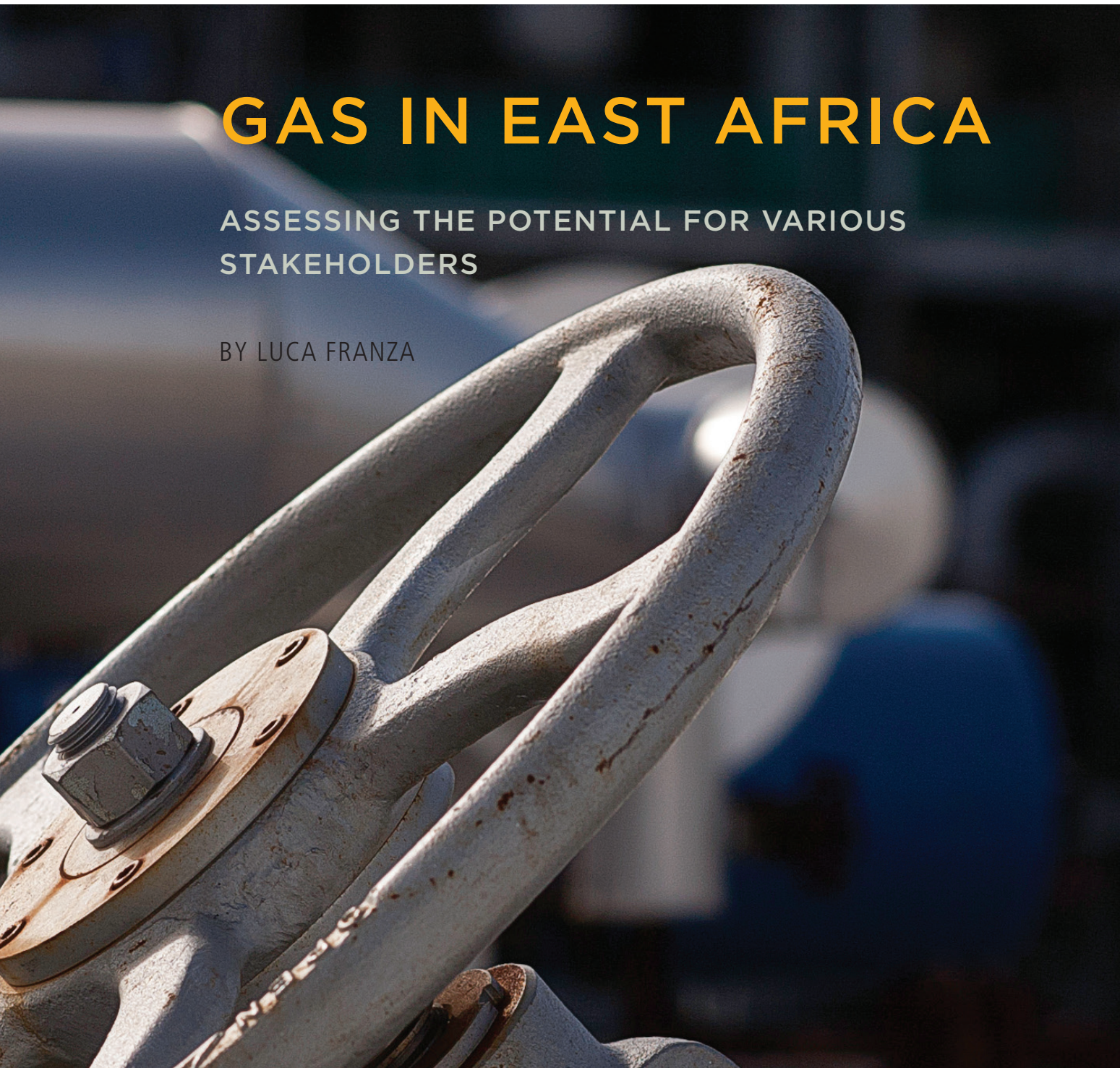


# GAS IN EAST AFRICA

ASSESSING THE POTENTIAL FOR VARIOUS  
STAKEHOLDERS

BY LUCA FRANZA



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**AUTHOR**

Luca Franza

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Deborah Sherwood

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Clingendael International Energy Programme (CIEP)

**ADDRESS**

Clingendael 7, 2597 VH The Hague, The Netherlands  
P.O. Box 93080, 2509 AB The Hague, The Netherlands

**TELEPHONE**

+31 70 374 66 16

**TELEFAX**

+31 70 374 66 88

**EMAIL**

[ciep@clingendaenergy.com](mailto:ciep@clingendaenergy.com)

**WEBSITE**

[www.clingendaenergy.com](http://www.clingendaenergy.com)

# **GAS IN EAST AFRICA**

## **ASSESSING THE POTENTIAL FOR VARIOUS STAKEHOLDERS**

LUCA FRANZA

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# 1 INTRODUCTION

The outlook for natural gas production in East Africa, especially in Mozambique and Tanzania, looks rosy thanks to a substantial reserve base and a fairly low risk profile. However, important challenges may slow down projects in the region as they move from the exploration phase to the ramp-up phase<sup>1</sup>. While some of these challenges are inherent to any greenfield project, many of them will depend on the outcomes of the choices with which Mozambique and Tanzania are currently confronted, regarding how to monetise the gas.

Although the international energy community is focussing almost exclusively on East Africa's LNG potential, broader development options deserve a closer look. Mozambique and Tanzania – among the world's poorest countries<sup>2</sup> – rightfully perceive the recent gas discoveries to be a unique opportunity for socio-economic development. While LNG offers the best economics from a field development perspective, there are additional development options that could be of interest to the host countries. These are discussed in detail in the Draft Natural Gas Master Plan for Mozambique, prepared by ICF International for the World Bank and the Government of Mozambique and presented in August 2012<sup>3</sup>.

This report reviews the challenges and opportunities underlying the projects proposed to date and presents a qualitative discussion of the factors affecting their viability in the current market environment. We also try to highlight the different expectations and strategies of the stakeholders involved, acknowledging that the present international focus is essentially commercial and does not address the viewpoint of local governments or the implications of prospective gas developments for the people of Mozambique and Tanzania. We are not suggesting that the objectives of governments and acreage holders are mutually exclusive. On the contrary, we think that these can be conjugated and that the significant gas volumes present can feed both local development projects and profitable export schemes. However, the gas industry and governments must operate carefully so as not to repeat the mistakes made by other African countries, which have been unable to translate their resource endowments into long-lasting and more widely spread prosperity.

1 'The Geopolitics of East Africa', Energy Intelligence, 17 April 2012.

2 According to the World Bank, the average GDP per capita in PPP (2005-2011) was 975\$ in Mozambique (ranking 171<sup>st</sup> out of 180 countries) and 1,512\$ in Tanzania (158<sup>th</sup>).

3 Draft Natural Gas Master Plan for Mozambique, ICF 2012.

## 2 RESERVE BASE AND DISTRIBUTION

The sheer size of the natural gas reserves lying under East African waters is the primary reason why the region has stolen the show in international gas market symposia, and the enthusiasm seems quite well grounded. Even though estimates vary significantly, information disclosed by the acreage holders suggests that the scale of East African gas findings is more than enough to justify investments. Depending on the source, 3 to 4.5 Tcm of potentially recoverable gas<sup>4</sup> are thought to lie under Mozambican waters, with more than 95% in the Northern Rovuma Basin alone (Map 1)<sup>5</sup>. The ICF Draft Master Plan estimates Mozambique's potential reserves at around 3.85 Tcm, an amount great enough to supply Germany, France, Italy and the UK for 12 years at current consumption levels. Up north, 0.7 to 1.2 Tcm of gas has been found under Tanzanian waters, spread across the Rovuma and Mafia basins<sup>6</sup>. In the Draft Natural Gas Policy, the Ministry of Energy and Minerals refers to 1 Tcm of potential reserves<sup>7</sup>. Dry gas findings in Kenya have been modest (60-140 Bcm), but future oil production there may generate volumes of associated gas.

4 In this study, the terms 'potentially recoverable gas' or 'potential reserves' refer to the sum of *proven* reserves (also known as 'P90s', reserves with a 90% probability of being commercially viable), *probable* reserves (also known as 'P50s', reserves that are more likely to be commercially viable than not) and *possible* reserves (also known as 'P10s', reserves that are unlikely to be commercially viable). P50s and P10s are sometimes grouped together as *unproven* reserves. Our definition of 'potentially recoverable gas' thus excludes YTF (or 'yet-to-be-found') resources (cfr. footnote 8). The reason why we chose to present data on potential reserves is that figures on proven reserves in Mozambique and Tanzania are still unrealistically low (127 and 6 Bcm respectively, EIA 2013), while estimates on YTF resources appear too tentative. Unfortunately there is no uniform use of definitions, with several press articles and studies referring to 'recoverable' reserves without making it clear whether these indicate proven reserves or rather technically recoverable reserves. We thus chose to follow the few analyses that provide clear explanations of their interpretations of reserves, and mainly the ICF Draft Master Plan, which clearly indicates that the figure of 3.85 Tcm pertains to '3P' reserves (proven, probable and possible).

5 The range of 3-4.5 Tcm takes into account different estimates by companies and governments, updated to the latest discoveries in 2012. Consultants such as Wood Mackenzie and SPTEC Advisory reckon potentially recoverable reserves of 3 Tcm, while press articles equally quote the lower and the higher value of the range.

6 The range of 0.7-1.2 Tcm takes into account different company and government estimates, updated to the latest discoveries in 2012. Press articles tend to converge on the approximated figure diffused by local authorities at the end of 2012 (1 Tcm), but local newspapers also reported that data available at the Tanzania Petroleum Development Corporation (TPDC) pointed at 1.2 Tcm.

7 In its 2012 World Energy Outlook, the IEA had noted Mozambique's gas reserves as 3-4 Tcm and Tanzania's as 340 Bcm. The divergence from other estimates – especially those on Tanzania – depend perhaps on the fact that the report does not incorporate all the new findings. Since the quick pace of exploration and ongoing appraisal require constant updating to include new discoveries, the figures presented in this study may also be subject to change.



MAP 1: LOCATION OF THE MAIN GAS PROSPECTS IN KENYA, MOZAMBIQUE AND TANZANIA  
(SOURCE: CIEP)

Independent geologic assessments suggest that East Africa’s untapped gas resources could be much larger<sup>8</sup>. The reserve base could grow further in the second half of 2013 as a result of the intense drilling activity currently underway. East Africa is in fact a frontier region, as only 600 wells<sup>9</sup> have been drilled, compared to 14,600 in West Africa and 19,000 in Central and North Africa<sup>10</sup>. The table below compares East Africa’s reserve base to countries with major gas reserves.

