ENERGY SECURITY:
CHALLENGES & PROSPECTS
IN NIGERIA

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Presentation Outline

- Background
  - Energy & the economy
  - Energy & the environment
- Energy Security Anchors
  - Availability
  - Affordability
  - Accessibility
  - Sustainability
- Nigeria: A case study in SSA
  - Challenges
  - Outlook
- Concluding Remarks
Energy Security Components

- Availability
- Accessibility
- Sustainability
- Affordability
Energy Security Components

- **Energy Availability Determinants**
  - massive investment is required
  - diversification of energy sources
  - geopolitics and energy trade policy
  - sufficiency relative to demand
  - durability of energy flow irrespective of unforeseen factors

- **Energy Affordability Features**
  - the importance of price for the end users
  - market structure
  - public policy instruments
  - regulatory institutions and governance structure
Energy Security Elements

- **Energy Access Notables**
  - It is not about access to energy sources
  - energy requirements must be met in terms of security of energy flow;
  - social development in terms of economic output expansion and improved quality of life;
  - pricing of energy is also key to accessibility

- **Energy Sustainability Drivers**
  - environmental acceptability;
  - uninterrupted flow to end-users;
  - global equity & geopolitics & trade
GLOBAL ENERGY CONSUMPTION

Primary Energy Consumption

Energy consumption by region

- Other
- Africa
- Other non-OECD Asia
- India
- China
- OECD

BP Statistics 2016
Nigeria’s per capita electricity consumption is amongst the lowest in the world and far lower than many other African countries.

Nigeria’s per capita electricity consumption is just 7% of Brazil’s and just 3% of South Africa’s.

Brazil has 100,000 MW of grid-based generating capacity for a population of 201 million people.

South Africa has 40,000 MW of grid-based generating capacity for a population of 50 million people.
Social Progress Index vs Energy per country

Liter Oil Per Day (Per Capita, Energy Equivalent)
Not all shipping and aviation energy included
FUNDAMENTAL ENERGY SECURITY
ISSUES OF CONCERN FOR NIGERIA

- Tackling energy poverty and doing it in a sustainably manner in both the short run and long run require massive investments.
  - Is privatization the answer to energy investment requirements in Nigeria?
- Energy access in Africa especially Nigeria is paramount for the attainment of global energy security.
  - In Nigeria, energy access is constrained by inadequate and intermittent power in on-on grid areas and off-grid supply options are currently expensive
  - 600 MM SSA has no access to electricity and about 15% are in Nigeria
- Comparative advantage dilemma
  - The shift in supply route and low oil prices is changing the geopolitical dynamics of the international petroleum market.
  - Uneven distribution of energy resources and geopolitics of energy trade premised more on the ability to pay than potential energy need
- Morality of energy use, population growth, and climate change policy demands
Global Electricity Generation (Terawatts-hours)

Electricity Generation

- North America: 21.8%
- South & Central America: 5.4%
- Europe & Eurasia: 22.0%
- Middle East: 4.5%
- Africa: 3.2%
- Asia Pacific: 43.2%

BP Statistics 2016
GLOBAL CARBON EMISSIONS (MILLION TONNES CARBON OXIDE)

Carbon Emissions By Regions

North America: 19.4%
South & Central America: 4.1%
Europe & Eurasia: 18.5%
Middle East: 3.6%
Africa: 3.6%
Asia Pacific: 47.9%

BP Statistics 2016
FUNDAMENTAL ENERGY SECURITY CHALLENGES FOR NIGERIA

- Dependence on petroleum, especially natural gas, yet there has been no workable natural gas policy framework over the years.
- Treatment of energy resources as a source of revenue rather than as a source of power for economic development.
- Weak and instability in energy policy and regulatory institutions to implement laudable power and petroleum sector reform, define standards, and design implement policy incentives.
- Energy diversification agenda premised on energy sector reforms seems destined to fail for lack of policy coherence, political willpower and transparency in energy sector governance.
- From a short-term energy security perspective, the ability to respond to supply-demand balance is low due to aging and poor maintenance of power generation plants, transmission and distribution infrastructures.
- Lack of timely investments to upgrade infrastructure necessary to supply durable energy services for economic development affects long-term energy security goals.
FUNDAMENTAL ENERGY SECURITY CHALLENGES FOR NIGERIA--Population
**Electricity Demand Projections**

- **4-Scenario Approach**
- **GDP based**
  - 7% growth - Scenario 1
  - 10% growth - Scenario 2
  - 11.5% growth - Scenario 3
  - 13% growth - Scenario 4

Source: Iledare & Onwuka, 2015
FUNDAMENTAL ENERGY SECURITY CHALLENGES FOR NIGERIA—Energy Mix

