Export of Raw Energy Resources Versus Local Utilization in Africa: Optimizing the Value of Africa’s Natural Resources for Development

By

Dr. Ben K. D. Asante, P.Eng, CEO, Ghana Gas

The views expressed are those of the author and do not necessarily reflect the views of UNCTAD.
Export of Raw Energy Resources Versus Local Utilization in Africa

Optimizing the Value of Africa’s Natural Resources for Development

Multi-Year Expert Meeting on Commodities and Development
UNCTAD, Geneva, Switzerland

Dr. Ben K. D. Asante, P.Eng
CEO, Ghana Gas
10th October, 2023
Presentation Outline

1. Value Chain
2. Africa’s Gas Reserves, Production & Utilization
3. Commercial Models
4. Challenges to Resource Development & Local Utilization in Africa
5. Commodity Pricing Models
6. Recommended Development Framework
Gas Utilization Model

Gas Source
(Domestic/Import)

Energy
- Electricity (Power Generation)
- Heating
  Industrial/ CHP
  Domestic (LPG)

Gas Processing/ Conditioning

- Export (LNG)
- Vehicular Transport - CNG
- Feedstock for Petrochemicals
- Agrochemicals
- Domestic (LPG)
<table>
<thead>
<tr>
<th>Country</th>
<th>Reserves (TCF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Nigeria</td>
<td>206.53</td>
</tr>
<tr>
<td>2 Algeria</td>
<td>159.1</td>
</tr>
<tr>
<td>3 Senegal</td>
<td>120</td>
</tr>
<tr>
<td>4 Mozambique</td>
<td>100</td>
</tr>
<tr>
<td>5 Egypt</td>
<td>77.2</td>
</tr>
<tr>
<td>6 Tanzania</td>
<td>57.54</td>
</tr>
<tr>
<td>7 Libya</td>
<td>53.1</td>
</tr>
<tr>
<td>8 Angola</td>
<td>13.5</td>
</tr>
<tr>
<td>9 Congo</td>
<td>10.1</td>
</tr>
<tr>
<td>10 Cameroon</td>
<td>4.8</td>
</tr>
<tr>
<td>11 Sudan</td>
<td>3.0</td>
</tr>
<tr>
<td>12 Ghana</td>
<td>0.8</td>
</tr>
</tbody>
</table>

**Total in excess of 800 TCF**

The **Mauritania, Senegal, Gambia, Guinea-Bassau-Conakry Basin** offshore West Africa is an exciting frontier for oil and gas exploration.

The basin includes:

- the GTA gas field, which is estimated to contain more than 100 trillion cubic feet of natural gas
- Yakaar-1 gas field in northern Senegal - estimates at 15 trillion cubic feet.
- the AGC joint maritime zone, sitting between Guinea-Bissau and Senegal and features a regional collaboration between the governments of the five countries.

**Gas Reserves -2021 [in excess of 800TCF]**

**Gas Production [10-15%, of Global Production]**

**Gas Consumption [5-6%, of Global Consumption]**

Source: https://energycapitalpower.com/top-ten-african-countries-sitting-on-the-most-natural-gas/
## Gas Production - Africa

### Production Volume of Natural Gas in Africa in Bscf

<table>
<thead>
<tr>
<th>Country</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>3,709.56</td>
<td>3,549.59</td>
</tr>
<tr>
<td>Egypt</td>
<td>2,82.91</td>
<td>2,364.71</td>
</tr>
<tr>
<td>Nigeria</td>
<td>1,715.31</td>
<td>1,564.69</td>
</tr>
<tr>
<td>Libya</td>
<td>856.17</td>
<td>840.74</td>
</tr>
<tr>
<td>Others</td>
<td>526.29</td>
<td>545.05</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>248.86</td>
<td>286.23</td>
</tr>
<tr>
<td>Angola</td>
<td>311.48</td>
<td>194.41</td>
</tr>
<tr>
<td>Ghana</td>
<td>120.56</td>
<td>127.75</td>
</tr>
<tr>
<td>Cameroon</td>
<td>84.05</td>
<td>82.64</td>
</tr>
<tr>
<td>Gabon</td>
<td>16.03</td>
<td>16.35</td>
</tr>
<tr>
<td>Congo</td>
<td>14.66</td>
<td>14.94</td>
</tr>
</tbody>
</table>

**Source:** statista.com (2023)
Gas Consumption - Africa

- Total Gas Consumption of natural gas in Africa for 2021 – 5185 BCF
  - Egypt – 2116 BCF
  - Algeria – 1664 BCF
  - Nigeria – 777.4 BCF
  - Ghana - 121.04 BCF

Africa’s gas share in the global market was 6% in 2021 and its expected to increase to over 11% by 2050.