8 The Draft Natural Gas Master Plan for Mozambique reckons that total resources (including YTF or ‘Yet To be Found’) could be more than twice as much as the potentially recoverable reserves: besides the Rovuma Basin, which could host up to 7.05 Tcm of deepwater gas, 540 Bcm could lie offshore Central Mozambique, 390 Bcm offshore Southern Mozambique and another 370 Bcm onshore throughout the country. According to the US Geological Survey (2012), the mean undiscovered recoverable resources are 5.45 Tcm in Mozambique and 2.15 Tcm in Tanzania, and Wood Mackenzie calculated East Africa’s YTF reserves at 2.85 Tcm.

9 ‘A New Frontier: Oil and Gas in East Africa’, Control Risks, 2012.

10 ‘East Africa, an Underexplored Oil and Gas Province’, Reuters, 1 November 2011.



Country	Proven reserves in Tcm (EIA 2012)
Russia	50.4
Iran	35
Qatar	26.7
Saudi Arabia	8.5
United States <sup>11</sup>	8.2
Turkmenistan	8
United Arab Emirates	6.5
Venezuela	5.9
Nigeria	5.4
<b>East Africa (*)</b>	<b>4.9</b>
Algeria	4.8
Indonesia	4.2
<b>Mozambique (*)</b>	<b>3.9</b>
Iraq	3.4
Australia (2011)	3.3
China	3.2
Kazakhstan	2.6
Malaysia	2.5
<b>Tanzania (*)</b>	<b>1</b>

(\*) = For the reasons explained in footnote 4, data for East Africa refer to potentially recoverable reserves. Data for Mozambique are derived from ICF, and data for Tanzania are derived from the Ministry of Energy and Minerals.

TABLE 1: COMPARISON BETWEEN EAST AFRICA'S POTENTIAL GAS RESERVES AND PROVEN RESERVES IN OTHER COUNTRIES

Table 2 offers an overview of East Africa's largest gas discoveries. Given the distribution of gas reserves across the region, our study will focus primarily on Mozambique and Tanzania. Yet other parts of East Africa have a considerable hydrocarbon potential. Kenya in particular has been in the spotlight since Tullow Oil's liquid strikes in Blocks 10BB and 13T and because of promising exploration in the Turkana/South Omo Basin across the Kenyan-Ethiopian border. Other acreage holders will be drilling for oil in Kenya during 2013, namely Anadarko and Total in the Lamu Basin<sup>12</sup>. In 2006 Tullow also laid its hands on substantial oil reservoirs around Lake Albert in Uganda, but a fiscal dispute between the government and the acreage holders led to an impasse. In addition, the monetisation of hydrocarbons in Uganda is complicated by the fact that

<sup>11</sup> Most of the country's shale gas resources are still not accounted for in this figure.

<sup>12</sup> Kenya is in a good position to become a regional oil hub. In addition to its oil potential, the country also hosts in Mombasa the only functioning refinery of East Africa, which is, however, running significantly below its nameplate capacity of 80,000 bbl/d.

the country is landlocked in an unstable region<sup>13</sup>. Similar issues are slowing down developments in South Sudan, which has not exported oil for a long period after its independence. In addition to Tullow Oil's activity in the South Omo Basin, exploration in neighbouring Ethiopia is being pioneered by Hong Kong-based Petro Trans in a very challenging environment. Geology offers good prospects for dry reservoirs in the Ogaden Basin, but upstream activity is impaired by separatist guerrilla activity. Exploration is also ongoing across the Mozambique Channel in Madagascar, but this has not yet resulted in any commercially viable findings.

For a long time, East Africa was virtually ignored by international gas players. To date, the largest producing fields in the region are Pande and Temane in Southern Mozambique and Songo Songo offshore Central Tanzania. Only Mozambique has any experience as a gas-exporting country. In the face of today's limited output, Mozambique and Tanzania have had the lion's share of post-2010 findings and are now the frontrunners in prospective gas developments, while Kenya has yet to find enough gas to justify investment in production.

13 It would be actually possible to evacuate Ugandan oil by pipeline through Kenya, but the Uganda National Oil and Gas Policy contains plans for the construction of a refinery in Uganda and a cluster of petrochemical industries. This \$2.5bn project is struggling to gain financial backing but is also blocking the building of a pipeline to Kenya, which is the main reason for the present stalemate. Tullow Oil and the Government recently agreed on a plan that includes the construction of a 30,000 barrels a day refinery and an export pipeline, which may end the long-standing stalemate.

Main gas discoveries	Location	Partners	Potential reserves <sup>14</sup>	Status
Mamba <sup>15</sup>	Area 4, Offshore Mozambique	Eni (50%), CNPC (20%), ENH (10%), Galp Energia (10%), Kogas (10%).	1.98-2.12 Tcm <sup>16</sup>	Planned
Atum-Golfinho	Area 1, Offshore Mozambique	Anadarko (36.5%)↓ <sup>17</sup> , Mitsui (20%), ENH (15%), Bharat (10%), Videocon (10%)↓, PTTEP (8.5%).	430-990 Bcm <sup>18</sup>	Planned
Prosperidade <sup>19</sup>	Area 1, Offshore Mozambique	Anadarko (36.5%)↓, Mitsui (20%), ENH (15%), Bharat (10%), Videocon (10%)↓, PTTEP (8.5%).	480-850 Bcm <sup>20</sup>	Planned
Jodari-Mzia-Chaza	Block 1, Offshore Tanzania	British Gas (60%), Ophir (40%).	380-590 Bcm	Planned
Papa	Block 3, Offshore Tanzania			
Zafarani-Lavani	Block 2, Offshore Tanzania	Statoil (65%), Exxon (35%).	280-370 Bcm	Planned
Pande-Temane	Onshore Southern Mozambique	Sasol (70%), ENH (25%), IFC (5%).	85 Bcm	Producing (2004)
Mbawa	Block L8, Offshore Kenya	Apache (50%), Origin (20%), Pancontinental (15%), Tullow Oil (15%).	60-140 Bcm	Planned
Songo Songo	Offshore Central Tanzania	Pan Ocean (100%)	33 Bcm	Producing (2004)

TABLE 2: OVERVIEW OF THE LARGEST GAS DISCOVERIES AND PRODUCING GAS FIELDS IN EAST AFRICA

14 Original data (estimates by companies) expressed in Tcf. Data in cubic metres are approximated.

15 The Mamba complex includes the Mamba North, Mamba South and Coral discoveries.

16 According to Eni's estimates, around 650 Bcm of gas are exclusively located in its own license area. The rest (up to 1.5 Tcm) is probably part of the Mamba-Prosperidade giant field stretching across Areas 1 and 4. As part of their December 2012 Heads of Agreement, Eni and Anadarko will have to unitise their reserves ahead of their planned joint development.

17 The arrow (↓) points to the fact that these partners are in the process of selling 10% of their stakes (more details below).

18 Unlike in the Prosperidade complex, these reserves are fully contained within Area 1.

19 The Prosperidade complex includes the Windjammer, Barquentine, Lagosta, Camarão and Tubarão discoveries.

20 Shared with Area 4 (cfr. footnote 16).

The current state of gas production in the region will be discussed in more detail in the second part of this report. For the purpose of comparison, Table 3 below shows the potential reserves of selected giant gas fields worldwide.

<b>Gas field</b>	<b>Country</b>	<b>Potential reserves in Tcm<sup>21</sup></b>
North Field	Qatar	27
South Pars	Iran	14
Urengoy	Russia	10
Groningen	The Netherlands	2.8

TABLE 3: POTENTIAL GAS RESERVES IN SELECTED GIANT GAS FIELDS WORLDWIDE

21 Estimates for potential reserves at the time of discovery.

### 3 PROSPECTS FOR LNG DEVELOPMENTS IN EAST AFRICA

The two tables above show that the presence of an adequate reserve base is not a matter of concern for investors eyeing LNG developments. However, the stakeholders still have to carry out full appraisals and certify resources in the coming months, a necessary step toward LNG marketing and a Final Investment Decision (FID)<sup>22, 23</sup>.

Geology is commonly understood to play in favour of ventures in the East African basins. The deepwater reservoirs stretch 50 to 200 kilometres offshore Southern Tanzania and Northern Mozambique. The acreage holders insist that the quality of these reservoirs is very high, potentially enabling ‘prodigious rates of 1-2 Bcm of output from every single well’, which would help contain costs<sup>24, 25</sup>. The projections of the wellhead costs of the largest fields assessed to date (Prosperidade-Mamba and Atum-Golfinho) are in fact very promising<sup>26</sup>. As we will briefly discuss later, a number of factors may negatively affect cost in the future, yet this will not compromise the robustness of these projects. What is undisputable is that large fields are the most commercially viable in the region and thus the most likely to attract investment in the first place. Investors have indicated that the minimum threshold of gas that would allow them to recover the cost of LNG infrastructure would be 230-280 Bcm<sup>27</sup>.

Estimates vary but suggest that East Africa’s reserve base could theoretically support up to 16-20 LNG trains with a capacity of 5 million tons/year (MTPA) each, equivalent to an output of 80-100 MTPA<sup>28</sup>. However, the actual number of proposed trains is about half as many, and it is already quite optimistic to forecast the construction of 4 trains by the end of this decade.

22 ‘Eni Deal Lands China in Mozambique LNG’, World Gas Intelligence (WGI), 20 March 2013.

23 ‘Anadarko Presses Mozambique Advantage’, World Gas Intelligence (WGI), 12 September 2012.

24 ‘Mozambique Gas Up for Grabs’, World Gas Intelligence (WGI), 13 March 2013.

25 As declared by Claudio Descalzi (Eni), ‘geologically there are no challenges: we have 500 meters of thickness, [reservoir] continuity of 25 to 30 kilometers, high permeability and you can drill a well in under four weeks’, quoted by World Gas Intelligence (WGI), 20 March 2013.

26 The Draft Natural Gas Master Plan for Mozambique indicates that the wellhead cost in Prosperidade-Mamba is 1.71\$/MMBtu and the wellhead cost in Atum-Golfinho is 2\$/MMBtu. An ex-processing cost of 0.75\$/MMBtu should be added to both figures.

27 ‘Statoil in Fresh Tanzania Gas Find’, Financial Times, 18 March 2013.

28 Wood Mackenzie 2012.

## MOZAMBICAN LNG

Mozambique clearly has an edge over Tanzania on LNG production and commercialisation prospects, thanks to its more aggressive investment schedule. As operators of Areas 1 and 4, Anadarko and Eni signed a preliminary agreement in December 2012 for the joint exploitation of the Prosperidade-Mamba giant field, including an onshore project in the Cabo Delgado province<sup>29</sup>. The future partners plan to build an initial 4-train, 20-MTPA scheme by 2018<sup>30</sup> and envisage a possible expansion to 10 trains with a production capacity of 50 MTPA, plateauing in 2032<sup>31</sup>. In order to start production by 2018, the next steps for them will be to certify reserves by mid-2013, agree on unitisation, define the structure of the project, decide which field to develop first, determine if they want to maintain exclusive management over some of their unshared fields in Areas 1 and 4<sup>32</sup> and take an FID on at least two trains by the end of 2013. As this schedule is overly ambitious, the production start date will almost certainly be pushed beyond 2018.