U.S. 2014 Electricity Generation By Type

- Other: 1.2%
- Renewables: 13.2%
- Nuclear: 19.5%
- Natural Gas: 27.4%
- Coal: 38.8%

Nigeria Energy Mix 2014

- Oil: 16%
- Hydro Power: 21%
- Natural Gas: 63%

Onwuka & Iledare (2015)
ENERGY SECURITY PROSPECTS IN NIGERIA: Resource Potential is High

- Fossil energy resources and reserves potential is high
- Estimated potential of non-fossil fuel energy resources is of large quantity
- Potential for high return on investment in energy technologies that ensure energy efficiency is high
- Youthful workforce waiting to be properly developed is an asset in waiting for the energy
- Diversification of energy resources and domestication of energy resource use have gripped the nation.
- Following the world trend towards energy sustainability is expected to bring the require investments
## ENERGY SECURITY PROSPECTS IN NIGERIA: Fossil Fuel Potential

<table>
<thead>
<tr>
<th>S/N</th>
<th>Resource Type</th>
<th>Reserves</th>
<th>Production</th>
<th>Domestic Utilization (Natural Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Natural Units</td>
<td>Energy Units (Btoe)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Crude Oil</td>
<td>37.1 billion barrels</td>
<td>5.06</td>
<td>2.35 million barrels/day</td>
</tr>
<tr>
<td>2</td>
<td>Natural Gas</td>
<td>180.5 Trillion SCF</td>
<td>4.54</td>
<td>50.1 billion SCM/day</td>
</tr>
<tr>
<td>3</td>
<td>Coal and Lignite</td>
<td>2.175 billion tonnes</td>
<td>1.92</td>
<td>(insignificant)</td>
</tr>
<tr>
<td>4</td>
<td>Tar Sands</td>
<td>31 billion barrels of equivalent</td>
<td>4.22</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Nuclear Element</td>
<td>Not yet qualified</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Onwuka (2016)
## ENERGY SECURITY PROSPECTS IN NIGERIA: Non Fossil Fuel Resources mostly Untapped

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<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Natural Units</td>
<td>Energy Units (Btoe)</td>
</tr>
<tr>
<td>1</td>
<td>Hydropower Large</td>
<td>11,250 MW</td>
<td>0.8 (over 38 yrs)</td>
</tr>
<tr>
<td>2</td>
<td>Small Hydropower</td>
<td>3,500 MW</td>
<td>0.25 (over 38 yrs)</td>
</tr>
<tr>
<td>3</td>
<td>Solar Radiation</td>
<td>3.5 - 7.0 KWh/m²/day (485.1 million MWh/day using 0.1% Nigeria land area)</td>
<td>15.0 (38 years and 0.1% Nigeria land area)</td>
</tr>
<tr>
<td>4</td>
<td>Wind</td>
<td>(2.4) m/s at 10m height</td>
<td>8.14 (4m/s@ 70m height φ 20m windmill, 0.1% land)</td>
</tr>
<tr>
<td>5</td>
<td>Biomass</td>
<td>11 million hectares of forest and woodland</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>Fuel Wood</td>
<td>211 million assorted animals</td>
<td>Excess of 1.2m tonnes/day</td>
</tr>
<tr>
<td></td>
<td>Animal waste</td>
<td>72 hectares of Agric Land</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Onwuka (2016)
CONCLUDING REMARKS

• It is important for Nigeria to adopt global strategy for primary energy resource supply mix in the pursuit of energy security, keeping the following in perspective:
  – Diversification of its energy supply mix as an emerging economies is imperative for sustainable economic development.
  – Substitution of high carbon emission for energy to low carbon emission energy inevitable, but must be done pragmatically.
  – Energy conservation policy and investment strategy to promote energy technologies, which ensure energy efficiency must be in the mix.
CONCLUDING REMARKS

• Transparency in governance, political & policy stability, and energy sector institutional reform and restructuring are imperative for attaining energy security potential
  – Petroleum industry reform process has created too much investment uncertainty in the energy sector
  – Governance structure in most of the energy sector institutions is amorphous, confusing and overlapping, leading to regulatory capture and inefficiency
  – Relevant workforce very handicapped to make bold decisions because of undue political interference and/or perhaps nepotism. This must be avoided!
CONCLUDING REMARKS

• Pragmatic public policy with due consideration to implement regional energy resource comparative advantage is essential along with carrot and stick policy approach when appropriate
  – Dedicated energy supply mix for end-users and regions
  – Regional energy demand and supply balance rather then centralization strategy is the way forward
  – State energy regulatory agencies working along with federal institutions to create appropriate incentives to promote regional comparative advantages
  – Enforcement of the rules of law with appropriate sanctions and rewards within the context of sanctity of contractual agreements.
THE NIGERIAN DREAM

MY GENERATOR IS NOW FOR SALE