Energy Challenges & Opportunities in East Africa

Finding Petroleum Event

February 25th, 2019
Africa Projects - Growing Gas Portfolio

DEAL MAP
UPCOMING MEGA PROJECTS
An estimated $1.64 billion will be spent on 10 planned oil and gas projects between 2018 and 2020.

NIGERIA
Projects in Nigeria are expected to account for 25 percent of the total planned CAPEX investments in Africa.
- Ultra-deepwater (Nakama Deep project) ($1 billion CAPEX planned)
- Deepwater (Bonga North) ($6.9 billion)
- Deepwater (Ngozi South/Egogo) ($3.3 billion)

MOZAMBIQUE
An estimated $3.3 billion is needed between 2017 and 2022 to develop planned LNG projects in Mozambique.
- Girassol-Luto Complex ($10.9 billion CAPEX planned)
- Ultra-deepwater (Mamba Complex: Mozambique) ($22.2 billion)
- Ultra-deepwater Coral South (Mozambique) ($9.5 billion)

ANGOLA
An estimated $3.5 billion is needed between 2017 and 2022 to develop planned LNG projects in Mozambique.
- Kwanza Complex ($5.1 billion CAPEX planned)
- Okra ($3.7 billion)
- Luanda Deep ($2.2 billion)

GAS PROJECTS EXPECTED TO REACH FID IN 2018
With proven gas reserves of 483.3 trillion cubic feet across Africa, gas has the potential to provide 450 GW of power. Power Africa aims to complete 16,000 megawatts of gas to power projects in West Africa by 2030, with projected capital costs of $17.5 billion.

EQUATORIAL GUINEA
- Fina 1.2 MW
- Ekker 3.5 MW

EGYPT
- Bahri SW project

NIGERIA
- Asa North/Obah South Nigeria LNG Train 7

KAMRIB
- Kudu gas-to-power

MOZAMBIQUE
- Anadarko Kusile 1 project

SENEGAL
- Senegal Bofou Maitoue LNG

POWER PROJECTS
The World Bank estimates the annual investment in generation, distribution, and transmission needed to achieve universal electricity access between 2015 and 2040 is between $534.4 billion and $632.2 billion. Power Africa aims to complete 16,000 megawatts of gas-to-power projects in nine countries by 2030, with projected capital costs of $17.5 billion.

SOUTH AFRICA
- 27 renewable energy IPP deals signed in 2018
- New renewable-energy IPP bidding round to launch in November, to add 1.3 GW to grid
- Jasper Solar Plant
- Limpopo Pump Storage Scheme

KENYA
- Olkaria Geothermal Power Plant
- Lake Turkana Wind Project

RWANDA
- Rwamagana Solar Energy Plant

DR CONGO
- Ngaga Hydropower Project

MOROCCO
- Morocco Solar Power Plant
- Tarfaya Wind Farm

ETHIOPIA
- Grand Renaissance Dam

TANZANIA
- 240 MW Winyere II gas power plant

GHANA
- 1,500 MW Ghana 1060 gas power plant

NIGERIA
- 450 MW Aja-Oko Power Plant completed in May 2018
AFRICAN INFRASTRUCTURE PLANS

Previous & Current Planned Ugandan export route in green...Now through Tanzania

No transcontinental pipelines
Cross border pipelines a rarity

Major systems:
North Africa: Algeria, Libya, Egypt
West Africa gas pipeline
Chad - Cameroon
Mozambique - South Africa
Sudan – South Sudan
Tanzania Mnazi Bay Songo Songo

New systems planned:
Niger Agadem to Chad: oil
Uganda to Tanga: oil
Kenya to Lamu: oil
Ethiopia Ogaden to Djibouti: gas
‘Major’ Discovery Offshore South Africa
# Global LNG Projects

The table below represents approximately $160 of total project spend across various LNG projects.