The operators of Areas 1 and 4 have already awarded Front-End Engineering Design (FEED) contracts<sup>33</sup>, and a number of acreage holders have sold part of their equity. This is a necessary step toward funding the ambitious LNG projects under consideration, which will require an upfront investment of \$12-20bn for an initial 2-train development<sup>34, 35</sup>. The distribution of equity in the areas of the main findings is undergoing rapid change, and we expect that the recent round of farm-outs will bring further evolutions. The main identifiable trend is that small exploration companies<sup>36</sup> and investors with broad asset portfolios that lack a specific interest in LNG<sup>37</sup> are farming out, while larger companies, especially Asian NOCs, are farming in<sup>38</sup>. Operators such as Anadarko and

29 Eni Press Release, 21 December 2012.

30 Upstream Online, 24 December 2012.

31 Estimate by Anadarko.

32 The Heads of Agreement simply states that independent fields shall be developed 'efficiently'.

33 For onshore facilities, FEED contracts have been awarded to 3 consortia: CB&I and Chiyoda; JGC Corp and Fluor Transworld Services; Bechtel. For offshore facilities (subsea production systems, gathering pipelines), FEED will be conducted by Technip, Saipem and Subsea-7.

34 Wood Mackenzie 2012, quoted by World Gas Intelligence, 2 January 2013. The companies indicate an investment requirement of \$12-15bn.

35 Africa Business argues that 'based on the experience of other countries in Africa, about 5 Tcf [i.e., 140 Bcm] reserves are required to provide sufficient feedstock to justify the construction of an LNG train, which would be required to operate for at least 20 years to support construction costs. Liquefaction trains generally cost at least \$1bn for every 1 MTPA of production capacity, while a single train typically has production capacity of at least 4 MTPA. The development of 10 trains would therefore require capital investment of at least \$40bn and probably substantially more'. 'Africa Sitting on Gas Fortune', Africa Business, 22 November 2012.

36 An example is Cove Energy, which sold 8.5% of its stake in Area 1 to PTTEP in the summer of 2012.

37 Such as Videocon, which recently declared it is planning to sell its 10% stake in Area 1 and farm out from the license area.

38 While OGNC of India, Oil India and Exxon are thought to be the frontrunners for the 10% stakes sold by Anadarko and Videocon, BP, Total, Shell, Sumitomo, Marubeni and Mitsubishi have also been quoted as possible buyers. CNPC has recently farmed in following Eni's sale of a 20% stake.



Eni are also selling part of their equity<sup>39, 40</sup>. While these players want to maintain their current operatorship rights, they are also aware that the farming in of large IOCs with solid balance sheets and a long track record in LNG is important to guarantee adequate funding and expertise<sup>41</sup>. As shown by Table 2, a distinctive feature of Mozambican and Tanzanian projects is that NOCs have limited participation in the projects, which is one of the main differences between East and West Africa. This should make speedy LNG developments possible in Mozambique and Tanzania. We will discuss this in more detail in the second part of the paper, in connection with our analysis of the institutional framework and the contractual and fiscal regimes.

### TANZANIAN LNG

In March 2013, Statoil's discovery of an additional 110-170 Bcm offshore Tanzania cleared the air of doubts about the viability of Block 2. The new findings pave the way for a joint development between the Norwegian company and BG Group (UK), also favoured by the Tanzanian government. The two companies are planning to team up for the construction of a 2-train LNG plant in a location that is yet to be determined<sup>42, 43</sup>. Statoil signed a pre-FEED contract for an LNG plant but has not yet disclosed detailed schedules for a prospective LNG venture. BG Group and Ophir had expressed their interest in developing LNG but recently softened their enthusiasm by asserting that the country is not ready to receive investment because of poor infrastructure and a lack of political consensus on monetisation<sup>44</sup>. Analysts tend to agree that Tanzania risks 'falling behind its neighbour'<sup>45</sup> due to the government's ambivalence towards export-oriented projects and the higher costs of its LNG projects relative to those of Mozambique<sup>46</sup>.

39 Anadarko declared it is planning to sell 10% of its stake in order to reduce its \$13bn long-term debt. After the transaction, Anadarko would retain its 26.5% equity participation and operatorship of Area 1.

40 Eni sold 20% of its 70% Area-4 stake to CNPC in exchange for \$4.2bn and an agreement for the exploitation of the Rongchang shale gas play in China.

41 Eni needs \$10bn in total to fund its activities, but financial sources suggest that after the CNPC deal the Italian major may sell its remaining stakes in Saipem and Galp rather than additional stakes in Area 4. Anadarko is also unlikely to farm out further in 2013, as this would compromise the company's goal of maintaining its current operatorship rights.

42 The Tanzanian Government is encouraging the operators to unify their reserves. 'Tanzania May Ask BG, Statoil to Unify LNG Project Development', Bloomberg, 1 August 2012.

43 'Statoil in Fresh Tanzania Gas Find', Financial Times, 18 March 2013.

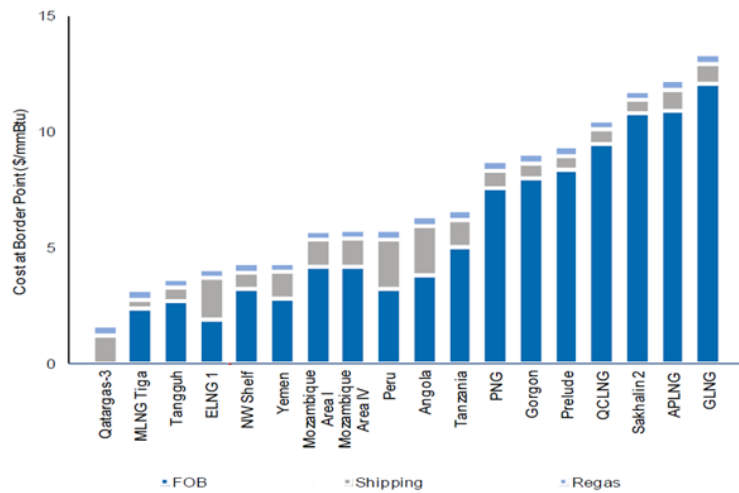
44 'BG Group to Slow Tanzania LNG Plans on Lack of Infrastructure', Bloomberg, 5 February 2013.

45 'Tanzania: LNG on Ice?', Financial Times, 10 September 2012.

46 Upstream Advisor estimates that the economics of Mozambique's projects are 60% better than Tanzania's. 'East Africa – New Frontier Exploration Forum', Upstream Advisor, 21 January 2013. Among the reasons for Mozambique's comparative advantage is that the project developers can profit here from economies of scale, given that the reservoir's geography allows for joint development. This is impossible in Tanzania, where the two largest fields are further away from each other than from the coast.

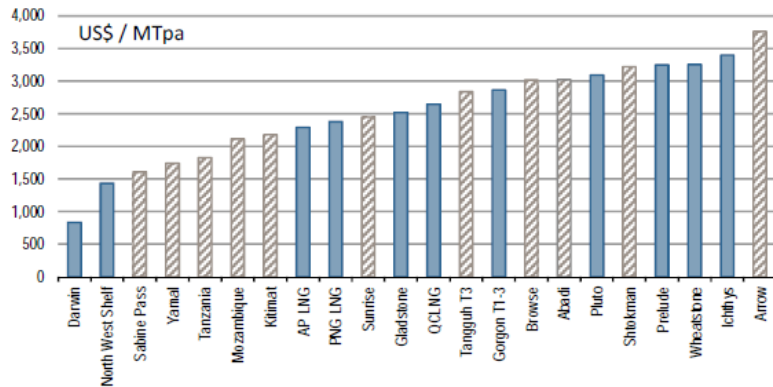
## COMPETITIVENESS

International investors view LNG as the principal monetisation option, and consultants are particularly positive about the profitability and competitiveness of East African LNG. The cost curves prepared by Wood Mackenzie and Credit Suisse (Graphs 1 and 2) suggest that East African LNG will be extremely cost-competitive relative to other greenfield projects targeting Asia.



GRAPH 1: COST OF SUPPLYING JAPAN, KOREA AND CHINA WITH LNG FROM SELECTED PROJECTS (WOOD MACKENZIE, 2012)

This holds true especially in comparison to the new Australian supply coming on stream by the end of this decade, which represents the bulk of Asia's new imports. As a matter of fact, Australian LNG projects are being hit by cost overruns owing to the strength of the currency, the shortage of affordable labour and stringent environmental regulation. According to Credit Suisse, LNG schemes in East Africa would cost around \$2,000/ton, compared to \$3,000-4,000 in Australia. In Wood Mackenzie's view, the cost of supplying Northeast Asia with Mozambican LNG would be close to \$5.3/MMBtu (and slightly above \$6 for Tanzanian LNG), compared to \$10-13 for Australian LNG.



GRAPH 2: COST OF SUPPLYING JAPAN WITH LNG FROM SELECTED PROJECTS (CREDIT SUISSE, 2012)

Qatar (where the cost is below \$2,000/ton but further expansions are currently blocked by a moratorium) and brownfield projects in Australia and the US Gulf Coast seem in a much better position to compete with East Africa for market shares in Asia.

At this preliminary stage, there are no factors indicating that East African LNG projects will inevitably suffer from severe cost blowouts. Yet greenfield projects in frontier regions are often exposed to unpredictable challenges, which in East Africa's case may notably stem from:

- The lack of oilfield services (due to the lack of prior experience with associated gas, unlike in West Africa);
- The shortage of a skilled work force;
- Poor infrastructure (besides LNG infrastructure, the region needs a deepwater port capable of servicing big tankers<sup>47</sup> as well as roads, railways and airports for the import of construction material);
- Difficult access to financing;
- Obstacles to cross-border trade (mainly due to intricate customs procedures);
- Regulatory uncertainty (among others about fiscal terms, which are expected to tighten);
- A weak institutional framework (with a very high risk of corruption) and
- Security threats.

These challenges could negatively affect the unit cost of production and require additional financing.

47 'East Africa: Embarrassment of Riches Hard to Exploit', Financial Times, 8 October 2012.

## DESTINATION MARKETS

If all of the current acreage holders take an interest in LNG, we can expect consortia to seek long-term contractual commitments before making FIDs. As a matter of fact, there would be a large number of project participants with different financial positions, and some of them would fiercely oppose arrangements other than the traditional long-term, oil-indexed contracts. Individually, some of the players involved could potentially be interested in hub indexation, which means that the window of opportunity for spot transactions is not indefinitely closed. Regarding potential markets, a simple netback analysis shows that the most likely outlet for East African LNG will be Asia, but marginal volumes could technically reach Europe and South America as well.

