

A photograph showing Derek Hudson, a man in a patterned green and brown shirt, leaning over a table and interacting with a group of school children. The children are wearing white shirts and blue vests. They are gathered around a table with various items, including a red hose and a blue bottle. The setting appears to be an outdoor or semi-outdoor structure with a wooden frame.

Opportunities in the East Africa Gas and LNG Arena

Derek Hudson

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BG East Africa

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Agenda

1 Safety Moment

2 East Africa Exploration

3 East Africa LNG Projects

4 Domestic Gas Markets

5 Opportunities in the East Africa Gas and LNG Arena

6 Global LNG Markets – Implication for East Africa

Road Safety in Tanzania

- All of us engage in driving activities
- Steady increase in number of accidents and fatalities
- Impacts families and the national economy
- ≤ 10 % seriously injured are transported by ambulance

Trends in Road Traffic Deaths:



DATA

Reported road traffic fatalities (2010)	3 582 ^b , 77%M, 23%F
Estimated GDP lost due to road traffic crashes	3.4% ^c

^b Police records. Definition not specified.
^c 2008, National Road Safety Policy.

POST-CRASH CARE

Emergency access telephone number(s)	112
Seriously injured transported by ambulance	≤10%

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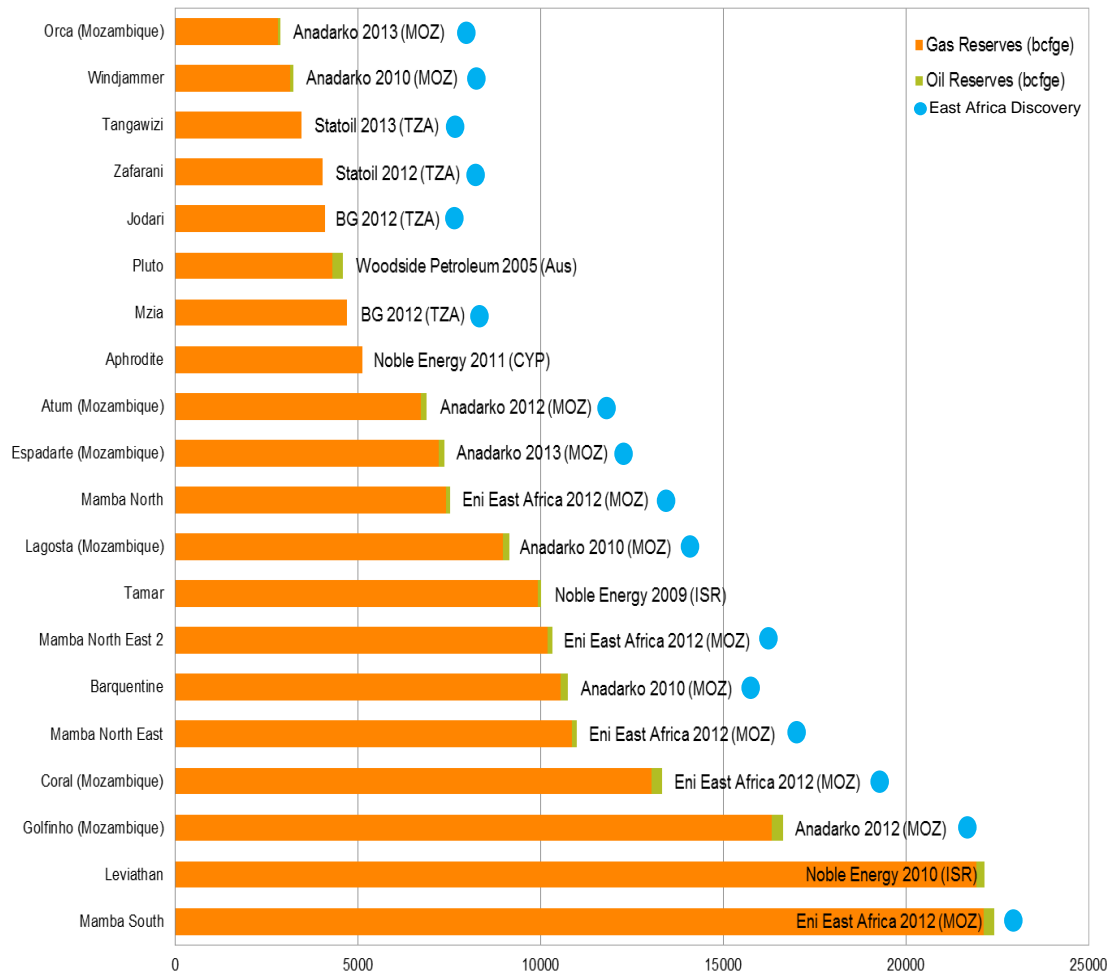
4 Domestic Gas Markets

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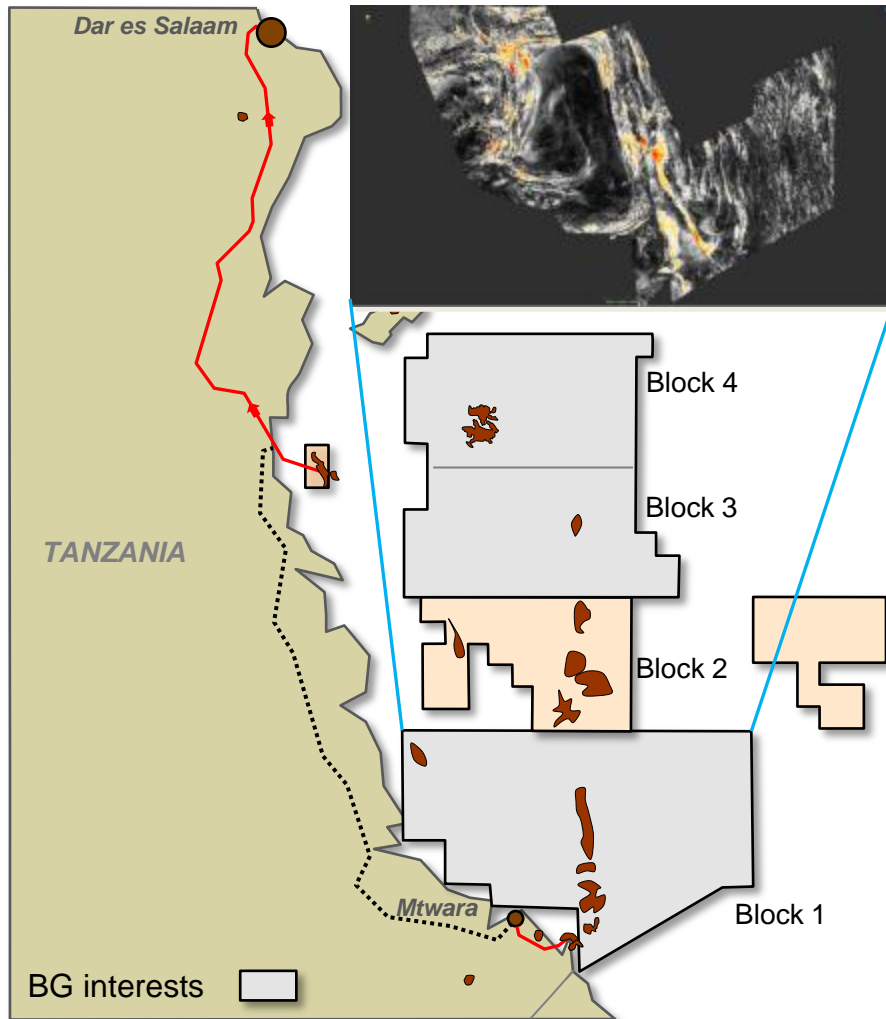
East Africa Deep Water Exploration

Top 20 Worldwide Gas Discoveries (2004 – 2014):