## Probable FIDs

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>State / Province</th>
<th>Region</th>
<th>Target FID Date</th>
<th>Capacity (MMtpa)</th>
<th>Unit Cost ($ / Metric ton)</th>
<th>Project Cost ($B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG Canada</td>
<td>British Colombia, Canada</td>
<td>Americas</td>
<td>3Q18</td>
<td>26.0</td>
<td>$1,180</td>
<td>$30.7</td>
</tr>
<tr>
<td>Magnolia LNG</td>
<td>Louisiana, U.S.</td>
<td>Americas</td>
<td>4Q18</td>
<td>8.0</td>
<td>$625</td>
<td>$5.0</td>
</tr>
<tr>
<td>Calcasieu Pass LNG</td>
<td>Louisiana, U.S.</td>
<td>Americas</td>
<td>1Q19</td>
<td>10.8</td>
<td>$420</td>
<td>$4.5</td>
</tr>
<tr>
<td>Golden Pass LNG</td>
<td>Texas, U.S.</td>
<td>Americas</td>
<td>1Q19</td>
<td>15.6</td>
<td>$640</td>
<td>$10.0</td>
</tr>
<tr>
<td>Driftwood LNG</td>
<td>Louisiana, U.S.</td>
<td>Americas</td>
<td>2Q19</td>
<td>27.6</td>
<td>$550</td>
<td>$15.2</td>
</tr>
<tr>
<td>Rio Grande LNG</td>
<td>Texas, U.S.</td>
<td>Americas</td>
<td>2Q19</td>
<td>9.0</td>
<td>$640</td>
<td>$5.8</td>
</tr>
<tr>
<td>Sabine Pass (T6)</td>
<td>Louisiana, U.S.</td>
<td>Americas</td>
<td>4Q19</td>
<td>4.5</td>
<td>$560</td>
<td>$2.5</td>
</tr>
<tr>
<td>Texas LNG</td>
<td>Texas, U.S.</td>
<td>Americas</td>
<td>4Q19</td>
<td>4.0</td>
<td>$600</td>
<td>$2.4</td>
</tr>
</tbody>
</table>

**Total U.S. & Canada**: $105.5 billion, $613 per million metric tons, $76.1 billion

## International Projects

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Country</th>
<th>Region</th>
<th>Target FID Date</th>
<th>Capacity (MMtpa)</th>
<th>Unit Cost ($ / Metric ton)</th>
<th>Project Cost ($B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tortue FLNG</td>
<td>Mauritania / Senegal</td>
<td>EMEA</td>
<td>4Q18</td>
<td>2.5</td>
<td>$1,160</td>
<td>$2.9</td>
</tr>
<tr>
<td>Mozambique LNG</td>
<td>Mozambique</td>
<td>EMEA</td>
<td>2Q19</td>
<td>12.9</td>
<td>$1,553</td>
<td>$20.0</td>
</tr>
<tr>
<td>Qatar LNG 5, 6 &amp; 7</td>
<td>Qatar</td>
<td>EMEA</td>
<td>2Q19</td>
<td>23.4</td>
<td>$1,179</td>
<td>$27.6</td>
</tr>
<tr>
<td>Artic LNG-2</td>
<td>Russia</td>
<td>EMEA</td>
<td>4Q19</td>
<td>19.8</td>
<td>$1,010</td>
<td>$20.0</td>
</tr>
<tr>
<td>PNG LNG Train 3</td>
<td>Papua New Guinea</td>
<td>APAC</td>
<td>4Q19</td>
<td>8.0</td>
<td>$1,625</td>
<td>$13.0</td>
</tr>
</tbody>
</table>

**Total International**: $66.6 billion, $1,179 per million metric tons, $83.5 billion

*Source: Evercore January 2019*
UGANDAN TALENT DEMANDS

> Demand for talent ramping up dramatically

> Transformation required in some areas

3. General Findings

**Manpower Demand**

Out of total manpower required, 15% are engineers & managers, 60% are technicians and craftsmen and 25% are people without any educational background (casual workers).

**Industry Demand**

Some sectors will need a complete transformation to be able to cope with future needs, like hazardous waste disposal.

Collection, transportation, and storage of hazardous waste (bio-hazardous waste, used oils, and batteries, etc.), and collection of oil-based mud cuttings from drilling activities.
Activity in East Africa

Tullow Exploration

~7 BBO
17 Leads
16,063 sq km
35% equity

- Large, operated, offshore oil play in East Africa
- Simple drilling and attractive fiscal terms
- Managed cost exposure in frontier acreage
- Flexible options to leverage seismic market
- Rapid deal-making with like-minded partner