Destination <sup>48</sup>	Transit times (days) <sup>49</sup>	Transportation cost (\$/MMBtu) <sup>50</sup>	Landed Prices March 2013 <sup>51</sup>	Netback (price minus shipping)
India	16	0.6 – 0.8	15.70	14.90-15.10
Spain	29	1.2 – 1.7	15.25	13.55-14.05
Argentina	33	1.2 – 1.6	18.09	16.49-16.89
China	34	1.2 – 1.6 (est.) <sup>52</sup>	19.35	17.75-18.15
Japan	36	1.3 – 1.7	19.75	18.05-18.45

TABLE 4: NETBACK OF EAST AFRICAN LNG SALES TO DIFFERENT DESTINATIONS

East Africa enjoys an advantageous geographical position at the crossroads of the Atlantic and Pacific Basins. However, with the exception of India and perhaps South Africa, the region is not very close to any sizeable gas market. Discussions on LNG marketing are currently underway in Mozambique, and Anadarko admitted it has begun talks with potential Japanese customers<sup>53</sup>. According to financial sources<sup>54</sup>, the operator of Area 1 and its partners are working on oil-linked sales, with Mitsui taking the lead. These contacts were facilitated by a Memorandum of Understanding signed in 2012 by Mozambique and Japan paving the way for coal and gas trade between the two countries<sup>55</sup>. The world's largest importer of LNG, Japan has been willing to pay a substantial premium on spot transactions since the Fukushima

48 The supposed destinations are Dahej (India), Barcelona (Spain), Bahia Blanca (Argentina), Shanghai (China) and Osaka (Japan).

49 Figures refer to round-trips.

50 'Natural Gas: Bumpy Road to Global Markets', CitiGroup 2012.

51 Waterborne Energy, February 2013 (estimated landed prices for March 2013).

52 CIEP estimate.

53 'Anadarko Holds Talks With Japan Over Mozambique LNG Supply', Bloomberg, 13 March 2013.

54 World Gas Intelligence, 13 March 2013.

55 Petroleum Africa, 31 October 2012.

accident, making it a very attractive market. At the same time, the country is trying to obtain lower prices in its long-term contracts and is actively seeking diversification<sup>56</sup>. Nonetheless, the probable nuclear restart<sup>57</sup> and future US supply<sup>58</sup> are set to compete with East African gas.

LNG import demand in the Asia-Pacific region is expected to rise dramatically in the coming decades, with the bulk of future growth coming from non-OECD Asia. The IEA indicates that Chinese gas imports will rise from the current 30 Bcm to 130 Bcm by 2020 and eventually to 225 Bcm by 2035, which amounts to 40% of the total expansion in global inter-regional trade. According to the WEO 2012 'New Policies Scenario', Chinese natural gas demand (which was 110 Bcm in 2010) will exceed 300 Bcm by 2020 and reach 544 Bcm by 2035. In India, gas demand is projected to grow from 64 Bcm to 92 Bcm by 2020 and 178 Bcm by 2035<sup>59</sup>, but the country's appetite for hub indexation may complicate negotiations with the consortia. Both China and India are putting in place different strategies to achieve security of supply, including engagement by their NOCs in overseas LNG ventures. This well-known process helps to create a community of interest and a long-term relationship between suppliers and buyers. In this perspective, we assume that CNPC plans to import gas from Mozambique, following its recent acquisitions in Area 4.

Netbacks to Southern Europe are also relatively attractive, but European buyers are more reluctant than their Asian counterparts to sign long-term deals for LNG supply. As a result of the post-2009 situation in the European gas market, buyers are renegotiating the terms of their gas contracts to include hub indexation. Their current unwillingness to engage in long-term, oil-indexed contracts may be at odds with the preferences of project developers and their bankers to secure such deals ahead of any substantial investment. For this reason, it is unlikely that significant, stable volumes of East African LNG will target the European market.

An "Indian Basin" is emerging alongside the Atlantic and the Pacific Basins. It is developing its own new dynamics, especially since the flooding of global markets by the first wave of Qatari LNG. This basin has the potential to gain an even more central role in gas flows, hosting both large exporters (East Africa, Australia, Qatar and Indonesia) and importers (India and numerous countries in Southeast Asia and the Persian Gulf). The Indian Basin shares some features with the Asia-Pacific region,

56 Declarations by Toshihiko Fujii (an official with Japan's trade and industry ministry). AFP, 29 October 2012.

57 'Japan to Begin Restarting Idled Nuclear Plants, Leader Says', New York Times, 28 February 2013.

58 'US Poised to Approve Shale Gas Exports to Japan', Kuwait News Agency, 28 March 2013.

59 World Energy Outlook 2012, IEA.

such as the prominence of the booming Asian economies as destination markets and the scarcity of pipelines. In addition, it presents specific patterns such as the lack of mature regional markets, India's eagerness to explore new business models based on spot transactions, and a very high security risk along the 'Crescent of Crisis'<sup>60</sup>.

East Africa has the potential to emerge as an important supplier in the Indian Basin, but in order to stand on its own legs this infant producing region will have to measure up against dynamic competitors. The challenge is remarkable, considering that when the dozen LNG liquefaction plants under construction around the world become operative, as much as 108 Bcm/y of gas will be added to the supply base<sup>61</sup>. Besides, other players will have the possibility to develop brownfield projects, which usually have shorter lead times and lower unit costs than greenfield projects do.

### **LNG FROM THE PERSPECTIVES OF MOZAMBIQUE AND TANZANIA**

In addition to the interplay between East African LNG and global gas flows, a crucial issue deserving further investigation is the contribution of LNG production to the socio-economic development of Mozambique and Tanzania. We already mentioned that LNG is the best monetisation option from a field development perspective. However, LNG can also play a very positive role in stimulating the local economy. By means of royalties, profit gas and corporate taxes, LNG ensures the highest government revenues among all the possible monetisation options<sup>62</sup>. These revenues can be used by the State to incentivise economic diversification, build infrastructure, reduce debt and improve welfare. Another advantage is that LNG brings in capital more quickly than other monetisation options because LNG infrastructure is easier to build and has shorter lead times than the combination of pipeline networks and industrial clusters. Finally, LNG also has very good potential in terms of job creation. In Mozambique, its estimated contribution would be 4,200 jobs in terms of direct and indirect employment and up to 71,400 jobs in terms of induced employment<sup>63</sup>.

60 In 1979, Zbigniew Brzezinski referred to 'an arc of crisis [that] stretches along the shores of the Indian Ocean, with fragile social and political structures in a region of vital importance to us threatened with fragmentation'. Even if the context has largely changed since the end of the Cold War, security threats are still a distinctive aspect of the Indian Basin. These are common to East Africa (Great Lake Region, Horn of Africa), the Gulf (Iraq, Iran), South Asia (Afghanistan, Pakistan, Kashmir) and Southeast Asia (Banda Aceh, Mindanao, Strait of Malacca). Even though the Atlantic and the Pacific Basins are also confronted with security threats, the situation in the Indian Ocean seems much more precarious.

61 World Energy Outlook 2012, IEA.

62 Draft Natural Gas Master Plan for Mozambique, ICF 2012.

63 Draft Natural Gas Master Plan for Mozambique, ICF 2012.

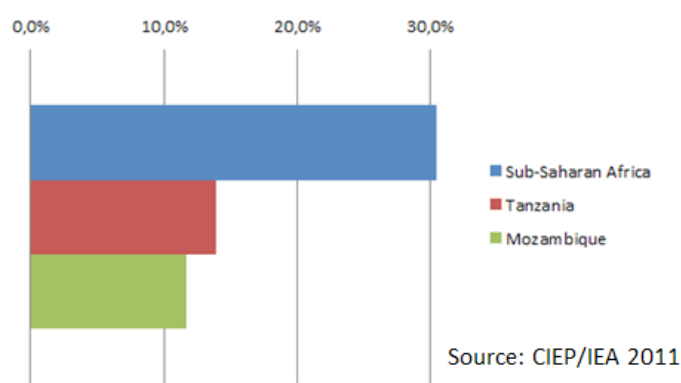


However, LNG alone might not be enough to maximise the collective benefit, and the revenues it originates entail some risk, chiefly Dutch Disease<sup>64</sup>. An appreciation of the Mozambican Metical and the Tanzanian Shilling would be detrimental for non-oil exports and would hinder the industrialisation of these two emerging economies. In order to soften the impact of large gas revenues, Mozambique and Tanzania are exploring the possibility of establishing Sovereign Wealth Funds (SWFs). Moreover, local governments may consider collecting substantial in-kind royalties (i.e., physical volumes of gas) in addition to cash royalties in order to reduce the amount of currency in circulation. Taking control over some physical gas volumes would not only reduce Dutch Disease, it would also help to launch projects for the benefit of the local population. These projects are the object of the following section.

64 Van der Linde, C., 'FAQ: Dutch Disease', Clingendael International Energy Programme (CIEP), May 2013.

# 4 PROSPECTS FOR DOMESTIC AND REGIONAL GAS DEVELOPMENTS IN EAST AFRICA

The newly discovered gas reserves can sustain important domestic development schemes in Mozambique and Tanzania by boosting access to energy. Today, energy poverty is a real scourge for East Africa, with only 11.7% of Mozambicans and 13.9% of Tanzanians disposing of electricity (Graph 3)<sup>65</sup>. Only the Democratic Republic of the Congo, Malawi and Uganda are worse off, and the average electrification rate in Sub-Saharan Africa is almost three times higher, at 30.5%<sup>66</sup>. Diesel-fired generation from obsolete and often isolated facilities remains an important component of the energy mix<sup>67</sup>, and most households are still reliant on wood and charcoal.



GRAPH 3: SHARE OF POPULATION WITH ACCESS TO ELECTRICITY. ACCESS TO ELECTRICITY IS IMPROVING EVERY YEAR AND LOCAL GOVERNMENTS CLAIM HIGHER ELECTRIFICATION RATES

Gas plays a relatively marginal role in both countries. Since 2004, the Sasol-operated Mozambican fields of Pande and Temane have produced 3.4 Bcm/y of gas, processed at Temane and predominantly (3.2 Bcm/y) piped through a 26-inch, 865-km pipeline to the South African location of Secunda<sup>68</sup>. This important infrastructure<sup>69</sup> is the only long-haul international gas pipeline ever built in the region. The exported gas is largely used as a feedstock in Sasol's GTL plant for the production of synthetic fuels

65 World Energy Outlook 2011, IEA.

66 World Energy Outlook 2011, IEA.

67 'Gas Long and Tortuous Negotiations Confront Commercial Progress', Financial Times, 6 December 2012.

68 Van Tonder, J., 'Tapping Into Southern Africa's Natural Gas', Science in Africa, 2002.

69 The pipeline cost \$1.2bn and has a total capacity of 3.9 bcm/y.

and chemicals, and also in the 140-MW Sasolbury gas power plant<sup>70</sup>. The rest of the gas produced in Pande and Temane is consumed domestically by small industrial and domestic clients in the Inhambane province and by the Mozal aluminium smelter at Matola. The capacity of the Temane processing plant has been recently expanded to 4.8 Bcm/y, with part of the additional output feeding the new 107-MW Ressano Garcia power plant<sup>71</sup>.