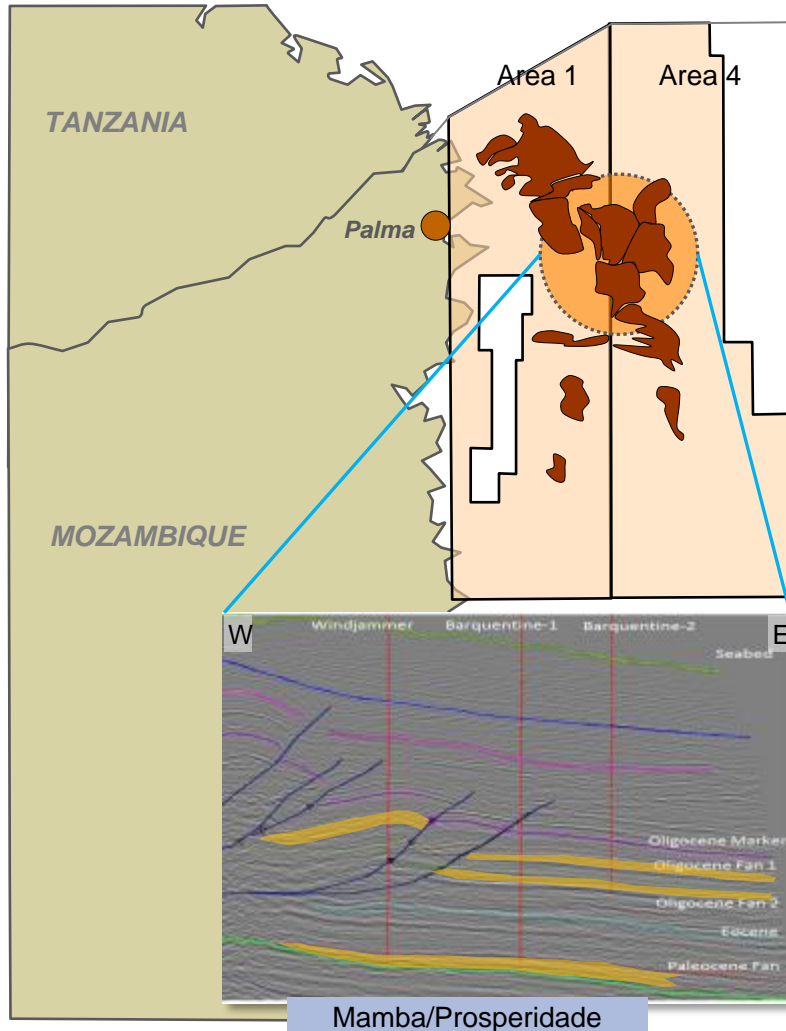
- East Africa leads in worldwide exploration success.
- In the last 10 years, 16 of the top 20 largest deep water gas discoveries in the world were made in East Africa.
- With the Rovuma Basin (both MOZ and TZA) being the most prolific in the region & currently the hottest conventional gas exploration play in the world.

Tanzania Exploration



- Blocks 1, 3 & 4: BG Group, Ophir & Pavilion
 - 16 successful wells, 100% success rate
 - 16 Tcf (recoverable reserves)
- Block 2: Statoil & Exxon
 - Several successful discoveries
 - 21 Tcf (GIIP)
- ~ 90% exploration success rates across multiple stratigraphic levels, however some operators have had failures
- Further potential in underexplored acreage
 - Blocks 8 - 12, north Tanzania
 - Deepwater blocks subject to recent 4th licensing round

Mozambique Exploration

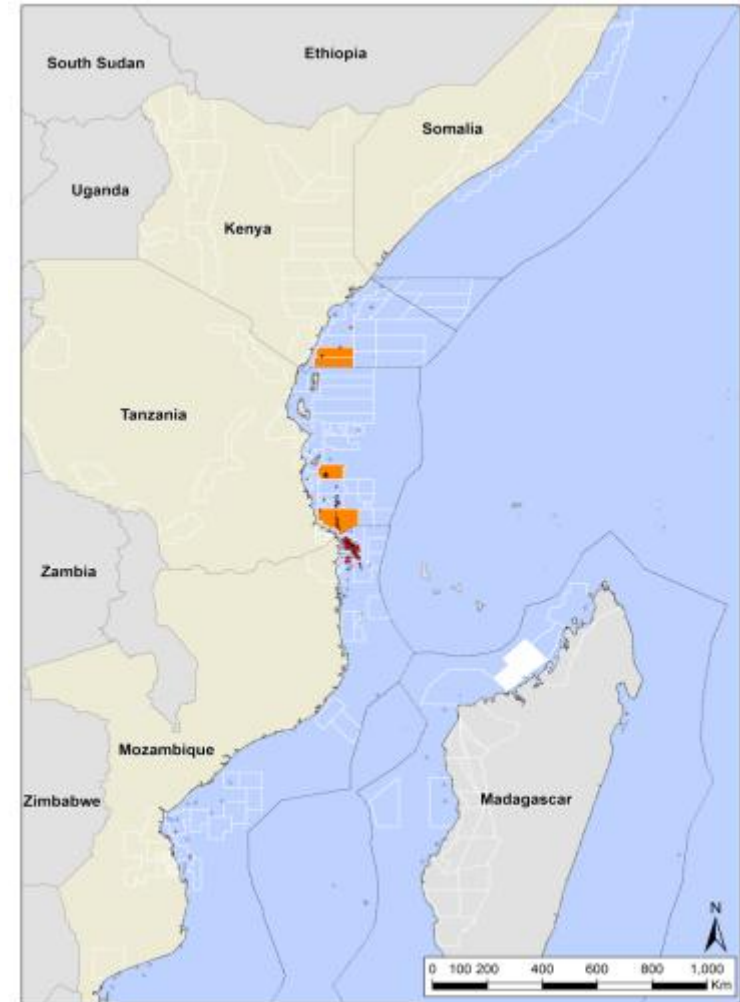


- Area 1: Anadarko, ONGC, Mitsui, Bharat Pet., Videocon, PTTEP, ENH
 - 25 successful wells
 - 50 - 70 Tcf (recoverable reserves)
- Area 4: ENI, CNPC, Galp Energia, KOGAS, ENH
 - 12 successful wells
 - > 60 Tcf (recoverable reserves)
- Supergiant Mamba / Prosperidade gas field
- Multiple reservoir levels: Oligocene, Eocene & Palaeocene

Elsewhere Offshore East Africa

- Kenya:
 - No economic commercial success to date
 - Government / Operator alignment challenges
 - Somalia disputing offshore border
 - No drilling expected in 2015, however, there is some renewed exploration focus

- Madagascar, Somalia:
 - No offshore drilling planned
 - Political challenges
 - Challenge to gain access to under explored acreage



