

Quantification of Direct and External Cost and Benefit of providing Energy Access in Africa

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Introduction

- The International Energy Agency (IEA) defines access to modern energy as “a household having reliable and affordable access to clean cooking facilities, a first connection to electricity and then an increasing level of electricity consumption over time to reach the regional average” (IEA 2011).
- Akin, Iwayemi suggests that there is potentially a “strong feedback relationship between the energy sector and the national economy.

Background of Study

- 1.2 billion people are without access to electricity and more than 2.7 billion people rely on the traditional use of biomass for cooking, which causes harmful indoor air pollution(*World Energy Outlook, 2015*).
- More than 95% of those living without electricity are in countries in sub-Saharan Africa and developing Asia, and they are predominantly in rural areas (about 80% of the world total). While still far from complete, progress in providing electrification in urban areas has outpaced that in rural areas two to one since 2000.
- Sub-Saharan Africa has now become the most electricity poor region in the world in terms of the total number of people (surpassing Asia), as well as the share of its overall population.
- The African continent is a net exporter of energy . In 2009 the net energy export was 40% of the energy production 13,177 TWh.

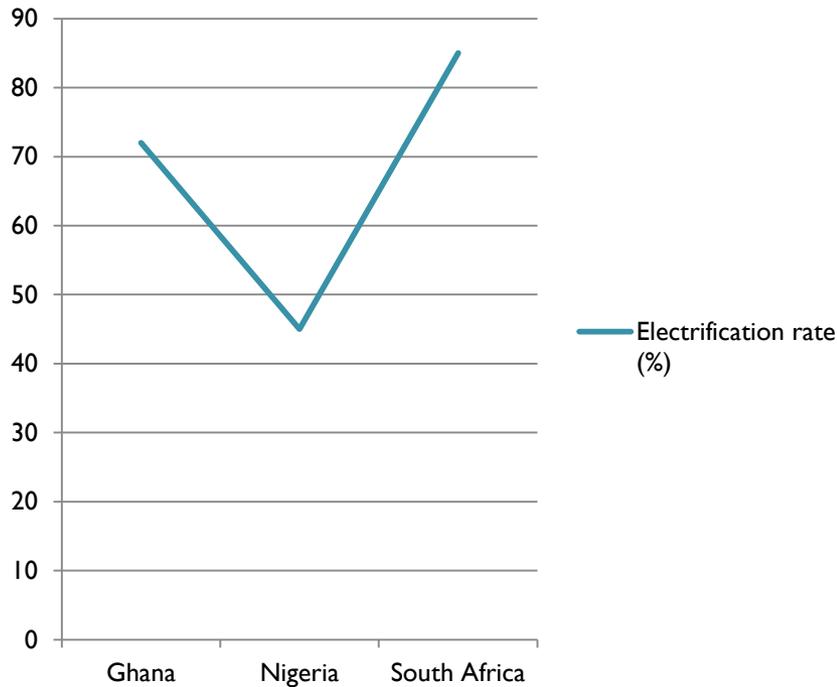
Energy access challenge

- According to the Africa Society, the population growth of sub-Saharan Africa is 2.2% annually; therefore, by 2025, it is estimated that Africa will consist of over a billion people.
- Electrical service in Sub-Saharan Africa also costs more than in other parts of the world. The protective tariff required in Sub-Saharan Africa is \$0.13 USD, compared to \$0.04-\$0.08 USD in the rest of the developing world.
- One of the sustainable development goals is to ensure access to affordable, reliable, sustainable and modern energy for all.