The offshore field of Songo Songo has been producing gas since 2004. Located on the Central Tanzanian shelf 15 km off the coast, this 33-Bcm field is operated by Pan African Energy, a branch of Canada's Orca Exploration. The current output of 1.2 Bcm/y is set to grow, thanks to the ongoing upgrade of the Songo Songo Island gas processing facility. The 16-inch, 207-km pipeline connecting Songo Songo to Dar-es-Salaam has a capacity of 1 Bcm/y, but a new pipeline is planned, as we will discuss later<sup>72</sup>. The entire volume is consumed within Tanzania by small industries and households, the Wazo Hill cement factory and power plants. The Ubungo facility, owned by the Tanzania Electric Supply Company (TANESCO), is fed by gas from Songo Songo and is the country's largest gas-fired power plant<sup>73</sup>. Wentworth extracts marginal volumes of gas at Mnazi Bay in Southern Tanzania and operates a processing plant and a small power generation facility in Mtwara.

The recent offshore discoveries create momentum for a new role of gas in the energy mix of Mozambique and Tanzania. Theoretically, gas could replace wood in cooking appliances, widen access to electricity and bolster industrialisation. This means that gas has the potential to improve the living standards of millions of people in a very tangible way. Among the alternative monetisation options, power generation, GTL, CNG, fertilisers, methanol but also aluminium, cement and steel production deserve special attention. As we will discuss, the economic viability of these projects is contestable, and only a few of them will actually see the light, in part because they would compete with each other.

## **POWER GENERATION**

One of the most tangible benefits of using natural gas domestically would be wider access to electricity. Before discussing this option, the current state of power generation in East Africa deserves a closer look. Quite paradoxically, Mozambique

70 Built in 2012 by Finalnd's Wärtsilä. 'Sasolbury Gas Engine Power Plant to Start Up Before Year-End', Gas-to-Power Journal, 14 June 2012.

71 Inaugurated in July 2012 by Aggreko and Shanduka. 'Mozambique: Guebuza Inaugurates Gas-Fired Power Station', All Africa, 19 July 2012.

72 TPDC website.

73 TANESCO website.

and Tanzania are often described as regional leaders in electricity. This is because they so far have been able to meet their internal demand, thanks to substantial hydroelectric power production, recently complemented by gas-fired power generation. In particular, the 2000-MW Cahora Bassa Dam (Map 2) is one of Africa's largest hydroelectric infrastructures and allows Mozambique to even export electricity to neighbouring South Africa and Zimbabwe<sup>74</sup>. Similarly, the Kidatu and Mtera Dams (Map 2) are the main sources of electricity production in Tanzania. Nevertheless, these countries' abilities to meet their long-term internal demand is in sharp contrast with frequent supply disruptions and very low electrification rates. Moreover, the current output will be insufficient to meet future demand, which is projected to skyrocket in both countries, driven by very high GDP growth, fast urbanisation and incipient industrialisation. In 2013, GDP will rise by 7.9% in Mozambique and 7.1% in Tanzania, and these figures are set to grow further in the next decade as the two countries start monetising their offshore gas reserves<sup>75</sup>. In terms of electricity demand, this will result in hundreds of thousands of new connections to the energy grid every year, potentially bringing the electrification rate of the two countries to more than 40% by 2030<sup>76</sup>.

Toward successfully meeting the challenge of electrification, Mozambique and Tanzania can now count on substantial offshore gas reserves. To be sure, offshore gas is not the only fuel available. The Mozambican government in particular is assessing alternative projects in the Tete province (Map 2), including new hydroelectric plants and coal-fired power plants<sup>77</sup>. Moreover, a production upgrade in Pande and Temane will result in additional generation capacity close to Maputo, the core of future electricity demand. All of these projects will probably see the light before any power generation development based in the North does, mainly because the CESUL ('Central-Southern', or 'Mozambique backbone') electricity transmission line from Tete to Maputo has already been approved<sup>78</sup>. Overall power generation capacity in Mozambique will increase by an annual average of 14.2% between 2012 and 2017<sup>79</sup>. Nonetheless, the forecasted boom in electricity demand beyond 2017 means that there could still be a window of opportunity for power generation fed by offshore gas. As a matter of fact, the ENP has already received a number of

74 Mozambique Power Report Q1 2013, Business Monitor International, 21 November 2012.

75 African Development Bank, 2011.

76 Mahumane, D., P. Mulder and D. Nadaud, 'Energy Outlook for Mozambique 2012-2030: LEAP-based scenarios for energy demand and power generation', IESE, 2012.

77 The proposed coal-fired power plants would be run on the new massive findings in the Moatize Basin, estimated at 23 billion tons.

78 The \$1.8bn transmission line will be built by China's State Grid and Portugal's Ren.

79 Business Monitor International, 2012.

applications from companies to supply 1.54 Bcm/y of gas to planned power plants in the North over a period of 30 years (corresponding to 46.2 Bcm of gas over the whole period)<sup>80</sup>. At least initially, gas from the Rovuma Basin is more likely to feed local gas-fired power generation than plants in Maputo – located 2,000 km south of the new gas findings – unless gas is transported to Maputo in liquefied form and transformed into electricity there<sup>81</sup>.

Prospects for gas-fired power generation are seemingly rosier in Tanzania, where distances are shorter and the political support for domestic monetisation options is stronger. The government has already secured a \$1.2bn Chinese loan for the construction of a gas pipeline from the prospective Mtwara processing plant to Dar-es-Salaam<sup>82</sup>. The 36-inch, 532-km pipeline will also have a 24-inch spur to Songo Songo in order to accommodate greater production from that field. The overall pipeline capacity will be 8 Bcm/y, an amount sufficient to produce 3,900 MW of electricity. However, this project has attracted stark criticism from both inside and outside the country (for opposite reasons). The acreage holders fear that the pipeline will compete with more lucrative export-based developments and regard the infrastructure as premature, stressing that there is no gas available to fill it and ‘no plan to sell what little exists’<sup>83</sup>. While criticism is well grounded in the sense that national electricity demand currently stands at only 900 MW, the pipeline may actually prove vital in the next years, as demand is expected to reach 2.7 MW by 2015. In November, President Kikwete disclosed plans to up generation capacity to 3MW, suggesting that Tanzania could become a net electricity exporter<sup>84</sup>. However, this promising picture is in sharp contrast with the current inefficiency of Tanzania’s power sector. TANESCO recently declared that it will have to increase tariffs by 80% to avoid bankruptcy<sup>85</sup>. This move will inevitably lead to the deterioration of an already tense political climate. In January 2013, deadly demonstrations exploded in Southern Tanzania in reaction to the government’s backing of the pipeline, which will bring all the natural gas produced in the Southern districts to Dar-es-Salaam<sup>86</sup>. The populations of the gas-rich Mtwara and Lindi regions – which also happen to be the poorest in Tanzania – lament the lack of decentralised development schemes and demand that local electricity supply be prioritised. Turmoil in Southern Tanzania shows that gas can

80 Draft Natural Gas Master Plan for Mozambique, ICF 2012.

81 The government is already building infrastructure to allow the port of Maputo to receive ships carrying domestically produced LNG. Dutch Embassy in Mozambique, 2011.

82 Tanzania Daily News, 7 September 2012.

83 ‘Gas: Long and tortuous negotiations confront commercial progress’, Financial Times, 6 December 2012.

84 ‘Tanzania: Nation Set for Power Boom By 2015’, Tanzania Daily News, 9 November 2012.

85 ‘Tanzania Gas Policy Consultation – December 2012’, Clyde&Co, January 2013.

86 ‘Pipeline Riots Leave 7 Dead in Tanzania’, Wall Street Journal, 28 January 2013.

become a very divisive issue if governments fail to meet the legitimate expectations of their citizens. Decision makers must ensure that especially people living in gas-rich districts are given access to electricity as soon as possible in order to cement consensus around gas projects. Moreover, urgent reforms are needed to improve the efficiency of the electricity sector.



MAP 2: GAS PRODUCTION, PIPELINES AND POWER GENERATION IN EAST AFRICA (SOURCE: CIEP)

Governments are currently assessing the various monetisation options based on their viability, macroeconomic impacts and contributions to the State budget. ICF estimates that a 250-MW gas-fired power plant in Mozambique would employ 140 workers<sup>87</sup> and generate \$340,000 in added value and \$150 million/year in government revenues. Unfortunately, the report does not provide aggregate data for all the power generation projects planned in the two countries. This makes it impossible to compare the overall macroeconomic impact of power generation with that of other monetisation options. Yet power generation certainly has two identifiable strengths in relation to alternative projects. The first is economic viability,

<sup>87</sup> Up to 2,400 jobs if induced employment is also considered.



as electricity production potentially has the second best netback value after LNG, well above the unit cost of production of \$3/MMBtu<sup>88</sup>. The second is that the availability of ample and affordable electricity supply is instrumental to GTL, fertiliser, methanol and other industrial products. This means that once LNG exports have provided Mozambique and Tanzania with the revenues necessary to fund domestic gas schemes, local governments should first invest in power generation and then in other projects. Alternatively, Mozambique and Tanzania could consider arrangements whereby gas-fired power plants are built by the LNG project developers alongside LNG infrastructure. In this way, the local governments would enjoy both high revenues and tangible benefits for their people in the early days of exploitation of their natural gas reserves. Spatial co-ordination is as important as temporal co-ordination in order to avoid bottlenecks, delays and cost blowouts. The gas-fired power plants will notably have to be built in the same locations as future energy-intensive industrial clusters, which requires careful advance planning.

Not only domestic, but also regional power generation projects will need to be addressed. First of all, Mozambique and Tanzania should commission a comprehensive study weighing their own power generation needs against those of the region in order to understand where the market for electricity really is. Southern Africa is probably entering a period of generation capacity shortage, following a period in which demand for electricity has been growing at 2.8% annually<sup>89</sup>. While small power plants serve the purpose of rural electrification, governments will need to integrate them with larger plants if they want to sustain export schemes and system reliability<sup>90</sup>. Another step that has to be taken to facilitate export is integrating grids within the Southern Africa Power Pool (SAPP)<sup>91</sup> and the East African Community (EAC)<sup>92</sup>. The EAC in particular is pushing for a regional infrastructure development under the auspices of the African Development Bank. Instead of long-haul transmission lines, the EAC has proposed to expand the future Tanzanian gas pipeline to the Kenyan energy hub of Mombasa, where it envisages the construction of a gas power plant<sup>93</sup>. On the other hand, Mozambique is likely to increase its current electricity exports to South Africa (which accounts for 80% of the SAPP region's demand<sup>94</sup>) and is considering plans to start exporting electricity to Malawi, the nearest foreign market to the Rovuma Basin<sup>95</sup>.