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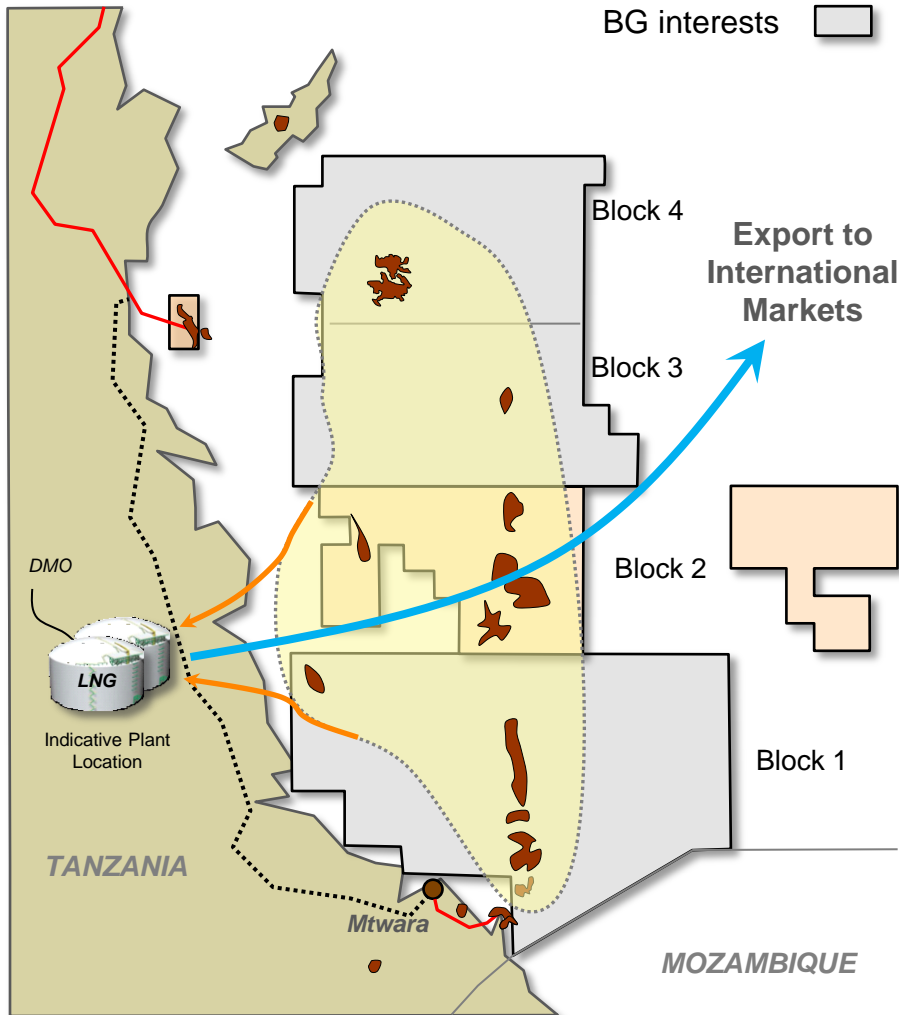
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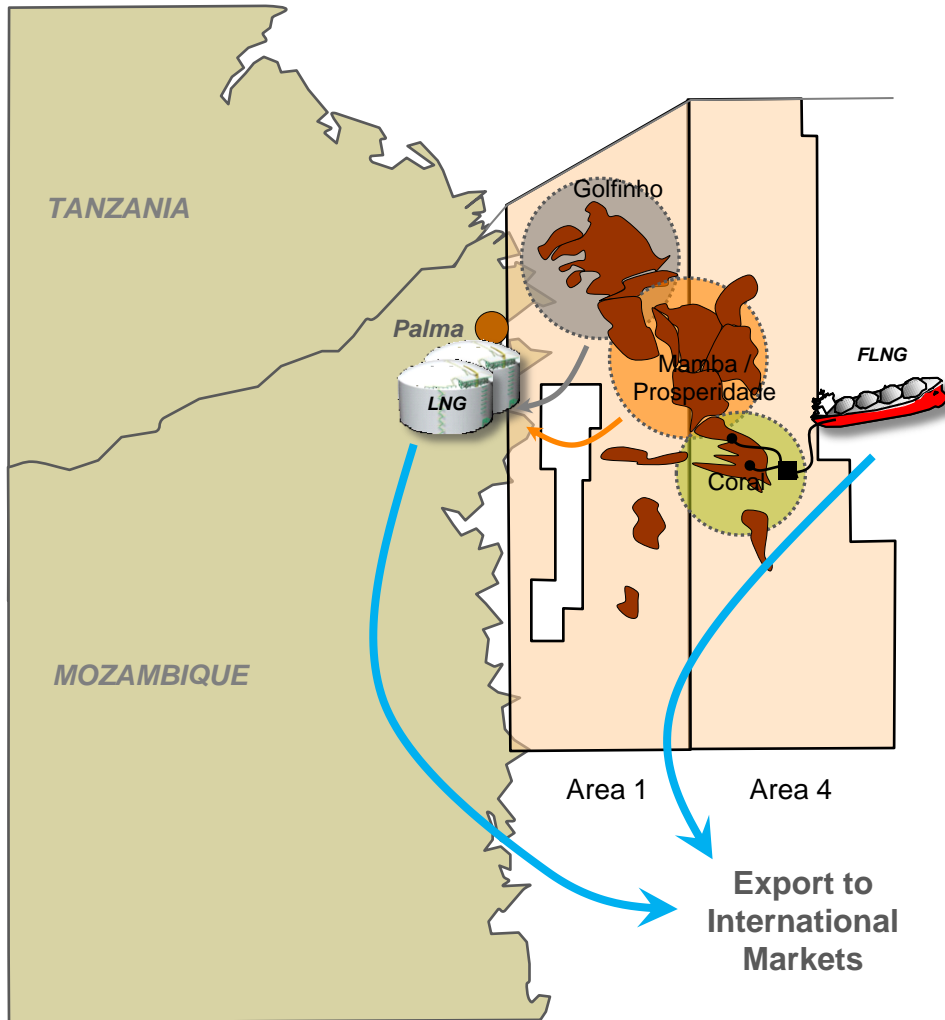
6 Global LNG Markets – Implication for East Africa

Tanzania LNG Opportunity



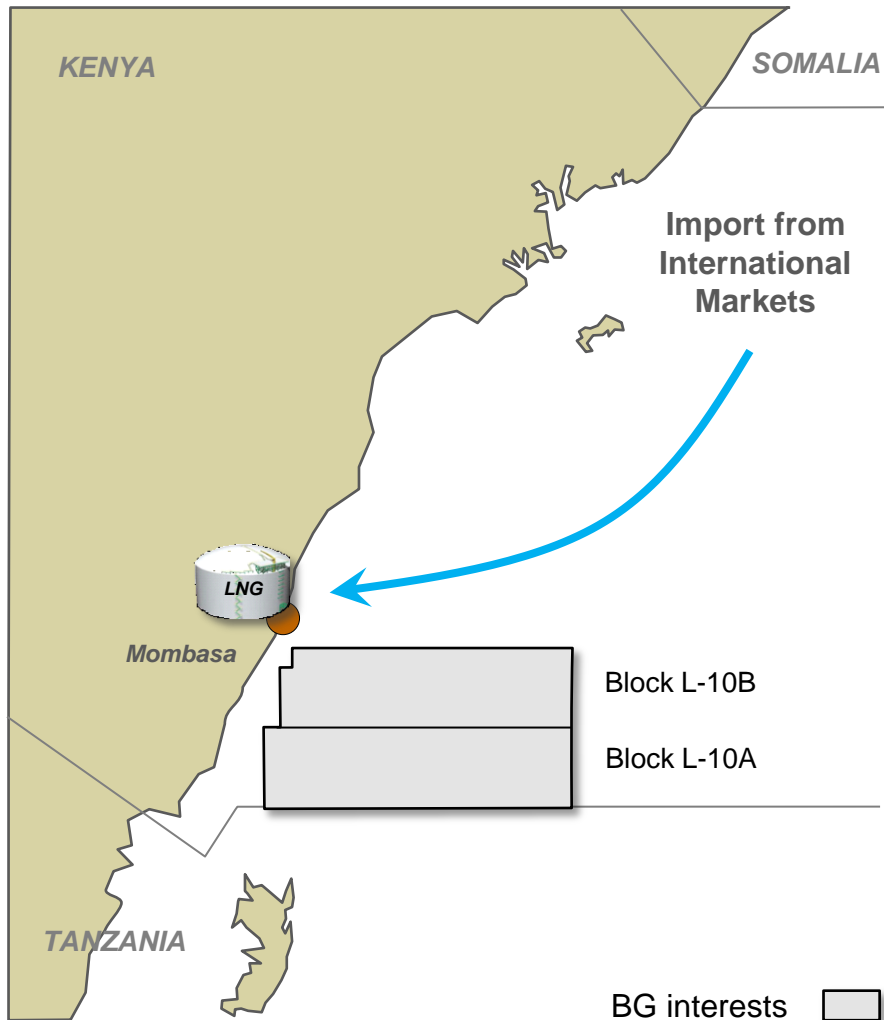
- Joint LNG development with Block 1, 2, 3 & 4 partners
- Identified LNG plant site
- Enough gas to underpin a multi-train land based LNG project – train sized to be decided
- Ongoing upstream development concept select process:
 - Floating production units vs. onshore gas processing plants