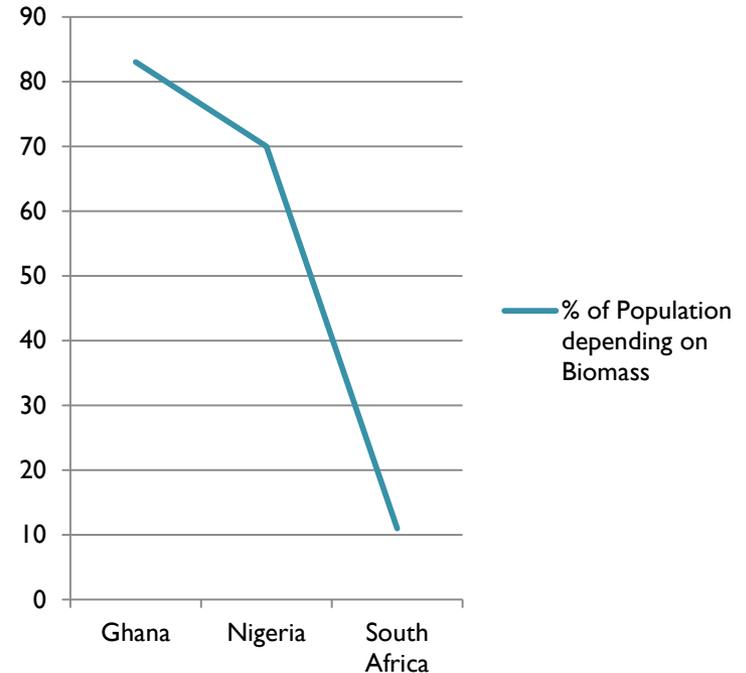
Research Problem

- Electricity access in Sub-Saharan Africa is about 24%, with an annual consumption of 518kwh; this is the amount of energy consumed by an individual in a developed country.

Electrification rate (%)



% of Population depending on Biomass



Objective and Methodology of Study

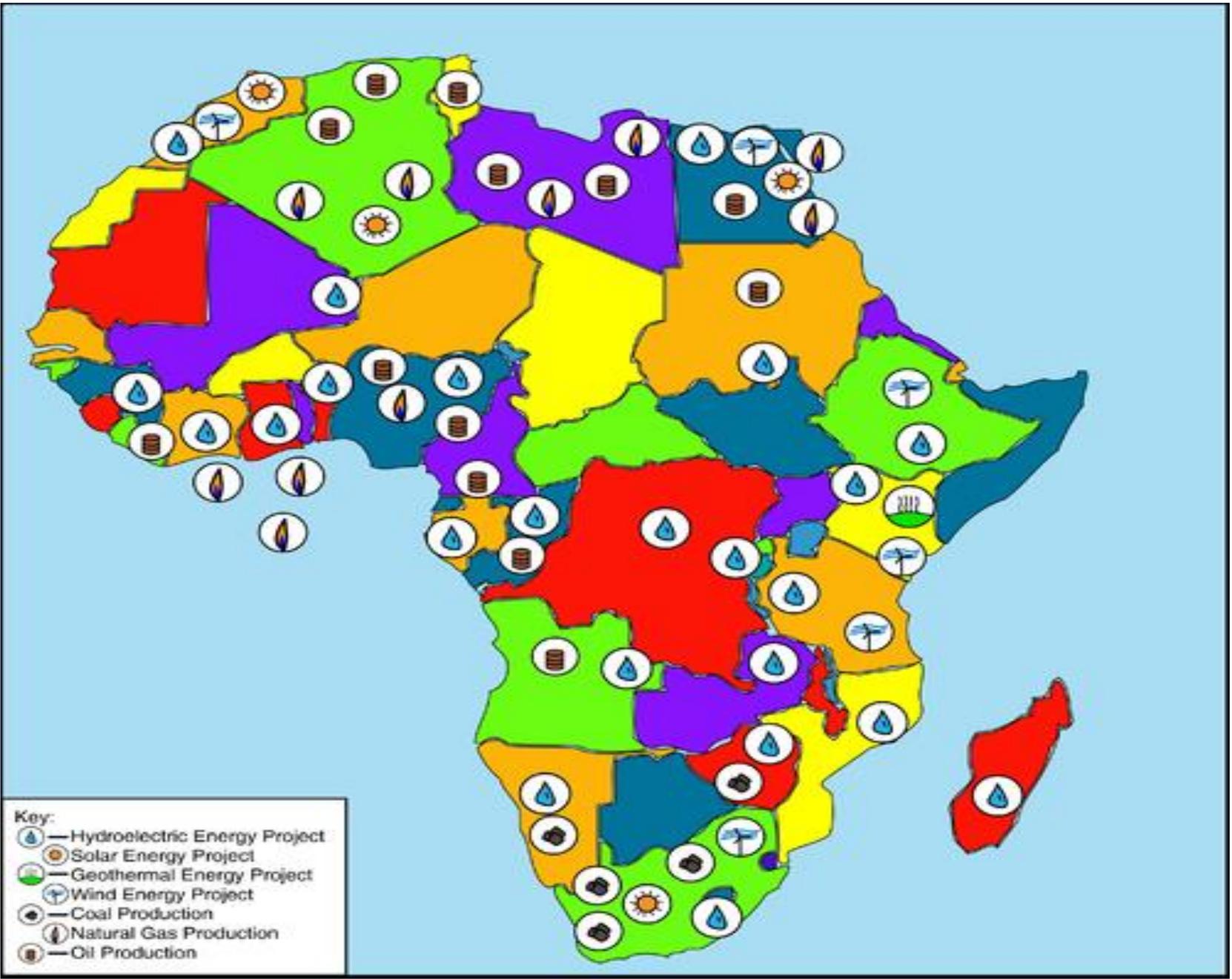
- This study investigates ways of addressing the issue of availability of modern energy in terms of accessibility, affordability, advantages and acceptability of modern energy.
- In order to provide evidence-based solutions, the paper will utilize qualitative approach to investigate the benefit and cost of energy access in South Africa, Ghana, and Nigeria.
- In addition, the issue of energy access has both supply and demand dimensions. The supply side of energy access will be focusing on how renewable energy resources can be utilized in meeting energy demand.