88 These figures, provided by the Draft Natural Gas Master Plan for Mozambique, refer to Mozambique only.

89 Draft Natural Gas Master Plan for Mozambique, ICF 2012.

90 Draft Natural Gas Master Plan for Mozambique, ICF 2012.

91 SAPP's members are electricity companies from Angola, Botswana, Democratic Republic of the Congo, Lesotho, Mozambique, Malawi, Namibia, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe.

92 EAC's members are Kenya, Tanzania, Burundi, Rwanda and Uganda.

93 'Tanzania: Mtwara Gas Pipeline to Connect EAC', Tanzania Daily News, 24 January 2013.

94 'Mozambique Regional Transmission Backbone Project – Feasibility Study', Norconsult, Vattenfall, 25 November 2011.

95 AFP, 26 July 2012.

## OTHER DOMESTIC MONETISATION OPTIONS

In order to fully capture the socio-economic benefits of their gas riches, local governments will have to promote a wider range of domestic schemes besides those in support of power generation, but only at a later stage. As we mentioned, gas can be used in a number of domestic applications, namely GTL, CNG, fertilisers, methanol, aluminium, cement and steel. Apart from their own added value, these products have the potential to set in motion a process of industrialisation with broader positive spin-offs, for instance by eliciting the emergence of satellite activities. If they are developed, these activities will facilitate economic diversification, which is crucial for producing countries in breaking their hyper-dependence on one commodity. Industrialisation also entails job creation, which in turn stimulates internal demand with potential multiplier effects. The emergence of industrial clusters is often accompanied by the construction of ancillary infrastructures and services, including schooling and health care. If possible, local governments should ensure that different regions benefit from industrialisation and not only the largest metropolitan areas or the regions close to the gas findings. An even geographical distribution of wealth is beneficial to the political climate, preventing centrifugal tendencies and uncontrolled migrations. Finally, some production processes could displace significant imports, having a positive impact on Mozambique's and Tanzania's balance of payment.

## GAS-TO-LIQUIDS (GTLs)

The product with the highest import substitution potential is arguably Gas-to-Liquids (GTLs). This monetisation option is currently under discussion, particularly in Mozambique, where South Africa's PetroSA is involved in talks with the government to develop a GTL plant with a capacity of 40,000 bbl/day<sup>96</sup>. From GTLs it is possible to obtain a number of valuable end products, including clean diesel, kerosene, feedstock for petrochemicals such as naphtha, lube oils, LPGs (Liquefied Petroleum Gases) and many others. Unlike LNG, these products are easily movable and not constrained to a fixed chain. A share of locally produced GTLs will certainly be absorbed by domestic markets but, depending on global market conditions, the bulk is likely to be exported to countries within and outside Africa. If GTL schemes can be developed economically, East Africa's dependence on imports of oil products could be drastically reduced, not only by decommissioning diesel-fired generation but also by substituting petroleum products in road transport and other applications. The interest in GTLs is also justified by the potentially high added value of these productions and the substantial government revenues they could generate<sup>97</sup>. Finally, large GTL schemes would create

96 'PetroSA in talks with Mozambique for GTL plant; 70% diesel output', Reuters, 29 April 2012.

97 Among the options explored by the Draft Natural Gas Master Plan for Mozambique, GTL appears the second best option after LNG in terms of both added value (\$4,580MM for a standard sized facility) and government revenue (\$860MM).

a lot of employment opportunities. For instance, according to the projections of the Draft Natural Gas Master Plan for Mozambique, a standard-sized GTL facility would employ more workers than a standard-sized LNG facility<sup>98</sup>.

While the availability of sizeable and relatively inexpensive gas volumes should not be a matter of concern in East Africa, the capital intensiveness of GTL infrastructure may pose an obstacle to development. Local governments certainly lack the resources to fund these projects autonomously, but financing could be a challenge also for larger companies, which would probably ask for tax breaks or other incentives. High capital costs have traditionally induced GTL project developers to seek economies of scale. As a result, GTL is currently produced in only a handful of very large plants in Qatar, Malaysia and South Africa<sup>99</sup>. The viability of GTL is very sensitive to variations in the oil price because its end products compete with petroleum products<sup>100</sup>. This strong dependence on the oil price clearly clashes with one of the main rationales behind the pursuit of alternatives to LNG, i.e., to decouple government revenues from the price variations of a single commodity. Some companies claim that technology is now in place to profitably construct small modular GTL reactors, which would better fit East Africa's case for the reasons outlined above. However, the profitability of these reactors has yet to be proven. Investors and governments should explore this option and conduct additional studies to learn whether small-scale GTL is viable<sup>101</sup>.

### **COMPRESSED NATURAL GAS (CNG) AND SMALL-SCALE LNG**

In addition to GTL fuels, Mozambique and Tanzania should consider other possible applications of gas in the transport sector. Natural gas can, for instance, be converted into CNG and used in the automotive industry. However, the diffusion of CNG in transport will probably be limited to urban buses in a handful of big cities because larger scale plans would require an expensive distribution system. CNG's attractiveness lies in its possibility to replace polluting imported fuel with cleaner, safer and cheaper domestic fuel. Some pilot CNG projects have already been launched in East Africa, starting with PanAfrican's pioneering application of CNG to vehicles, hotels and industries in Tanzania. CNG projects can be profitably developed on a smaller scale than GTL or LNG projects. For this reason, we do not expect that substantial volumes

98 Draft Natural Gas Master Plan for Mozambique, ICF 2012.

99 Shell's Pearl facility in Qatar stands out among these GTL facilities, with a gas feed rate of 40 MMcm/d and a production rate of 140,000 bbl/d.

100 GTL plants are potentially viable (the netback value could reach 10\$/MMBtu in ICF's best case scenario), but they largely depend on the volatile price of oil products, with which they compete.

101 So far, there are indications that small-scale GTL would be a profitable monetisation option for associated gas. As a matter of fact, this application would satisfy the producers' interest in reducing flaring and would enable them to produce synthetic crude oil and mix it with naturally produced oil. The outlook for small-scale GTL as a monetisation option for non-associated gas is much more uncertain.

of newly discovered gas will be absorbed by this market. Apart from its use as a fuel in transportation, CNG could also be an interesting solution as a means of transporting gas. As a matter of fact, CNG appears to be preferable to LNG for distances below 2,000 km and loads lower than 15 MMcm. This idea has already been applied by the Matola Gas Company in Mozambique, which implemented a “Virtual Pipeline System”, shipping CNG via lorry to industrial customers<sup>102</sup>. LNG could also be used in transportation but at a much higher cost than CNG. It is difficult to assess the feasibility of small-scale LNG schemes in East Africa, as there is no information available on prospective projects, but a comprehensive study on alternative monetisation options of gas should definitely address this possibility as well.

## FERTILISERS

The economies of both Mozambique and Tanzania are heavily reliant on agriculture, which represents a high share of GDP (30% and 28%, respectively<sup>103</sup>) and the employed workforce (80.5% and 76.5%<sup>104</sup>). Subsistence farming is still dominant, and the lack of modern farming techniques – including a scant use of fertilisers – keeps crop yields at very low levels. Demand for fertilisers in the region has lately been on the rise, mainly due to higher demand from the tobacco sector, and will grow further in the next years<sup>105</sup>. Local governments in Mozambique and Tanzania see agricultural development as a priority. A more widespread use of fertilisers would significantly enhance crop yields and is thus an essential component of these development plans. Compound fertilisers make up the bulk of fertilisers consumed in Mozambique and Tanzania. These are mainly imported from South Africa and a few other countries<sup>106</sup>, while locally produced blends are definitely cheaper but also of a much lower quality<sup>107</sup>. Tanzania used to have an industrial fertiliser production plant at Tanga, but it was shut down on technical grounds in 1991 and never reopened. Since then, countries in the region have eyed plans to produce fertilisers domestically, but doubts about sufficient gas supply have arguably prevented these projects from becoming reality. Today’s availability of large volumes of potentially cheap feedstock gas is a unique opportunity to establish a large-scale fertiliser industry in East Africa. This would allow Mozambique and Tanzania to displace costly imports and probably become regional exporters. As a matter of fact, demand for fertilisers is projected

102 ‘Virtual gas pipeline brings CNG to Mozambique’s industrial areas’, 2 February 2007, [Engineeringnews.co.za](http://Engineeringnews.co.za).

103 World Bank, 2011.

104 World Bank, 2003-2006.

105 Study on the Urea Fertilizer Complex Project in the Republic of Mozambique, Toyo Engineering Corp. and Sumitomo Corp., February 2012.

106 The Supply of Inorganic Fertilizers to Smallholder Farmers in Mozambique, International Food Policy Research Institute, December 2012.

107 PSI project: Manufacturing of granulated compound fertilizers for the Southern African markets, Dutch Ministry of Foreign Affairs, 2012.

to rise not only in Mozambique and Tanzania but also in other countries of the SADC region (from 478,000t in 2007 up to 794,700t by 2017<sup>108</sup>). Provided that the feedstock gas is priced well below LNG, East African countries will acquire a competitive advantage in fertiliser production and could sell it in rewarding markets like South Africa. However, prospects for exports outside Africa are less positive, as 58 new plants will come on stream in the next 3 years, posing a serious risk of overcapacity<sup>109</sup>.

The Mozambican government approved a plan in July of last year to boost national fertiliser production. Government officials declared that the country needs to produce fertilisers by 2015 and announced the construction of a plant in the Inhambane province<sup>110</sup>. While this project does not target feedstock gas from the Rovuma Basin, other projects counting on offshore gas production are on the table. So far, the ENP has received three applications to supply 1.82 Bcm/y of gas to planned facilities over a period of 20-25 years (40 Bcm of gas in total)<sup>111</sup>. Asian companies seem to have a special interest in fertiliser production in the country<sup>112</sup>. In Tanzania, the Tanzania Petroleum Development Corporation (TPDC) is looking for investors for a planned ammonia plant at Kilwe, while Wentworth and Maurel&Prom are planning a combined methanol/urea plant in Mtwara<sup>113</sup>. The possibility of undertaking regional fertiliser production projects should also be considered, perhaps with the involvement of international and regional development agencies. Regional schemes would be desirable from the perspective of a maximisation of synergies and a more efficient allocation of resources. Moreover, economic interdependence can be regarded as an instrument to cement good bilateral relationships. This idea was launched in the past by Kenya, which proposed to Tanzania and Uganda that they should embark on a joint fertiliser production project. Unfortunately, difficulties in this co-operation induced Kenya to develop its own fertiliser plant, having witnessed how difficult it is to co-ordinate policies in the region<sup>114</sup>.