Mozambique LNG Opportunity



- Supergiant Mamba / Prosperidade requires unitisation
- HoA signed for a joint 20 mmtpa onshore development for Area 1&4 – FID 2015; 1st production: 2019
- Anadarko and Eni submitted separate development plans for their reserves:
- Anadarko (Area 1):
 - Golfinho: 2x5 mmtpa
 - Up to 10 trains from Area 1
- Eni (Area 4):
 - Initial development of Coral gas via FLNG
 - Onshore LNG is being evaluated
- New petroleum law in 2014 which supports LNG investments

Kenya LNG Development



- Nascent exploration history
- Large discoveries required to underpin LNG export project
- **LNG opportunity in Kenya: supply opportunity?**
- Ministry of Energy and Petroleum issued expression of interest in October 2013 for LNG supply to Kenya:
- Floating LNG storage and re-gasification plant and
- 700-800 MW gas fired power plant in Mombasa

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Potential Domestic Use of Gas



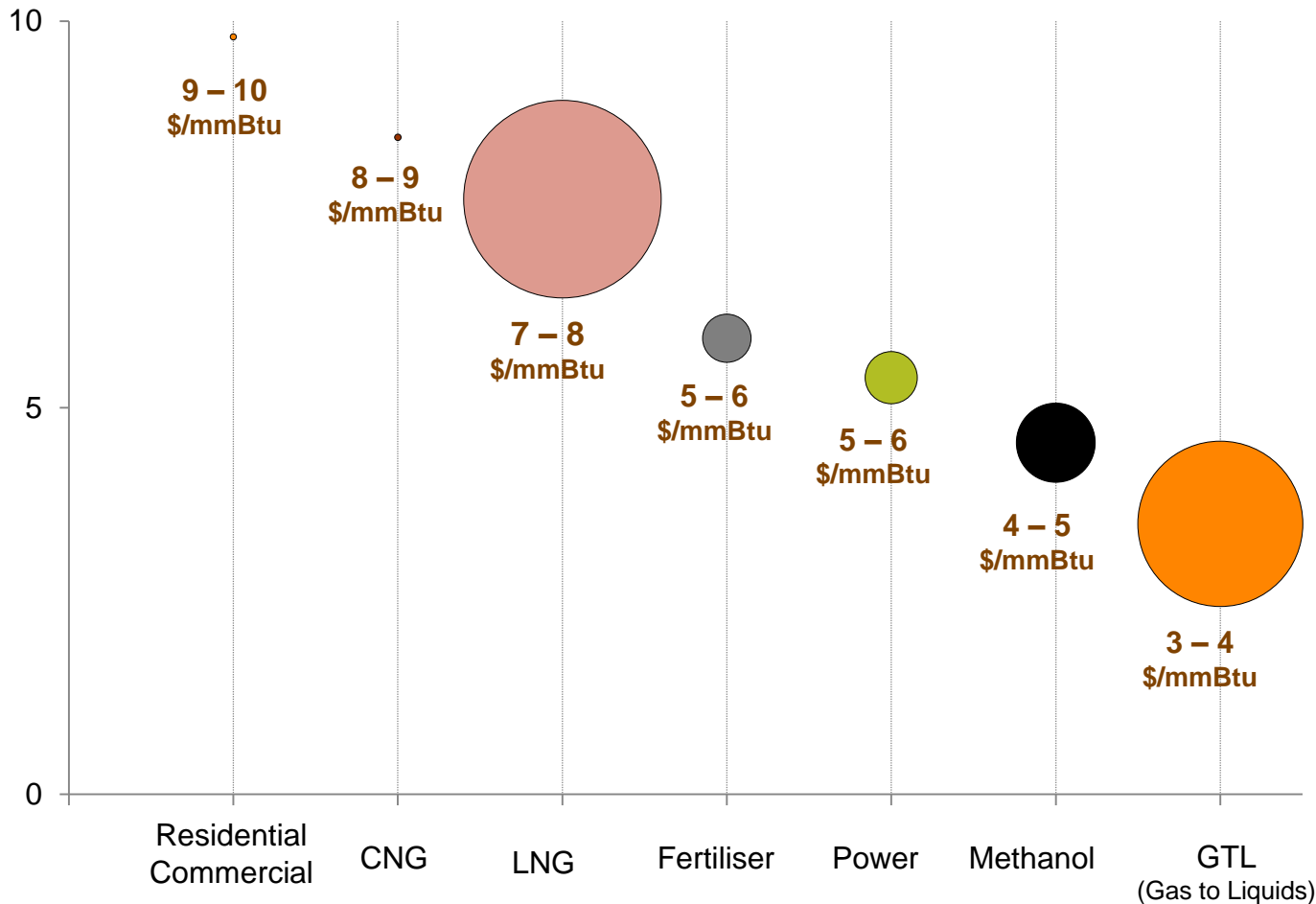
- Offshore blocks will deliver gas to the domestic market

Common features of the East African economies:

- Low electrification levels
 - Over reliance on hydroelectric power
 - Expensive petroleum products imports bill
 - Lack of electricity as an hindrance to socio economic development
 - Large contribution of agriculture to economy
 - Low use of fertilisers
- **Electrification policy key to Government's priorities**
- **Use of fertilisers must be encouraged**

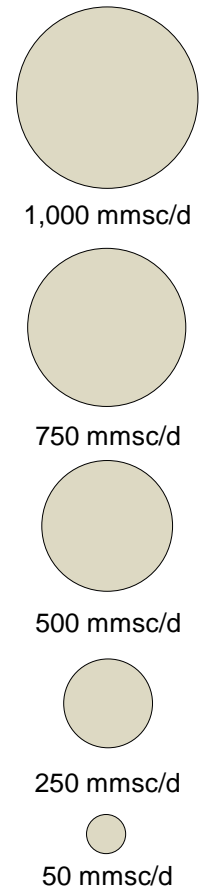
Indicative Feed Gas Price Ranking by Project

Feed Gas Price \$/mmBtu



Legend:

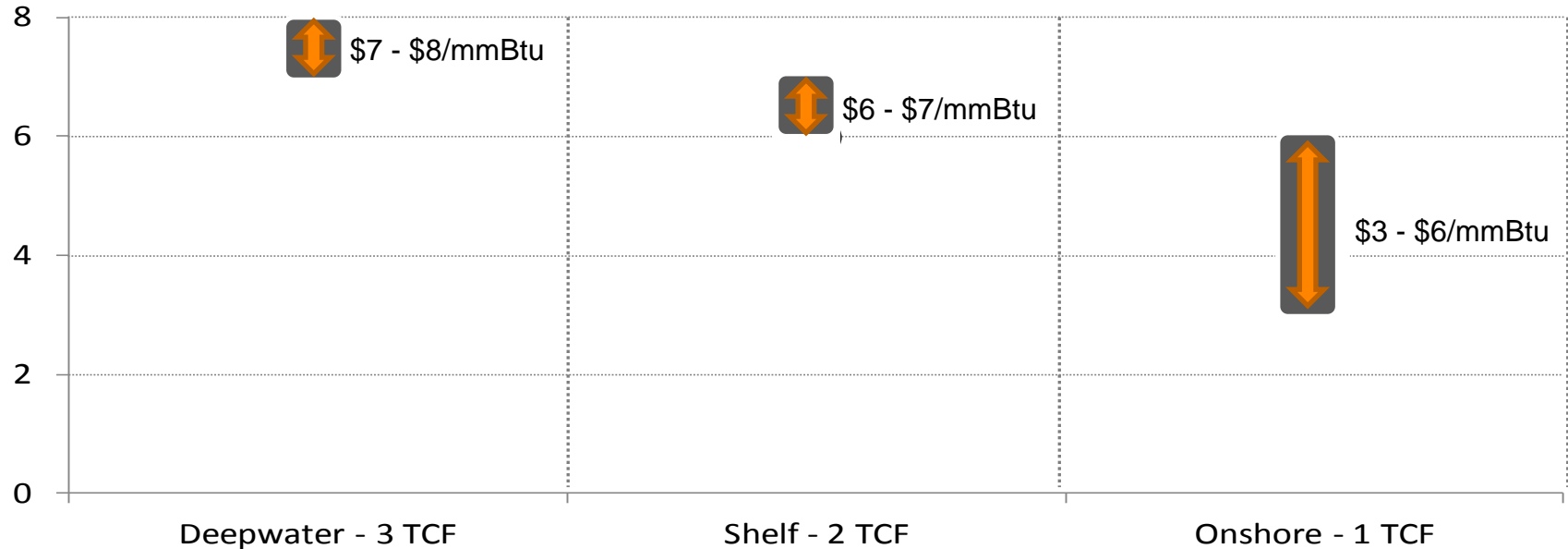
Gas Utilisation Rate:



Indicative Cost of Gas

Typical cost of development

Gas Price at Beach (\$/mmBtu)



Cost of gas varies:

- **Onshore/shallow offshore** reserves – lower cost gas
- **Deep water** reserves require significant long term investment and therefore high gas prices to develop - higher cost gas
- **Domestic Market Supply** from deep water reserves need a combined high gas price market exports to underwrite large capital investment, hence the LNG objectives

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Sources of State Income

- Significant economic progress in East African countries in recent years
 - Fairly modest level of human development:
 - Kenya: 143
 - Tanzania: 152
 - Madagascar: 151
 - Mozambique: 184
- } out of 187 countries in the United Nations Human Development Index
- Various direct and indirect benefits of deepwater LNG projects
 - **Development of LNG projects has the potential to transform the East Africa economy**

Direct Benefits:

- Foreign direct investment
- Employment
- Government take from the project
- Contribution to gross domestic product and gross national income
- Retained national income and national expenditure

Indirect Benefits:

- Induced impacts
- Multiplier effects from industry

Upstream Development Activities

Floating Offshore Production Facility:



Vs.

Onshore Gas Processing Plant:



Offshore Construction Phase

Near-shore Approach



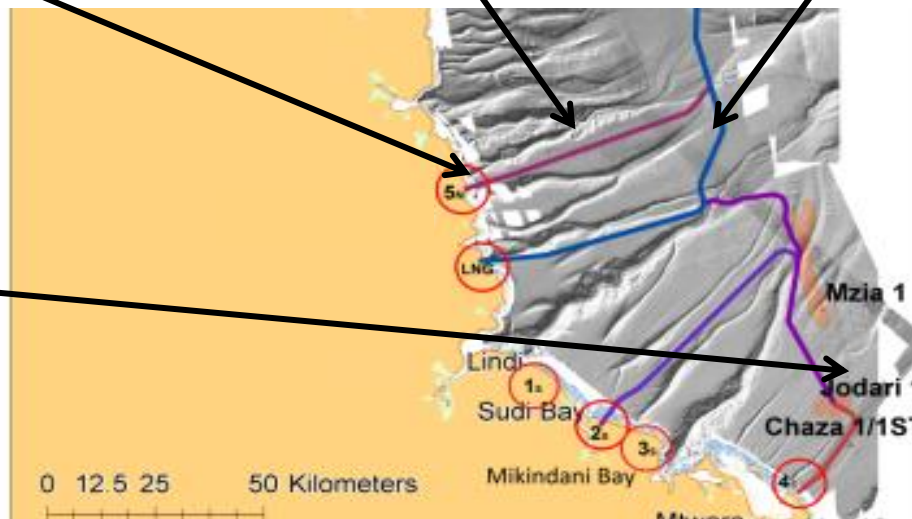
Pipelay & Construction



Deep water Pipelay



Infield Construction



QCLNG Site: October 2010



QCLNG Site: April 2011



QCLNG Site: April 2012



QCLNG Site: February 2013



QCLNG Site: LNG Train 1 (of 2)



QCLNG Site: LNG Tanks



QCLNG Site: LNG Jetty

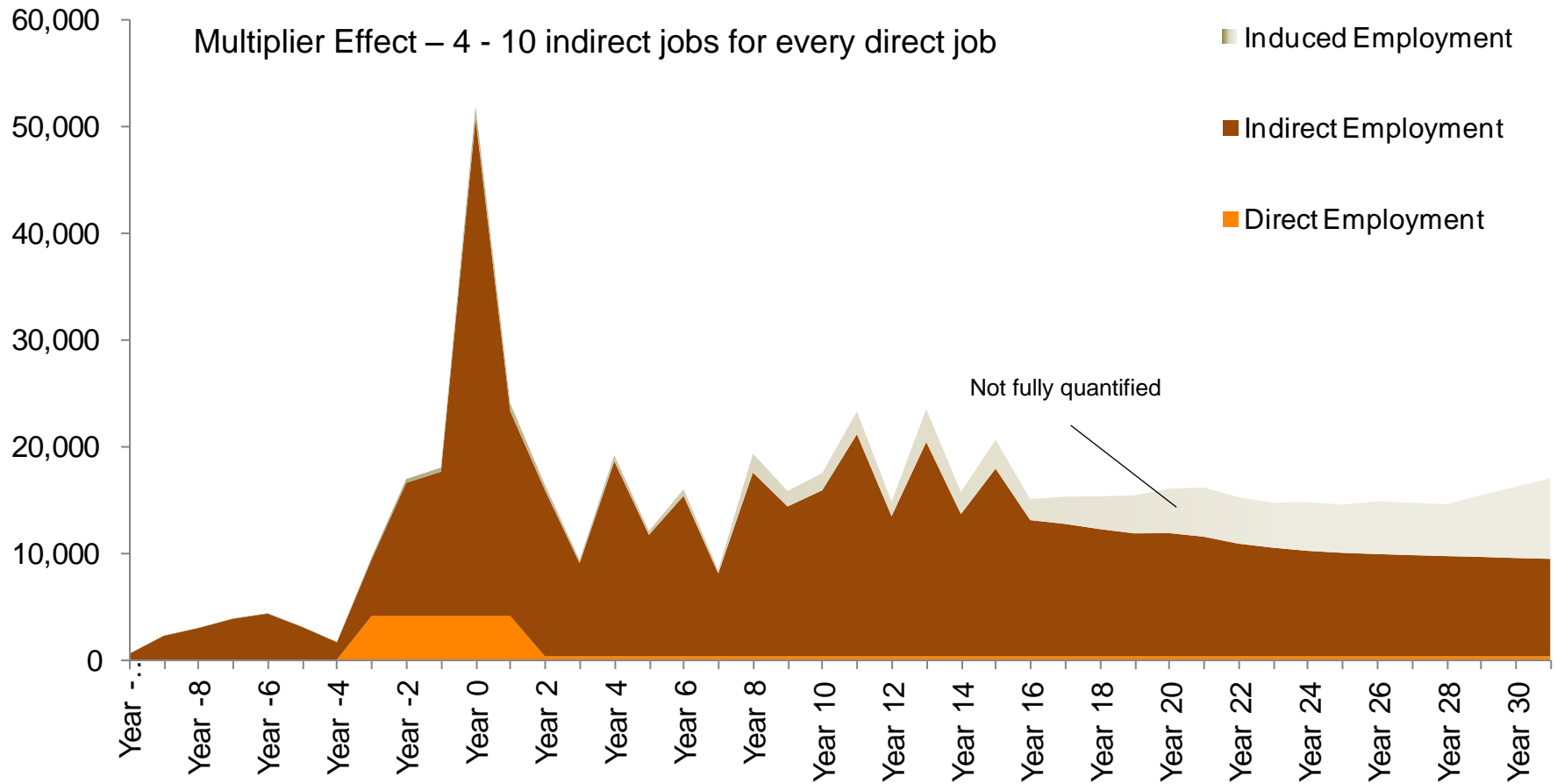


QCLNG Site: October 2014



Indicative Employment for a 2 train LNG Project

Indicative Number of Employees






Potential large number of jobs – Capacity building is paramount

Local Content Activities

- Identified Tanzanian registered companies that have the potential to offer services to Upstream project and mapped potential demand
- Engaged with 15 of these priority companies
- Agreed areas of collaboration with other IOCs as a way forward