Production is projected to increase from 260 billion cubic meters in 2021, to 585 billion cubic meters in 2050.

Source: statista.com (2023)

Production (10-15%)
Utilization (5-6%)
Commercial Models

- Export Model
- Local Utilization Model

- Exploration
- Production
- Gathering
- Processing/Liquefaction
- Transmission
- Distribution
- Local Utilization

For Oil Export

For LNG Export

For Local Oil & Gas Utilization

Export Model

Local Utilization Model
Challenges in the Development and Utilization of Energy Resources in Africa

<table>
<thead>
<tr>
<th>Development &amp; Utilization Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Lack of Access to Capital for projects</td>
</tr>
<tr>
<td>2  Lack of Adequate requisite Infrastructure</td>
</tr>
<tr>
<td>3  Unattractive Fiscal Regime/Taxation Requirement</td>
</tr>
<tr>
<td>4  Unclear Institutional and Regulatory Framework</td>
</tr>
<tr>
<td>5  Lack of adequate requisite Intellectual Capacity</td>
</tr>
<tr>
<td>6  Inadequate local/private sector participation in the energy sector</td>
</tr>
<tr>
<td>7  Non-Cost Reflective Delivered Commodity price</td>
</tr>
<tr>
<td>8  Inter-Sectoral Debt between Public Entities</td>
</tr>
<tr>
<td>9  Imprudent Management of Resource Revenues</td>
</tr>
</tbody>
</table>
Delivered Gas Price Components

The following are typical components of the delivered price of gas:

- gas commodity price
- gas pipeline tariff
  - gas gathering
  - gas transmission
  - gas distribution
- gas processing tariff
- levies, fees and taxes (where applicable)
### Delivered Gas Pricing Equation

**EQUATION FOR Delivered Gas Price**

\[
WACOG = \sum_{i=1}^{\eta} \left[ \frac{Q_i}{Q_T} \right] x(Gas \ Cost_i + Tariff_i + Levies_i + Fees_i) \]

<table>
<thead>
<tr>
<th><strong>WACOG</strong></th>
<th>Weighted Average Cost of Delivered Gas, $/MMBtu</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Qi</strong></td>
<td>Flow (c) associated with each <strong>Commodity source</strong>, <strong>Service type</strong>, <strong>Levies</strong> &amp; <strong>Fees</strong>, MMBtu/d</td>
</tr>
<tr>
<td><strong>QT</strong></td>
<td>Total System Flow(c), MMBtu/d</td>
</tr>
<tr>
<td><strong>Gas Cost</strong></td>
<td>Gas or <strong>Commodity Cost</strong> from supply source, $/MMBtu</td>
</tr>
<tr>
<td><strong>Tariff</strong></td>
<td>Tariff or Service Cost [gathering, processing, transmission], $/MMBtu</td>
</tr>
<tr>
<td><strong>Levies</strong></td>
<td>Regulatory <strong>Levy</strong>, $/MMBtu</td>
</tr>
<tr>
<td><strong>Fees</strong></td>
<td><strong>Gas Management</strong> Fees, $/MMBtu</td>
</tr>
</tbody>
</table>
Commodity Pricing Models

- Integrated Market Model
  - Cost Envelope

- Segregated Market Model
  - Cost Envelope
  - Cost Envelope
  - Cost Envelope
  - Cost Envelope
Recommended Development Framework for Africa’s Energy Sector

Some of the key considerations for a viable Energy Sector in Africa are as follows:

**Governance**

1. Develop a Master Plan or roadmap for guiding the development of the sector
2. Ensure clear and appropriate Institutional and Regulatory framework
3. Promote the building of Local Intellectual Capacity for the sustainability of the industry
4. Encourage Private Sector Participation in the development of the sector
5. Manage the Resource Revenue prudently along the chain to minimize sector debt

**Commodity Security & Monetization**

1. Provide sustainable and reliable Commodity Supply (supply plan)
2. Develop an Appropriate Balance for both Local and Export markets (demand plan)
3. Minimize the Delivered Cost of Commodity with minimum Fluctuation

**Financing and Infrastructure Assurance & Security**

1. Facilitate access to capital for projects (with attractive Fiscal Regime)
2. Ensure adequate and reliable infrastructure that links the supply sources to the markets
3. Develop effective Operations & Maintenance Protocols including Infrastructure Protection
Thank You!
Merci!