108 Mozambican Ministry of Agriculture.

109 Draft Natural Gas Master Plan for Mozambique, ICF 2012.

110 Petroleum Africa, 27 July 2012.

111 Draft Natural Gas Master Plan for Mozambique, ICF 2012.

112 Sumitomo and Toyo Engineering are planning to build a \$1.2bn fertiliser plant in Beira by 2016, with an estimated output of 600,000 tons/year (Bloomberg, 23 February 2012). In a bilateral ministerial level meeting in late 2012, India committed to building fertiliser and petrochemical plants to supply the country (Reuters, 26 October 2012). India's offer could be part of a larger deal to obtain acreage in the Rovuma Basin, as Mozambique specified it will favour companies that are willing to help develop domestic gas-based industries in the next licensing rounds (The Economic Times, 16 October 2012).

113 The cost of this facility – due to come on stream by 2015 – is \$1.5bn, and its expected production is 1 million tons/y of methanol and 800,000 million tons/y of urea (Wentworth, 27 November 2012).

114 'New feud over proposed fertilizer plant', Daily Nation, 24 January 2012.

## **METHANOL**

Another monetisation option that could foster industrial development in East Africa is methanol; however, it has limited market applications. Interest in methanol production has grown, particularly since GigaMethanol<sup>115</sup> and Insitec declared plans to build and operate the world's largest and most efficient methanol plant in Mozambique. This plant, which would be built in the proximity of Pande and Temane and fed by gas extracted there, would have the capacity to produce 15% of the world's annual methanol output<sup>116</sup>. Other international investors have applied for the supply of 15 Bcm/y of gas to five planned methanol factories over a period of 20-30 years (for a total volume of 377.4 Bcm)<sup>117</sup>. Given the volumes involved and the planned location of these plants (in the Cabo Delgado province), the project developers are clearly counting on supply from offshore fields. As mentioned, Tanzania is also considering methanol production in combination with urea. The main positive aspects of methanol production are its high added value, its job creation potential and the fact that it can promote industrialisation by serving as a feedstock for the chemical industry. The major obstacle to developments in this sector is that methanol markets are currently glutted, but project developers claim that new opportunities may emerge in future, mainly driven by Chinese demand<sup>118</sup>. Yet the construction of even one plant has the potential to significantly alter market conditions and lower prices.

## **ALUMINIUM, CEMENT AND STEEL**

Finally, energy-intensive industries including aluminium, cement and steel production are eyeing locations with low energy costs, and some of them may find a business opportunity in East Africa. Demand for aluminium and steel is expected to grow significantly in the region, and access to abundant raw materials, particularly in Mozambique, will encourage the further expansion of these sectors. Demand for cement could also rise dramatically due to a possible boom in the construction sector. This is a likely circumstance after large oil and gas discoveries, as recently shown by Angola<sup>119</sup>.

115 The company is registered in The Netherlands but is a subsidiary of the German, Swiss-based Janus Methanol AG.

116 Insitec website.

117 Draft Natural Gas Master Plan for Mozambique, ICF 2012.

118 IHS Chemical, March 2013.

119 Eisenstein, Z., 'Cement Crisis Hampers Angola Construction Boom', Reuters, 6 November 2007.



## 5 THE DECISION- MAKING PROCESS ON MONETISATION

In the previous section we presented numerous projects that Mozambique and Tanzania could implement to monetise their substantial gas reserves domestically, either for direct usage or as a feedstock for products that can be consumed internally or sold in regional and international markets. The various monetisation options described can contribute to the socio-economic development of the host countries in different ways. Some have a better potential in terms of job creation, added value or government revenues, while others are instrumental to industrialisation or agricultural development. Other considerations may also play a role in the choice: for instance, the main strength of some options is their high import substitution potential, while others may be preferred because they would benefit specific regions within Mozambique and Tanzania<sup>120</sup>. Finally, we also saw that some projects are better placed than others in the current market environment. To be sure, only a limited number of the projects described will actually be developed, in part because some options compete with each other. All of these factors must be taken into account when taking a decision on monetisation.

While license holders tend to prioritise LNG, local governments aim to diversify the use of their gas reserves and are carefully assessing all the options on the table. This process will inevitably take some time and will possibly delay LNG exports, but it is vital for Mozambique and Tanzania to design comprehensive policies and build consensus around them rather than embarking on fragmentary and contentious courses of action. This is desirable also from a company perspective. Without a serious internal debate on monetisation, the risk is that governments initially push for LNG exports but are then forced to revert their decisions due to mounting internal discontent. Experiences in Angola provide a recent, negative example of failed distribution of wealth that must be avoided in East Africa. In this and other respects, it is important to stress that the different viewpoints of governments and companies will not necessarily result in outright opposition. First of all, East Africa's substantial offshore reserves are more than sufficient to feed both LNG exports and domestic schemes. Secondly, a number of projects have good prospects in terms of economic viability, and companies may be interested in developing them. Thirdly, international investors and governments alike have an interest in ensuring that the people of Mozambique and Tanzania fully enjoy the benefits of gas production in order to maintain a climate of political stability.

<sup>120</sup> These considerations are of an equally political and economic nature.

The debate on monetisation currently underway in the two countries will lead to the enactment of new legislation and the issuance of new guidelines. The focus is especially on the Natural Gas Master Plan for Mozambique and Tanzania's Gas Legislative Package, to be approved between 2013 and 2014. These policy-making tools will be designed to maximise the benefits of gas production for the host countries and will address a wide range of issues, such as the pricing regime, future infrastructure developments, the framework for financing and the structure of the government take<sup>121</sup>. In this concluding section, we try to shed some light on this policy-making process by outlining the current institutional, contractual and fiscal setting and by capturing some of the ongoing trends.

## THE POLICY FRAMEWORK

The policy framework is changing rapidly, as East Africa is moving from the exploration phase (characterised by regulatory uncertainty and favourable contractual and fiscal terms) to the ramp-up phase (i.e., when legislation becomes clearer but terms are usually made less attractive).

Legislation in Mozambique and Tanzania is still less advanced and less encompassing than in well-established producing regions, including West Africa. In Mozambique, the Petroleum Law adopted in 2001 and now under revision is the main legal reference and has been complemented by other laws over the years<sup>122</sup>. The new Private-Public Partnership Law passed in 2012, easing the establishment of joint ventures between the government and investors on infrastructural projects<sup>123</sup>, will also apply to gas-related projects. As we already mentioned, a Draft Natural Gas Master Plan is being examined. In Tanzania, the Petroleum Law in force was adopted back in 1980 and needs to be updated. To this purpose, a comprehensive Gas Legislative Package is currently under discussion. This set of legislation consists of a Natural Gas Policy, a Gas Utilisation Master Plan (based on the guidelines provided in the Policy, but much more detailed), a Natural Gas Act, an Upstream Act and a Petroleum Policy<sup>124</sup>.

In both countries, the law still provides little detail on production and development issues, and the model Production Sharing Contracts (PSCs) or Exploration and Production Concession Contracts (EPCCs) leave much to be negotiated by the parties on a case-by-case basis<sup>125</sup>. More seriously, on some of these issues there is a lack of

121 Flak, A., 'Mozambique to Use Gas to Build Industrial Base, LNG exports', Reuters 14 December 2012.

122 Especially the Decree n.24/2004 on petroleum operations regulation.

123 Sharman, A., 'Assessment of Public-Private Partnerships in Mozambique', International Growth Centre, 13 December 2012.

124 Draft Natural Gas Policy for Tanzania, Clyde&Co Briefing, November 2012.

125 The Deloitte Guide to Oil and Gas in East Africa, January 2013.

clarity regarding what rule would prevail in case of conflict<sup>126</sup>. It is vital to eliminate regulatory uncertainty and loopholes in order to reduce the room for arbitrary decisions and improve the overall investment climate. The new legal acts under review in both countries aim to solve these issues by establishing a clear hierarchy between norms, simplifying regulation and avoiding contradictions. Both governments and investors have an utmost interest in establishing an adequate legal framework and a well-functioning rule of law. This is a crucial step toward ensuring that Mozambique and Tanzania will be able to translate their gas riches into widespread well-being.

Mozambique and Tanzania are engaging in this process of review not only to fill legislative voids but also to ensure that the contractual and fiscal terms provide them with a fair share of the gas value. The governments are determined to benefit from their natural gas resources. Local stakeholders confirm that the undiscounted government take in the two countries is now around 65-70%<sup>127</sup>. This figure is the result of a process that has been ongoing in the last months, when fiscal and contractual terms have appeared to tighten (for instance, with the increase of the Capital Gains Tax adopted in Mozambique). It would not be surprising if Mozambique and Tanzania decided to further increase their government takes in the coming months. As the region moves on from the status of gas frontier and the reserve base keeps on growing, local governments know they can afford a more assertive approach without losing the interest of international investors. Tanzania in particular has been explicit about the opportunity to review the current agreements. Even if Mozambique and Tanzania still have some room to increase their government takes, we advise that they act with moderation so as not to scare off investors. Table 5 in the Annex summarises the standard conditions currently applied to contracts in the two countries and compares them with selected countries in sub-Saharan Africa. Specific contractual conditions may vary greatly from the general trend outlined in our table, both because older contracts were signed under different terms and because several clauses were able to be negotiated *ad hoc*.

The main insight presented in the table is that local governments still have some room for manoeuvre to increase royalties and taxes. However, local governments have serious financial constraints and may find it useful to enter an arrangement with companies to fund infrastructures. For this reason, Mozambique and Tanzania may actually need not only to refrain from imposing stricter fiscal terms but also to renounce a portion of taxes and royalties in exchange for funding of both welfare-related infrastructure and gas projects. An option would be that LNG project

126 This is the case in Tanzania, where there is no clear hierarchy between the two model PSAs adopted in 2004 and 2008.

127 Interviews conducted by CIEP.

developers take full charge of infrastructures, in return for a substantial royalty and tax break from the governments. This is usually regarded as the best option from an investor's perspective, but governments may find it detrimental to only be able to dispose of their gas revenues several years after the start of production.

Governments thus have to find a way to simultaneously cash in some revenues in the early days of production and launch domestic monetisation projects with immediate benefits for the population. Consortia are mainly interested in LNG and see domestic monetisation as uneconomical. However, they may prefer to participate in some of the projects rather than paying higher taxes and royalties. Experiments with this kind of arrangement, also known as a "dual-flag approach", have already been implemented elsewhere in the world, including West Africa. Eni seems to be particularly keen on developing power generation projects – drawing inspiration from previous experiences in Nigeria and DR Congo – and Anadarko is also likely to agree<sup>128</sup>. If adequately managed, dual-flag approaches can prove to be a very good way to create synergies between the various players involved and pave the way for win-win situations.

Besides fiscal regimes and funding, another issue that has yet to be negotiated between governments and companies is pricing. If a large number of the projects described in the previous section are launched in addition to gas-fired power generation plants (fertilisers, GTL, methanol, etc.), the government's share of profit gas will certainly not be sufficient to feed them. For this reason, additional feedstock gas will have to be bought on the market. To guarantee the competitiveness of those production processes, the price of the feedstock gas will have to be lower than the price paid on the international LNG markets – which means that part of the opportunity value of gas will be lost.