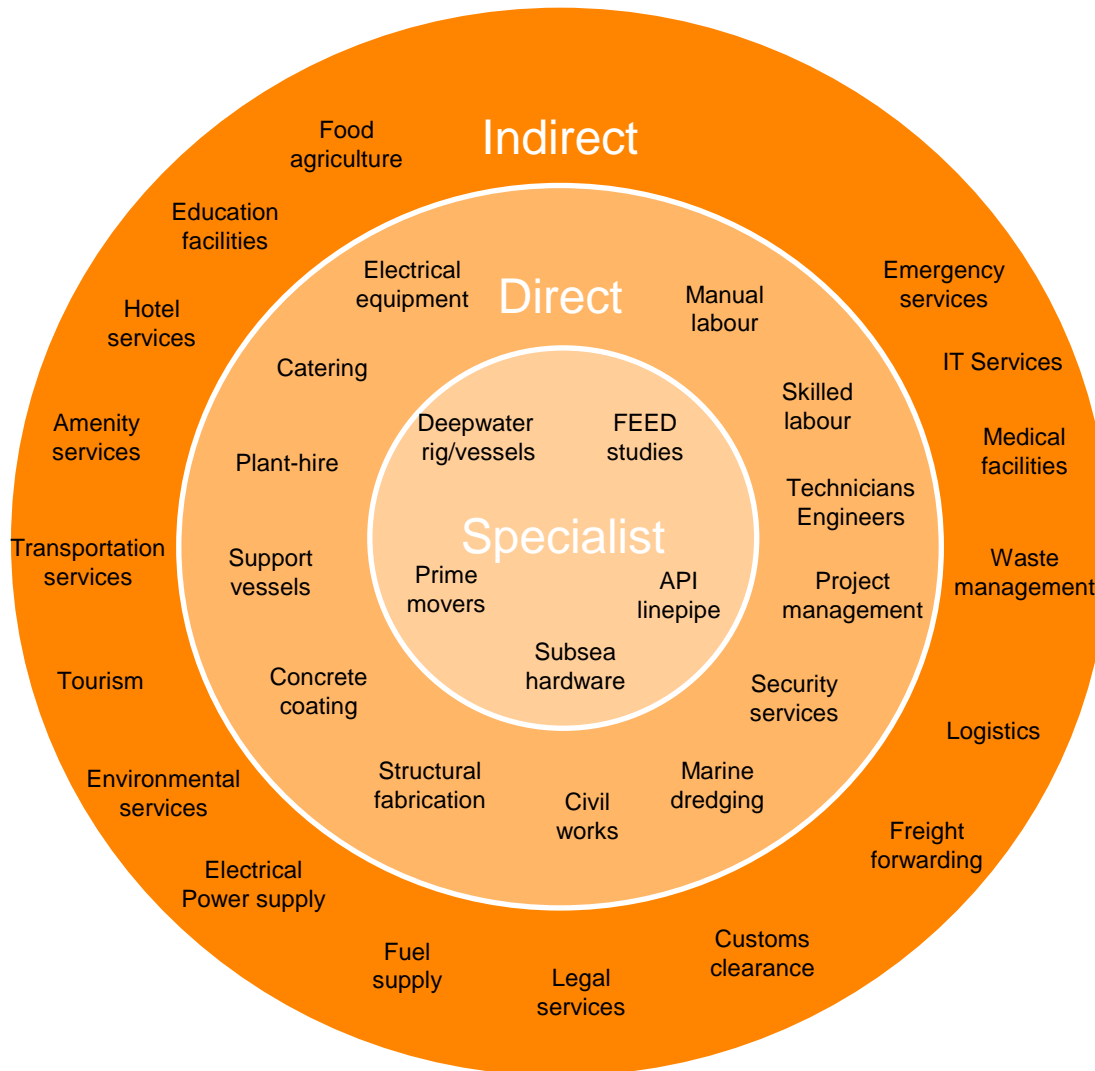
Analysing opportunities for in country supply:

Scope / Description	Source		
	Import	Develop	In Country
Linepipe (22 - inch)	Import		
Linepipe (14/10 - inch)	Import		
Linepipe (6 - inch)	Import		
Pre-com Downline	Import		
Marshalling Yard		Develop	In Country
Mechanical Testing		Develop	In Country
Freight Forwarding		Develop	
Customs Clearance			In Country
Pipe-haul	Import		
Coating (Internal / External)	Import		
Coating (Concrete)			In Country
Buckle Arrestors	Import		
BA Insertion			In Country
Anodes	Import		
Valves / ESDV	Import		
Actuators	Import		
Flex-Joints	Import		
Riser Buoyancy	Import	Develop	
Freespan Supports	Import	Develop	In Country
Structural Steel	Import	Develop	
Start-up-Laydown Heads			In Country
ILTs / PLETs		Develop	In Country
Manifolds		Develop	In Country
Land Pipeline		Develop	In Country
Land Survey / GIS	Import	Develop	In Country
Geotechnical Survey		Develop	In Country

-  To be imported
-  Facilities available in country but require further development
-  Facilities available in country, require minor development

Supplier Development:

Identify scope of Supply/Services



Capacity Building Initiatives

Element	Content	Partners
Higher Education	<ul style="list-style-type: none"> • 10 MSc UK and 8 National Scholarships • Teaching support to Dar es Salaam University, and Dodoma University (in collaboration with Aberdeen University) for petroleum geoscience undergraduate courses 	<ul style="list-style-type: none"> ✓ Universities of Dar es Salaam and Dodoma; Nelson Mandela Institute of Science and Technology ✓ British Council ✓ Three UK Universities
Technical Vocational Education & Training	<ul style="list-style-type: none"> • 300 students in Mtwara VETA being trained to meet international occupational standards • 224 students in Lindi VETA 	<ul style="list-style-type: none"> ✓ Ministry of Education Technical Vocational Education and Training ✓ VSO
Education attainment of school leavers	<ul style="list-style-type: none"> • 100 Schools participating (STEM, English language) • After-school/ summer school STEM projects 	<ul style="list-style-type: none"> ✓ Young Scientists Tanzania ✓ VSO Education ✓ READ international
Graduate Development Programme	<ul style="list-style-type: none"> • Graduates in International Graduate Program • Employee global career development 	<ul style="list-style-type: none"> ✓ BG Group

Higher Education Support

- Scholarships:
 - International:
 - 2012 (2); 2013 (2); 2014 (10)
 - Local:
 - 2012 (4); 2013 (4); 2014 (4)
- Equipment & Educational materials
 - University of Dodoma
 - University of Dar es Salaam
- Internships
 - 1 in 2012, 2 in 2013, 2 in 2014
 - BOSIET training; rig operations experience



UK SCHOLARSHIP AWARDS FOR GEOSCIENCE AND ENGINEERING

BG Tanzania is offering 30 scholarships to Tanzanian graduates to study for Masters of Science degrees in UK Universities. 28 courses are available to choose from, all of which are relevant to the oil and gas sector. The courses will be taught from one of three locations; Imperial College London, Aberdeen University and Robert Gordon University, Aberdeen.

