Prospects for East African LNG

Nick Fulford
Global Interest in Mozambique/Tanzania LNG

Note: Search frequency for Mozambique LNG/Tanzania LNG from Google Trends; no discernable interest before January 2012
The LNG World Today
US LNG Exports

**Outlook**

- Permits are pending for the export of up to 100 mmtpa of LNG
- Questions:
  - Panama Canal impact 2016+
  - Can shale resource keep up with demand?
  - How will US govt respond to sustained export pressures.
Canadian LNG Exports

**Outlook**

- 15 proposed LNG export projects in British Columbia, none of which are expected to reach FID by 2015

**Questions:**
- Which projects will survive attrition process
- Cost of Rockies pipeline crossing
- Cost of gas resource
- Climate impact on terminal construction

**Source:** BC Ministry of Mines/National Energy Board
## Russian LNG Exports

<table>
<thead>
<tr>
<th>Outlook</th>
<th>Key Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Several Asia-Pacific LNG proposals</td>
<td><img src="image" alt="Map of key locations" /></td>
</tr>
<tr>
<td>▪ major technical risks</td>
<td></td>
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<tr>
<td>▪ East Siberian gas supply has been earmarked for export pipeline</td>
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<tr>
<td>▪ Questions:</td>
<td></td>
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<tr>
<td>– Security of supply</td>
<td></td>
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<tr>
<td>– Regulatory and political certainty</td>
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</tr>
</tbody>
</table>

Source: ERI RAS
Australian LNG Exports

**Outlook**

- Australia is expected to account for the largest share of global LNG supply growth in the next decade

**Questions:**
- Sustainability of gas supplies, especially CSG
- Upstream productivity
- Labour costs
LNG Suppliers – How do they stack up?

<table>
<thead>
<tr>
<th>Parameter</th>
<th>US Lower 48</th>
<th>Canada (Montney)</th>
<th>Australia</th>
<th>Russia (Sakhalin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Potential</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>2</td>
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<tr>
<td>Technical Ease of Gas Production</td>
<td>1</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Regulatory/Political Environment</td>
<td>4</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Existing Infrastructure</td>
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<td>3</td>
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</table>
LNG development options for East Africa

- **Mozambique**
  - Commercialization Option
  - Onshore LNG x 2 then possible FLNG
  - Partner Alignment
  - Operators with less LNG experience
  - Announced Start
  - 2018
  - Japan price*
  - $11.50 / MMBtu

- **Tanzania**
  - LNG facility in Mnazi Bay
  - Partner Alignment
  - Well-established LNG players
  - Announced Start
  - 2021
  - Japan price*
  - ??

*Estimated delivery price to Japan, including shipping*
LNG Project Trend – Bigger and More Expensive

Source: Various LNG company websites, GCA, Univ. of Oxford Energy Studies
Liquefaction becoming more dominant than gas feedstock

**Industry Response**

- **1990s**
  - lower plant costs
  - Lower cost gas resource
- **2000s**
  - substantially rising gas input costs
- **2010s**
  - liquefaction cost inflation
  - global gas resource cost trending downwards

**LNG Price Breakdown 1997-2016**

Source: GCA, Bureau of Economic Geology at Univ. of Texas, Univ. of Oxford Energy Studies
Competitiveness of LNG projects in different regions

**Key Observation**

- Liquid production on upstream can significantly reduce gas production cost.
- Delivered price depends on not only upstream production cost, but also cost of liquefaction and shipping.

**Upcoming projects: Delivered Price to Japan/Korea Market**

<table>
<thead>
<tr>
<th>Region</th>
<th>Delivered Price (US$/MMBtu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Lower 48</td>
<td>10.9</td>
</tr>
<tr>
<td>Canada</td>
<td>12.1</td>
</tr>
<tr>
<td>Australia</td>
<td>13.5</td>
</tr>
<tr>
<td>Russia</td>
<td>12.2</td>
</tr>
<tr>
<td>Oceanic Pacific</td>
<td>9.1</td>
</tr>
<tr>
<td>Oceanic Pacific FLNG</td>
<td>15.1</td>
</tr>
<tr>
<td>East Africa</td>
<td>11.5</td>
</tr>
</tbody>
</table>

* The red-slashed block shows the delivered cost of Russian LNG after removing Export Duty and Mineral Extraction Tax exemptions.

Source: GCA, various news reports on global LNG projects.
Oil- or gas-indexation on LNG prices can achieve the same range of price targets

Key Observation

- Buyer’s side: geography does not significantly change things in terms of delivered prices
- Seller’s side: Which indexation has less exposure to risk???
- HH upside price risk; gas indexation is not a perfect solution.
East African LNG – Distance from Market

**Key Observation**

- Japan/Korea is actually the longest route
- Europe and China are roughly equivalent
- India is the nearest market

**Shipping Distance from Mozambique to Markets**

<table>
<thead>
<tr>
<th>Location</th>
<th>Nautical Miles</th>
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<tbody>
<tr>
<td>Japan/Korea</td>
<td>6,500</td>
</tr>
<tr>
<td>Argentina (Latin America)</td>
<td>4,000</td>
</tr>
<tr>
<td>Spain (Europe)</td>
<td>3,000</td>
</tr>
<tr>
<td>China</td>
<td>5,000</td>
</tr>
<tr>
<td>India</td>
<td>2,500</td>
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Routes:
- Suez Canal
- Cape of Good Hope
Target Markets for East African LNG - India

Principal LNG Trade 2025

**Strengths**
- Low shipping costs
- Regas availability
- Growing gas demand
- Partner involvement

**Weaknesses**
- Commercial risks
- Price sensitive end-market
- Uncertain demand forecast
Target Markets for East African LNG – China

Principal LNG Trade 2025

Strengths
- Lower shipping costs
- Growing demand

Weaknesses
- Competition with Russian pipeline
- Competition with indigenous resource potential

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<thead>
<tr>
<th>SIZE</th>
<th>0 - 10</th>
<th>10 - 25</th>
<th>25 - 50</th>
<th>50 - 75</th>
<th>75 - 100</th>
<th>100+</th>
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Target Markets for East African LNG - Europe

Strengths

- Lower shipping costs
- Well established market
- Welcome supply diversity

Weaknesses

- Lacklustre demand
- Competition from US LNG
Target Markets for East African LNG - Latin America

**Principal LNG Trade 2025**

**Strengths**
- Lower shipping costs
- LNG portfolio players service seasonal demand

**Weaknesses**
- Commercial risks
- Competition with pipeline supplies

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Target Markets for East African LNG – Japan/Korea

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Strengths
- Gas based economy – many buyers
- Alignment with project sponsors
- Reliable demand

Weaknesses
- Highly competitive market
- Prices arguably softening
- Higher shipping cost
## Comparison of LNG Suppliers

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Lessons to learn from: Angola?

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<td>Geopolitical instability</td>
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<td>Risk to fiscal stability</td>
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<tr>
<td>Outdated petroleum legislation</td>
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<tr>
<td>Lack of infrastructure (i.e., roads, ports and airports)</td>
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<td>Lack of skilled workforce</td>
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*Despite challenges, the Angola LNG project commenced operations in 2013.*
Domestic uses versus LNG export?

100,000 cubic feet: enough to fill a balloon, heat a Victorian home for a year, or supply the UK every second of an average December day.
What else can you do with 100,000 cubic feet?

- Lorry from Maputo to Lagos
- Power a 1MW ship engine for 1 day
- 1 month refuse truck
- 400 gallons of low-sulphur diesel
- Fuel an LNG powered plane
- 10% of a loco fuel stop