost the government \$8 billion per year
- Losses associated with embezzlement and mismanagement of the fuel subsidy program at about \$1.1 billion
- The richest 20 percent of households in Nigeria benefitting more than four times as much from the fuel subsidy in Nigeria than the poorest 20 percent
- Subsidy as it is increases inequality, inefficient use of fuels and

Improve access to modern cooking fuels

- 68% (115 million people) of Nigerians do not have access to modern cooking fuels
- leads to 69 000 deaths per year
- 4 million DALYS are attributable to negative health impacts of indoor air pollution
- avoided health costs are \$4.1- \$20.5 billion per year

Improve access to Electricity

- Only 45% of Nigerians have access to electricity
- Those with access to electricity face load shedding, blackouts, and a reliance on private generators
- Nigeria's power sector suffers from poor maintenance of electricity facilities, natural gas supply shortages, and an inadequate transmission and distribution network.
- The welfare gain associated with household lighting alone could be \$0.15-\$0.65 per kWh (IEG, 2013) in rural areas

Recommended targets

Target	Benefit-Cost	Revised target	Comments
Removing energy subsidies	1.3 - 2.8	Reduce subsidies by 50% and ensure appropriate transfers	Significant cultural and political resistance to removal
Improve access to electricity to 100%	1.54 - 2.74	Improve access to electricity to 93%	Reliability of the system will be key
Improve access to modern cooking fuels	11.5 - 62	Reduce share without access to 16% from 68%	This is the priority target