Scholarships are granted for a maximum period of 12 months with courses starting in September 2014. Those who qualify with successful degrees will be well placed for excellent employment opportunities in the emerging natural gas sector. In addition, those who successfully complete one of the listed courses will have the potential to qualify for BG Group's International Graduate Development Programme.

Applicants must be Tanzanian nationals and have a relevant Degree in Geoscience, Engineering or a related field and meet the requirements set out by the respective University.

The deadline for applications to reach the British Council in Dar es Salaam is the 30 April 2014. Successful applications will be announced in early June 2014.

How to apply

If you have already applied and received an offer for a place from one of the universities and for one of the courses offered, please request an application form from Malika Nkanyemba, or download the form from the British Council website (<http://www.britishcouncil.org/apply-uk/uk-scholarship>). Conditional offers are acceptable if the outstanding condition is funding.

If you are interested and eligible to apply to the Scheme but have not yet submitted an application to one of the universities and for one of the courses listed on the right, please contact the British Council. The British Council will provide reasonable support to eligible candidates to submit a university application. Upon receipt of an offer for a place on a relevant course, you can then apply to the scheme. Again, conditional offers are acceptable if the outstanding condition is funding.

Universities and courses covering the scheme:

Imperial College London

- www.imperial.ac.uk
- MSc Petroleum Engineering
- MSc Petroleum Geophysics
- MSc Petroleum Geosciences
- MSc Concrete Structures
- MSc Structural Steel Design
- MSc Environmental Engineering
- MSc Engineering Geology
- MSc Systems Engineering & Innovation
- MSc Transport
- MSc Soft Systems
- MSc Analogue and Digital Integrated Circuit Design
- MSc Control Systems
- MSc Sustainable Energy Futures
- MSc Advanced Materials Science and Engineering
- MSc Advanced Chemical Engineering with Process System Engineering

Imperial University of Aberdeen

- www.abdn.ac.uk
- MSc Oil and Gas Engineering
- MSc Safety & Reliability Engineering for Oil and Gas
- MSc Safety Engineering
- MSc Design and Information Systems
- MSc Oil and Gas Geology
- MSc Integrated Petroleum Science
- MSc Oil & Gas Chemistry

Robert Gordon University Aberdeen

- www.rgu.ac.uk
- MSc Oil & Gas Engineering
- MSc Drilling & Well Engineering
- MSc Petroleum Production Engineering
- MSc Oil & Gas Safety

Contact details and applications to:

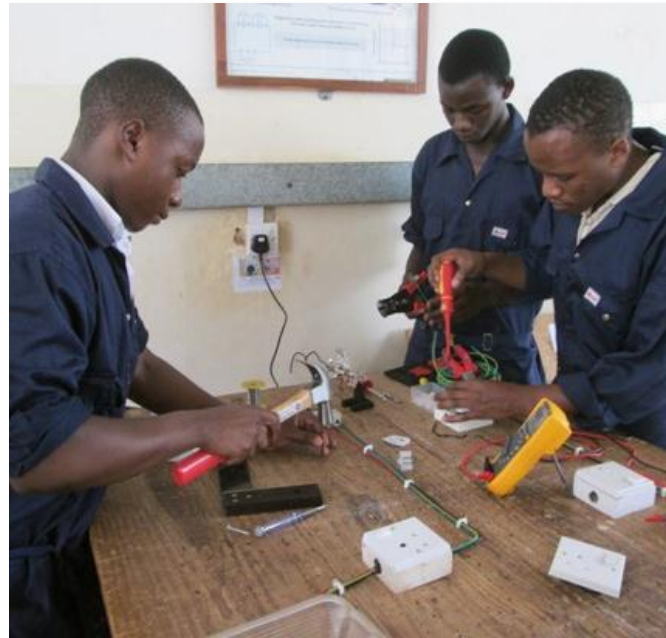
Malika Nkanyemba
BG Tanzania Scholarship Scheme Applications, Programmes and projects, British Council, Sarona Avenue/Ohio Street, PO Box 3701, Dar es Salaam – Tanzania

Telephone: +255 22 2695 900

Email: Malika.Nkanyemba@britishcouncil.org

Enhancing Employment through Vocational Training (VETA)

- Objectives: to improve the employability of young people in Mtwara and Lindi regions, with a specific focus on the oil and gas industry and related services.
- 6 specialty trades
 - Food preparation
 - Plumbing & pipe fitting
 - Welding & fabrication
 - Carpentry & joinery
 - Motor vehicle mechanics
 - Electrical installation
- Plus generic skills:
 - Maintenance
 - English language
 - Health & Safety
 - Entrepreneurship skills