Past and Present Energy projects

- In South Africa, the national electrification program took effect from 1994-1999 which was aimed at connect 2.5 million households making electrification rate increase to 66%(NER, 2011).
- By 2002, over 338,000 homes, 974 schools and 49 clinics were grid electrified as well as 5321 SHSs installed.
- The Electrification program cost over R7billion which was financed mainly by Eskom. In 2001 the state government took over funding of capital cost.

Past and Present Energy Project

- Ghana has set itself a target of achieving universal access to electricity by the year 2020. as at 2008, 66.7% national coverage has been achieved. As at 2011, national coverage had risen to 72%. Targets have been set for the contribution of renewable energy-mix.
- Nigeria's minister of Power has stated that Nigeria has the capacity to generate 12,000MW. The energy sector in Nigeria has suffered a lot of set back arising from lack of Government commitment to poor domestic utilization of her natural resources, leaving about 50% of its citizens without electricity.
- Recently, the Government in collaboration with UNDP has launched the installation of solar power grids in six communities in the six geo-political zones across the country. The project cost over N75.8billion



Data Analysis

- This section provides a qualitative analysis of the benefits and costs of energy access in South Africa, Nigeria and Ghana through linking with the performance of each of the economy.

Source of data

- The paper utilizes secondary data obtained from the World Bank World Development Indicators (WDI) 2016 as well as policy documents especially on energy related matters in order to conduct its qualitative analysis.

Data Analysis

- **Table I: Electricity access in S/Africa**

	1990	2000	2010	2012
Access to electricity (% of population)	65.0	66.1	82.7	85.4
Access to electricity, rural (% of rural population)	28.0	37.1	64.1	66.9
Access to electricity, urban (% of urban population)	99.1	88.1	94.3	96.6
Electric power consumption (kWh per capita)	4431	4681	4581	4407
Electric power transmission and distribution losses (% of output)	6.0	8.2	9.5	8.7
Renewable electricity output (% of total electricity output)	0.6	0.7	1.0	1.0
Renewable energy consumption (% of total final energy consumption)	16.6	18.5	16.9	16.9

• Table 2: Electricity access in Ghana

	1990	2000	2010	2012
Access to electricity (% of population)	30.6	45	60.5	64.1
Access to electricity, rural (% of rural population)	6	20.9	38.2	41.0
Access to electricity, urban (% of urban population)	73.5	75.7	81.7	85.0
Electric power consumption (kWh per capita)	327	334	283	348
Electric power transmission and distribution losses (% of output)	3.1	19.5	23.2	21.5
Renewable electricity output (% of total electricity output)	100.0	91.5	68.8	67.1
Renewable energy consumption (% of total final energy consumption)	80.6	73.5	56.6	49.5