Source: Invictus Sept 2018
## East Africa Transactions

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Block</th>
<th>Buyer</th>
<th>Seller</th>
<th>Transaction Type</th>
<th>Asset Stage</th>
<th>Equity Acquired</th>
<th>Equity Value US$(M)</th>
<th>Total Value US$(M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>South Africa, Namibia</td>
<td>Block 11B/12B &amp; 2B, PEL 37</td>
<td>Africa Oil</td>
<td>Africa Energy</td>
<td>Corporate</td>
<td>Exploration</td>
<td>6.09%</td>
<td>18</td>
<td>295</td>
</tr>
<tr>
<td>2017</td>
<td>Kenya, Ethiopia</td>
<td>Various</td>
<td>Maersk</td>
<td>Africa Oil</td>
<td>Farm in</td>
<td>Pre-Development</td>
<td>25%</td>
<td>~500</td>
<td>2,000</td>
</tr>
<tr>
<td>2014</td>
<td>Zambia, South Africa</td>
<td>Block 40 &amp; 41: Algoa-Gamtoos</td>
<td>Tower Resources</td>
<td>Rift Petroleum</td>
<td>Corporate</td>
<td>Exploration</td>
<td>100%</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>2013</td>
<td>Mozambique</td>
<td>Buzi</td>
<td>PT EnergiMega</td>
<td>ENH</td>
<td>Farm in</td>
<td>Post Discovery</td>
<td>75%</td>
<td>175</td>
<td>233</td>
</tr>
<tr>
<td>2013</td>
<td>Kenya</td>
<td>Block 2B</td>
<td>Premier Oil</td>
<td>Taipan Resources</td>
<td>Farm in</td>
<td>Pre Drill</td>
<td>55%</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>2013</td>
<td>Kenya</td>
<td>Block 2A</td>
<td>Ajax Exploration</td>
<td>Simba Energy</td>
<td>Farm in</td>
<td>Exploration</td>
<td>66%</td>
<td>16</td>
<td>24</td>
</tr>
<tr>
<td>2012</td>
<td>Kenya</td>
<td>Block 9, Block 12A</td>
<td>Marathon Oil</td>
<td>Africa Oil</td>
<td>Farm in</td>
<td>Exploration</td>
<td>50% + 15%</td>
<td>57</td>
<td>~100</td>
</tr>
<tr>
<td>2012</td>
<td>Ethiopia</td>
<td>South Omo</td>
<td>Marathon Oil</td>
<td>Agterra Ltd</td>
<td>Asset Sale</td>
<td>Exploration</td>
<td>20%</td>
<td>40 + 10</td>
<td>200</td>
</tr>
<tr>
<td>2012</td>
<td>Kenya</td>
<td>11B</td>
<td>Bowleven</td>
<td>Adamantine Energy</td>
<td>Farm in</td>
<td>Exploration</td>
<td>50%</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>2012</td>
<td>Madagascar</td>
<td>Morovcay</td>
<td>Octant Energy</td>
<td>Ophir</td>
<td>Farm in</td>
<td>Exploration</td>
<td>50%</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>2012</td>
<td>Somaliland</td>
<td>Odewayne</td>
<td>Genel</td>
<td>Jacka Resources</td>
<td>Farm in</td>
<td>Exploration</td>
<td>50%</td>
<td>26</td>
<td>52</td>
</tr>
<tr>
<td>2011</td>
<td>Tanzania, Kenya</td>
<td>Block 7, Block 9, Block L-15</td>
<td>Ophir</td>
<td>Dominion</td>
<td>Corporate</td>
<td>Exploration</td>
<td>100%</td>
<td>175</td>
<td>175</td>
</tr>
<tr>
<td>2011</td>
<td>Kenya, Somalia</td>
<td>Various</td>
<td>Various</td>
<td>Africa Oil</td>
<td>Corporate</td>
<td>Exploration</td>
<td>Various</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>2010</td>
<td>Kenya, Mali</td>
<td>Block 10BA, Block 7, Block 11</td>
<td>Africa Oil</td>
<td>Centric Energy</td>
<td>Corporate</td>
<td>Exploration</td>
<td>100%</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>2010</td>
<td>Kenya</td>
<td>Block 10BA</td>
<td>Tullow Oil</td>
<td>Centric Energy</td>
<td>Farm in</td>
<td>Exploration</td>
<td>50%</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>2010</td>
<td>Various</td>
<td>Various</td>
<td>Afrom</td>
<td>Black Martin Energy</td>
<td>Corporate</td>
<td>Exploration</td>
<td>100%</td>
<td>103</td>
<td>103</td>
</tr>
</tbody>
</table>

Source: Invictus Sept 2018
Tullow Kenya

Overview presentation
DEVELOPING KENYA’S DISCOVERED RESOURCES

South Lokichar development plan
• Discovered resources support development via export pipeline to Lamu
• Phased development approach planned
• Incremental developments to follow initial Foundation Stage, utilising installed infrastructure
• Full development to achieve plateau production of 100,000 bopd+