Electrical workshop

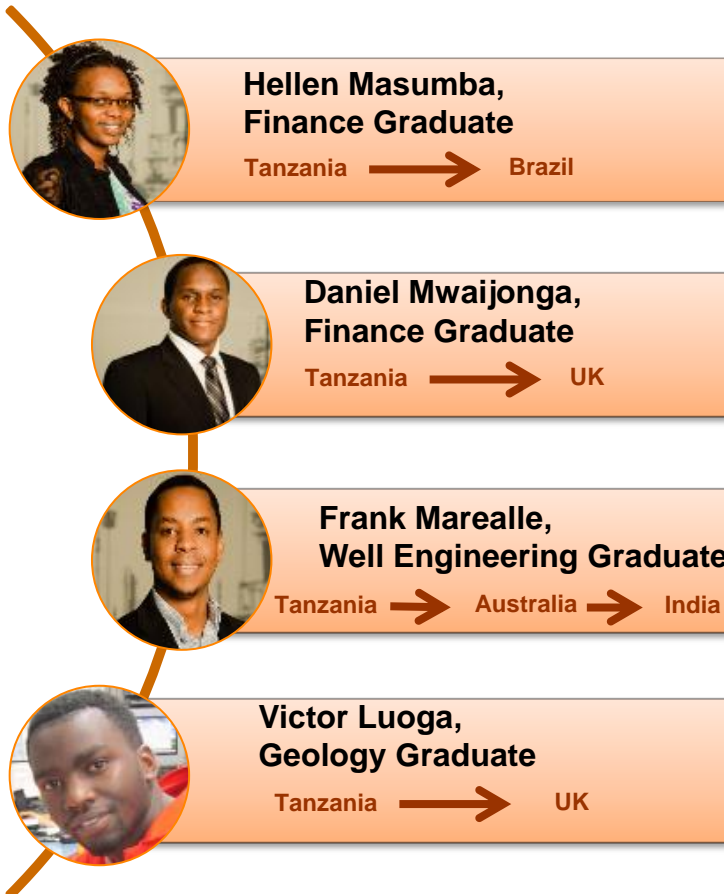


Welding workshop

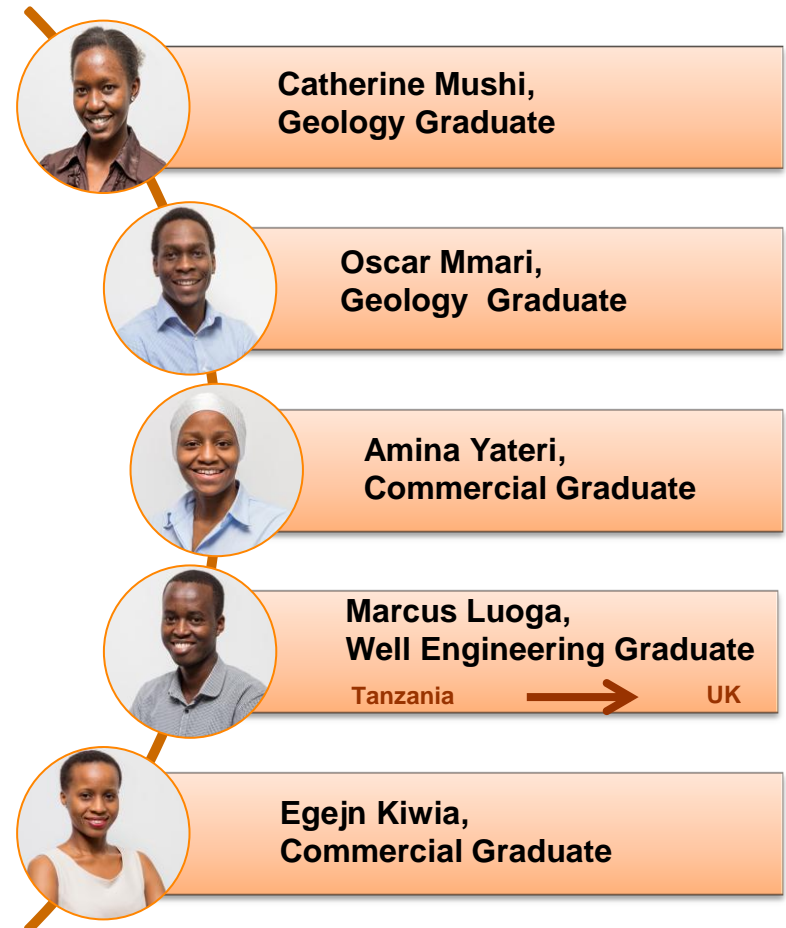
Graduate Programme

Opportunities to participate in exciting world class projects in Tanzania and around the world:

2013 Intake:



2014 Intake:



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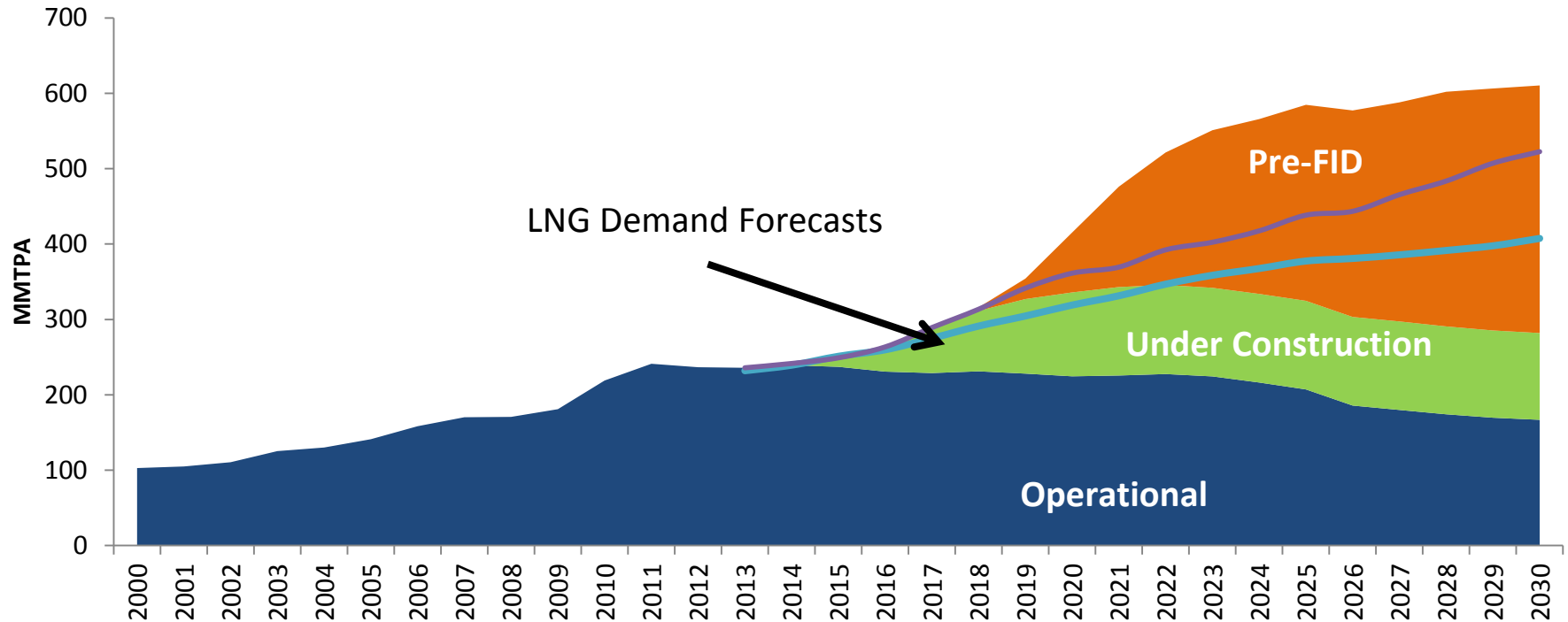
LNG Supply Competition

Wood Mackenzie Assessment of LNG Projects in Planning & Under Construction:



Global LNG Market Dynamics

Wood Mackenzie & other consultants assessment of LNG capacity* vs demand:

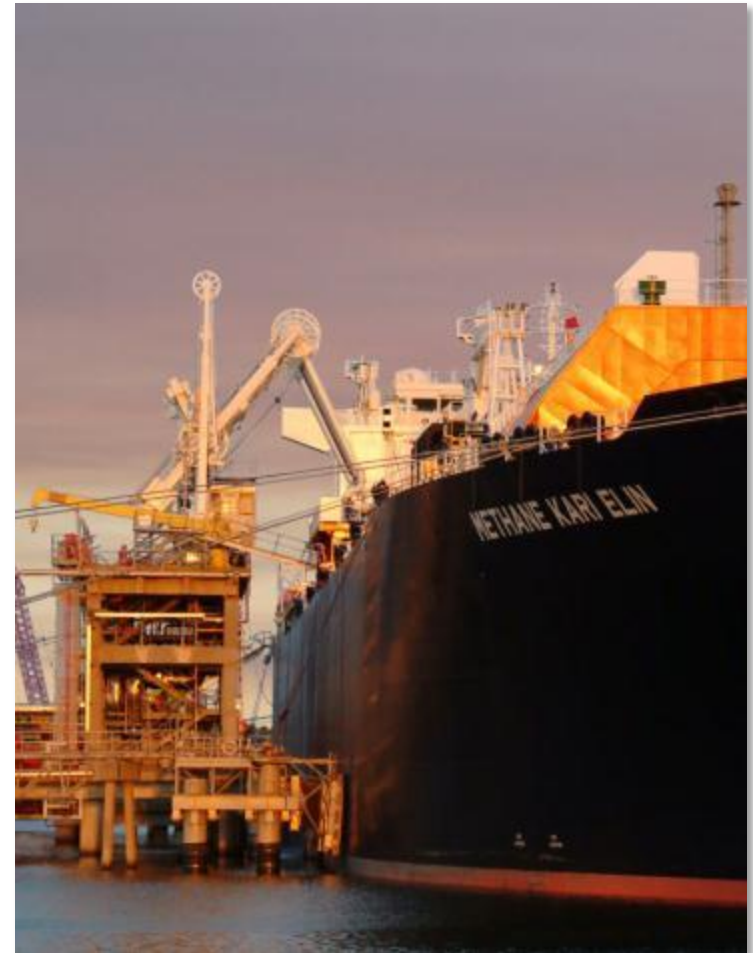


- LNG is now a global market
- East Africa LNG projects have competition

* On a delivered basis
 Source: BG interpretation of Wood Mackenzie and other consultants data

Closing Thoughts

- Remarkable success rate in East Africa gas discoveries over the last ten years
- Various opportunities related to LNG and other industrial developments that could be transformational to the economies
- Benefits include direct state income, introduction of new technologies, development of local industrial and construction expertise, capacity building, associated employment and overall improvements in standard of living
- Changes in energy market dynamics requires a rethink in the way forward



Ahsante Sana

BG TANZANIA