Source: WDI, 2016

- **Table 3: Electricity access in Nigeria**

	1990	2000	2010	2012
Access to electricity (% of population)	41.8	44.9	48.0	55.6
Access to electricity, rural (% of rural population)	25.1	27.9	34.9	34.4
Access to electricity, urban (% of urban population)	72.5	68.0	61.6	83.6
Electric power consumption (kWh per capita)	86.7	74.1	135.6	155.9
Electric power transmission and distribution losses (% of output)	38.4	38.1	17.2	8.7
Renewable electricity output (% of total electricity output)	32.6	38.2	24.4	19.7
Renewable energy consumption (% of total final energy consumption)	87.8	86.2	86.8	86.5

Source :WDI,2016

- Table 4: Structure of South African and Ghana Economy

	1990	2000	2010	2012
GDP growth (annual %)	-0.3	4.2	3.0	2.2
GDP per capita (constant 2005 US\$)	5068.1	4854.4	5910.7	6051.3
GDP per capita growth (annual %)	-2.3	1.7	1.5	0.7
GDP per capita, PPP (constant 2011 international \$)	10363.8	9926.9	12086.9	12374.5

	1990	2000	2010	2012
Gdp Growth (Annual %)	3.3	3.7	7.9	9.3
Gdp Per Capita (Constant 2005 Us\$)	376.6	445.9	605.0	717.9
Gdp Per Capita Growth (Annual %)	0.5	1.3	5.2	6.7
Gdp Per Capita, Ppp (Constant 2011 International \$)	1919.6	2272.7	3083.9	3659.2