Amosing/Ngamia/Twiga Foundation Stage
• Foundation Stage targeting 210 mmbo
• Initial production of 60,000 - 80,000 bopd
• Allows early FID to take advantage of low cost environment
• Targeting FID: 2019, First Oil 2022
• Foundation Stage gross capex of $2.9bn
  - Upstream $1.8bn
  - Pipeline $1.1bn
  - ~80% spend to First Oil

Diagram for illustration purposes only, not to scale

GROSS ANNUAL AVERAGE OIL RATE (BOPD)

2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048

0 20 40 60 80 100 120

Foundation Stage
Incremental developments
THE OIL AND GAS INDUSTRY IN UGANDA

REGULATORY STRUCTURE AND PRIORITIES

- **Uganda Ministry of Energy & Mineral Resources**
  Resource owner

- **The Uganda National Oil Company**
  State share of Ugandan oil and gas assets

- **The Uganda Petroleum Authority (UPA)**
  Regulator

- **National Oil and Gas Policy 2008**
  Benefit local economy, train and develop local talent

- **National Council for Higher Education**
  National Supplier Database

---

**Government aiming for 2020 first oil**

**UPA states that there are ca. 40 oil and gas experienced professional Ugandans**

**CNOOC targeting FDP approval in 4Q2018 with first oil in 2022**
20 separate discoveries
400m depth down to 1800m in the south (Heritage)
15-24 degree pore point….30-33 API
Darcies permeability
75 Successful wells out of 83 drilled
1.4 billion barrels of 2C- Contingent Resources
478mmb single discovery at Jobi-Rii
Waraga-1 tested at 12,000 bopd

Source: GeoExPro October 2018 Cloke, Cowley & Rindfuss
Uganda Upstream Plan

**Tilenga (190k bopd)**
- Operated by Total E&P Uganda B.V
- Consists of 8 fields, covering ~ 230Km²
- Discovered between 2008 & 2011
- PLs (5) issued in August, 2016
- STOIIP - 3.9 Billion BBL and recoverable – 857 MMBBL
- Phase: FEED

**Kingfisher (40k bopd)**
- Operated by CNOOC (U) Ltd
- Discovered in 2006, covers an oil area of 32.8 Km²
- Production License issued in February, 2012
- STOIIP – 635 MMBL & Recoverable – 196 MMBBL
- Phase: FEED

---

**Partners (Tilenga & Kingfisher)**

<table>
<thead>
<tr>
<th>Partners</th>
<th>Current</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total E&amp;P Uganda B.V</td>
<td>33.33%</td>
<td>37.5%</td>
</tr>
<tr>
<td>CNOOC Uganda Ltd</td>
<td>33.33%</td>
<td>37.5%</td>
</tr>
<tr>
<td>UNOC</td>
<td>-</td>
<td>15.0%</td>
</tr>
<tr>
<td>Tullow Uganda Ltd</td>
<td>33.33%</td>
<td>10.0%</td>
</tr>
</tbody>
</table>

---

1,053 MMBBL (P50)

---
Plans for Uganda - Total/CNOOC/Tullow

Key milestones to FID

Partner & Operator roles defined
- Total operate Tilenga
- CNOOC operate Kingfisher
- Tullow non-operator

Upstream
- FEED & Tilenga ESIA Completed
- EPC contracts ready for award
- CPF & well pad locations finalised
- 90% land acquired for CPF

Pipeline
- FEED completed on Uganda-Tanzania route
- Contracts for pipe & long-lead items prepared

Upcoming activities
- Award of major upstream EPC contracts
- Approval of Pipeline & Kingfisher ESIA
- Completion of pipeline geotechnical/geophysical surveys

FID
- Partners targeting 1H 2019
Planned Infrastructure & Export Routing
Ugandan Refinery Demand Projections

Source: Ugandan Ministry Energy and Mineral Resources Sept 2018 Master Plan

Uganda Base Case petroleum product demand to 2030 (Source: GCA study 2009 (adapted)
Oil Industry in Uganda - Kibaale Industrial Park
PROGRAMMES WE OFFER
WE ARE GROWING

Public Health
International Development
Business Administration
  + Executive MBA
  + Tourism and Hospitality
  + Environmental Managemental
  + Women in Finance
ICT for Development
Oil and Gas MBA
  + MSc Oil & Gas Upstream O&G – coming soon
  + Diploma in Upstream O&G Management – coming soon
Corporate Academy

Specialisations
Petroleum in East Africa- Summary

1. Plenty of opportunity, BUT
   - Security issues
   - Multinational institutions need to deliver
   - Capital is required BUT...it comes with significant conditions

2. Mega projects are coming- slowly
   - International investors are cautious

3. Local content is essential...but

4. Shortage of talent- Education Education Education