The final issue affecting the relationship between companies and governments is State equity participation. Unlike Nigeria, where NNPC has a mandatory stake of 55-60% in all operating areas, the NOCs of Mozambique and Tanzania (ENH and TPDC) have limited participation. ENH has a 10% stake in Area 4 and a 15% stake in Area 1, and the Law prescribes that it is entitled to a 5-20% interest in development<sup>129</sup>. In Tanzania, TPDC does not hold stakes in the areas of the main findings, but the Law prescribes that it could be entitled to a 20% interest in development<sup>130</sup>. Experiences in other oil and gas producing countries show that equity participation of cash-

128 'Anadarko's Rovuma basin plans take shape', Offshore Magazine.

129 Five to twenty percent in post-2012 EPCCs, negotiable up to 25% in pre-2012 EPCCs.

130 'Refining the rules – the lucrative East African market for natural oil and gas', Clyde&Co, 15 March 2013.

constrained NOCs complicates financing. In this perspective, the marginal presence of NOCs in East Africa should play in favour of a speedy development of the projects. The weight of local NOCs can vary over time. Theoretically, NOCs could either strengthen their role in new contracts or sell part of their equity (the latter especially if governments have to raise capital to fund infrastructure). At this stage, none of the two scenarios are imaginable in East Africa. On the one hand, Mozambique and Tanzania are not yet in the position to impose a substantially higher NOC equity participation. On the other hand, as mentioned, governments are likely to choose alternative arrangements to fund domestic infrastructures rather than equity sales.

This report has shown that companies and governments have the possibility to work together to monetize East Africa's gas reserves and make sure that these foster the socio-economic development of Mozambique and Tanzania. A decisive phase for the region is about to begin, where a number of very important decisions will have to be taken. A win-win solution is possible but the road towards it still appears bumpy. As a matter of fact, the policy-making process risks being compromised by a not-so-stable political climate, a still immature institutional setting and the persisting scourge of corruption.

# CONCLUSION

Excluded from major gas flows and virtually ignored by the gas industry and analysts for a long time, East Africa emerged in the last three years as a new, promising gas frontier. A substantial reserve base of more than 5 Tcm of potentially recoverable gas – possibly growing further in the future as a result of ongoing drilling activity – could enable Mozambique and Tanzania to become important suppliers in the up-and-coming ‘Indian Basin’.

Prospects for LNG projects in East Africa are excellent as their estimated cost of production is low. If cost estimates are confirmed, East African LNG will be extremely competitive relative to other supplies due to come on stream by the end of this decade, notably Australian developments. Faced with a booming gas demand and willing to pay a premium to secure new gas supplies, Asia will be the primary destination of East African LNG. While consortia are likely to sign long-term, oil-indexed contracts with East Asia, there could be a more marginal window of opportunity for alternative contractual arrangements especially with European or Indian buyers.

In spite of excellent prospects for viability, expectations on lead times are not always realistic. Mozambique clearly has an edge over Tanzania thanks to a more aggressive investment schedule, but even Mozambican LNG trains are unlikely to come on stream before 2020 as consortia still have to make several steps before reaching a Final Investment Decision. East Africa is not currently facing risks of cost overruns, but a number of issues might complicate the picture in the future including poor infrastructure, lack of prior experience in oil and gas production, regulatory uncertainty and security threats.

Besides being very attractive for companies, LNG is also a unique chance for the socio-economic development of the host countries as it would ensure high government revenues and create employment opportunities. Governments are rightfully supporting LNG ventures and aim to cash in substantial revenues that can be used to alleviate poverty, reduce debt, incentivize economic diversification and build infrastructure.

Nevertheless, governments are also assessing alternative monetization options to maximize benefits from gas production. In this paper, we briefly discussed the

outlook for power generation, GTL, CNG, fertilizers, methanol, aluminium, cement and steel. These development options differ greatly in terms of market environment and potential impact on the local economies, and they all have advantages and disadvantages. Only a relatively small portion of these projects will see the daylight, because not all of them are economically viable. Furthermore, the various projects will compete with each other.

We devoted special attention to power generation because the newly discovered gas can be effectively used to cope with the scourge of energy poverty. Moreover, increased availability of power supply is a prerequisite for the other developments we discussed. Building gas-fired power plants would also be a way to create consensus in the nascent gas industry, as the local population will immediately perceive the benefits of gas production. This would be conducive to a stable political climate, which is a shared interest of governments and consortia. The governments of Mozambique and Tanzania, which are currently drafting new legislation and master plans, will probably need to involve consortia in some of these projects as they lack the financial capacity to fund them autonomously.

We concluded that there is room for fruitful cooperation between companies and governments in East Africa. Adopting what is usually referred to as a 'dual flag approach', LNG project developers may agree to finance some domestic monetization projects in return for partial tax and royalty breaks. Local governments would then be able to both collect some revenues from the onset of production and obtain funding for domestic developments.

# ANNEX: FISCAL AND CONTRACTUAL REGIMES

	Mozambique	Tanzania	Kenya	Uganda	Angola	Nigeria
<b>Contract denomination</b>	Exploration and Production Concession Contract (EPCC)	Production Sharing Agreement (PSA)	Production Sharing Contract (PSC)	Production Sharing Agreement (PSA)	Both Production Sharing Contract (PSC) and Joint Ventures (JVs, of a R/T <sup>131</sup> Concession type)	Production Sharing Contract (PSC)
<b>Most relevant legislation</b>	2001 Petroleum Law, Decree no. 24 of 2004, 2012 Private-Public Partnership Law, <i>Draft Petroleum Law and Gas Master Plan under discussion</i>	1980 Petroleum Act, <i>Draft Natural Gas Policy (part of a broader Gas Legislative Package, yet to be drafted) under discussion</i>	1986 Petroleum Act	1985 Petroleum Act, 2008 National Oil and Gas Policy, <i>two Draft Petroleum Bills under discussion</i>	2004 Petroleum Act	1969 Petroleum Act, 2008 National Gas Master Plan, 2010 Nigerian Oil and Gas Industry Content Bill, <i>Draft Petroleum Industry Bill under discussion</i>
<b>Institutional framework</b>	Ministry of Mineral Resources, INP (regulator), ENH (NOC)	Ministry of Energy, TPDC (NOC)	Ministry of Energy, NOCK (NOC)	Ministry of Energy and Mineral Development, NOC yet to be set	Ministry of Petroleum, Sonangol (NOC)	Ministry of Petroleum Resources, NNPC (NOC)
<b>State participation</b>	ENH is entitled to an interest in development (5-20% in post-2012 EPCCs, negotiable up to 25% in pre-2012 EPCCs) but must reimburse exploration costs.	TPDC is entitled to a 20% interest in development and does not have to reimburse exploration costs.	NOCK is entitled to a negotiable interest in development and does not have to reimburse exploration costs.	The State Nominee is entitled to a negotiable interest in development (up to 20%) and does not have to reimburse exploration costs.	Sonangol is entitled to equity participation in any project. Sonangol is entitled to a negotiable carried interest in PSCs but must share costs with the concessionaire in JVs.	The Government generally holds a 55-60% mandatory equity participation through NNPC. In some contracts, NNPC is entitled to a negotiable carried interest.
<b>Signature Bonus</b>	Negotiable (0.5-5% total asset value)	Not applied	Negotiable (often \$0.3MM, will be raised to \$1MM)	Negotiable (often \$0.5MM)	Negotiable (\$10-70MM <sup>132</sup> )	\$10-25MM depending on water depth
<b>Corporate Income Tax</b>	32%	30% (with additional 10% Branch Profit Tax <sup>133</sup> )	30% for resident companies, 37.5% for branches	30% (with additional 15% Branch Profit Tax)	General CIT: 35%; Oil & Gas sector: 50% (PSCs), 65.75% (concessions)	General CIT: 30%; Oil & Gas sector: 65.75% (first 5 accounting periods), 85% (other accounting periods)
<b>Royalty</b>	6% for gas, 10% for oil	5% for offshore <sup>134</sup> , 12.5% for onshore and continental shelf	Negotiable (variable)	5-12.5% depending on daily production	Not applicable in PSCs; 16.67% in JVs nationwide, 20% in the Cabinda JV (with a possible reduction to 10%)	20% for onshore oil, 0-18.5% for offshore oil depending on water depth; 7% for onshore gas, 0-5% for offshore gas depending on water depth
<b>Surface Fee</b>	Not applied	Negotiable for exploration (\$4-16/sq.km), \$200/sq.km for development	Negotiable (variable)	Negotiable (\$2.5-7.5/sq.km)	\$300/sq.km	\$1.3-3.2/sq.km depending on the nature of the agreement and production levels
<b>CAPEX Allowances</b>	Negotiable (25% according to the model EPCC)	20%	20%	Negotiable (50-75% initial allowance on machinery and plant depending on location)	40%	20%
<b>Education Tax<sup>135</sup></b>	Not applied	Not applied	Not applied	Not applied	\$0.15/barrel	2%
<b>Value Added Tax</b>	17%	18%	16%	18%	10%	5%
<b>Cost Oil (Recovery Ceiling)</b>	Negotiable, differs for onshore and offshore	50-70% of production net of royalty depending on the period	Negotiable	Negotiable	Negotiable	Negotiable
<b>Profit Oil</b>	Negotiable based on a R factor	Negotiable based on production	Negotiable based on production	Negotiable based on production	Negotiable based on production	Negotiable based on production

TABLE 5: OVERVIEW OF FISCAL AND CONTRACTUAL REGIMES IN EAST AFRICA AND OTHER SUB-SAHARAN COUNTRIES<sup>136,137</sup>

131 Royalty/Tax system

132 But up to \$300MM for each of the Blocks 31, 32, 33 (among the world's record high signature bonuses).

133 Additional tax on profits that are considered to be repatriated by the branch of the head office.

134 Distinction introduced in 2010 by the Addendum to the Existing PSA between GOT, TPDC and Contractor ABC for Deep Sea Operations. Analysts reckon that Tanzania will increase its royalties in the future.

135 Even when an education tax is not applied on a regular basis, companies are usually required to give *una tantum* contributions to training support programmes.

136 Sources: Deloitte January 2013, PLC February 2013, Tax Rates 2013, Upstream Advisors January 2013, PWC November 2012, Ernst & Young 2012, Wood Mackenzie September 2009.

137 General, publicly declared terms. Specific contractual terms may vary remarkably from this outline.







CLINGENDAEL INTERNATIONAL ENERGY PROGRAMME | CIEP

**VISITING ADDRESS**  
Clingendael 12  
2597 VH The Hague  
The Netherlands

**POSTAL ADDRESS**  
P.O. Box 93080  
2509 AB The Hague  
The Netherlands

**TEL** +31 (0)70-374 66 16  
[www.clingendaelenergy.com](http://www.clingendaelenergy.com)  
[ciep@clingendaelenergy.com](mailto:ciep@clingendaelenergy.com)