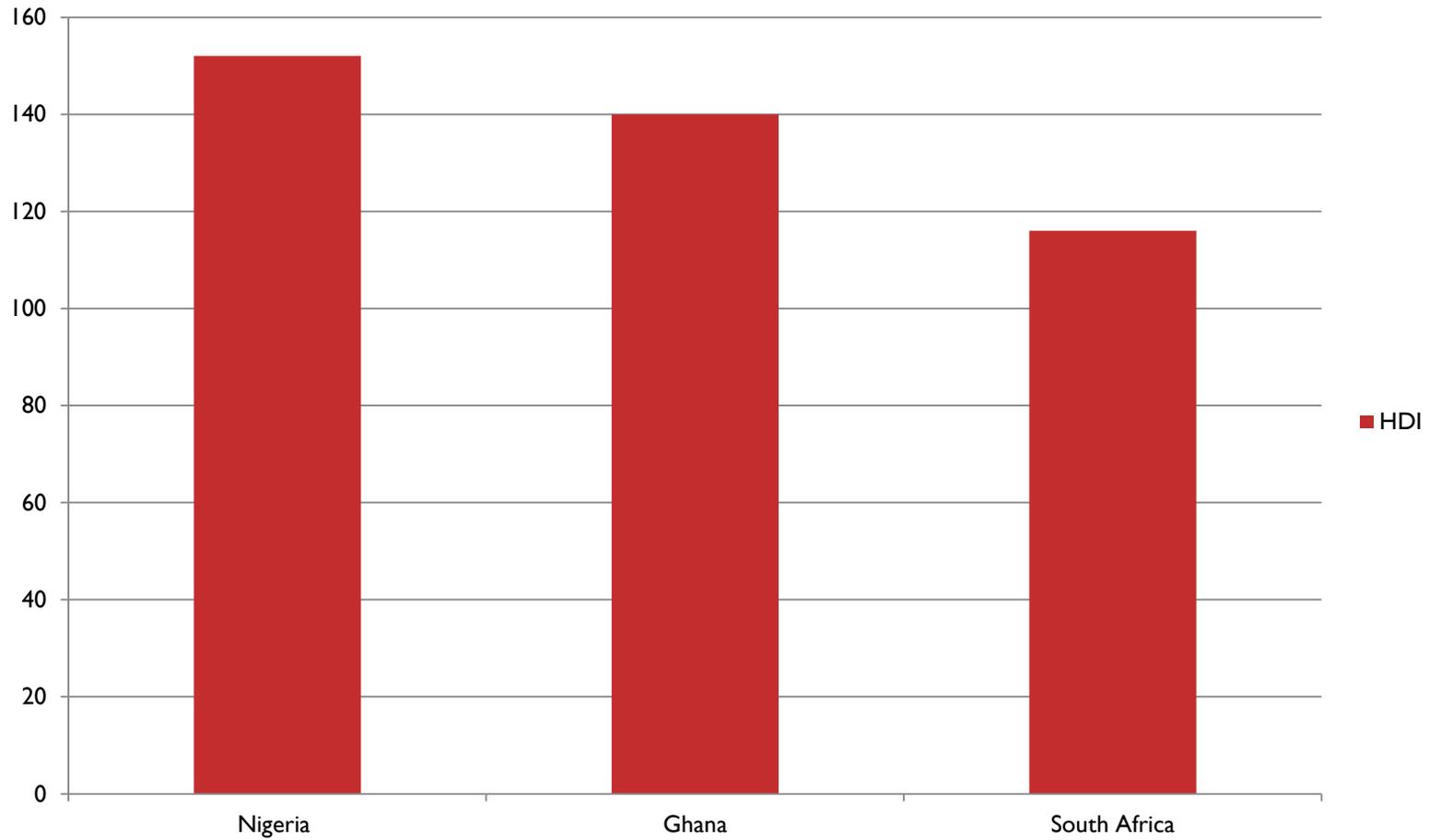
Source: WDI, 2016

- **Table 5: structure of Nigerian Economy**

	1990	2000	2010	2012
GDP growth (annual %)	12.8	5.3	7.8	4.3
GDP per capita (constant 2005 US\$)	590.1	552.2	997.4	1033.8
GDP per capita growth (annual %)	9.9	2.7	5.0	1.5
GDP per capita, PPP (constant 2011 international \$)	3030.5	2836.0	5122.8	5309.5
	1990	2000	2010	2012
Industry, value added (% of GDP)	45.3	52.2	24.9	26.7
Manufacturing, value added (% of GDP)	5.5	3.7	6.6	7.8
Services, etc., value added (% of GDP)	23.2	21.8	51.2	51.2

Source: WDI, 2016

HDI



Benefits of providing energy access in Africa

Energy is Central to nearly every major challenge and opportunity the world faces today.

It provides the following benefits :

- Improves Economy
- Increases food Production
- Improved standard of living
- creation of jobs
- Access to better health care
- Access to quality education and better learning environment
- Attraction of foreign investment
- Energy security

Future Energy Trend in Africa

- It has been estimated that by 2040, energy consumption level will increase to 1,600 tetra watt hours.
- Most of the energy will come from solar which has about 10 terawatts of potential capacity, 400 gigawatts of gas generated power, 350 gigawatts of hydro, 300 gigawatts for coal, 109 gigawatts of wind capacity and 15 gigawatts of geothermal.
- 25% of the total energy in 2040 would come from clean energy (Renewables)

Future Energy Trend in Africa cont'd

- The cost of supply this energy across Sub-Saharan Africa will cost about \$490 billion dollars for new generating capacity plus another \$345 billion for transmission and distribution.
- Renewable energy generation is one of the game changer that will shape the landscape in the sub-saharan Africa over the next 25 years.
- Study has shown that regional integration will save more than 40 billion in capital spending, therefore there is need for synergy between countries and private investors.

Conclusion

- Expanding energy access requires huge amounts of financial resources. This might be difficult to any government to provide the needed financial resources to scale up the energy access. The difficulty arises from a continuous fall in government revenue as a result of a recent drastic decline in the global crude oil prices. Despite abundant coal resources in Nigeria, the cost of acquiring technologies to make the resources clean is very expensive.
- All in all, empirical studies have found that electricity system in the selected countries still depends on two or three types of fuels in generating electricity and which invariably leads to less diversity in the sector. Less diversity in the sector buttresses its failure to achieve supply security in the electricity as indicated in their Shannon-Weiner index. Therefore, there is a need for a robust energy mix.

Policy Recommendation

- Conducting electricity access planning on regular basis in order to determine seasonal demand profiles of electricity consumption in the area where energy access is to be provided.
- Developing a sound, spatially disaggregated energy resource database over different period in a year
- Electricity tariffs should reflect cost of electricity and cost should be transparent.
- Government should demonstrate sincere commitment by providing regulations and infrastructure that will promote energy access across the continent.

Acknowledgement

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