

Gas for development or just for money?

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Mozambique's gas can be used to promote industrialisation and rural development, but only if key choices are made now. Current priorities are for export based mega-projects promising high revenues, but like past mega-projects doing little to create jobs or reduce poverty. Mega-projects costing tens of billions of dollars are essential, but the Council of Ministers can instruct that negotiations give a higher priority to using the gas to create a domestic industry and jobs, even if it reduces short term income.

Mozambique has one of the largest gas reserves in Africa. It was only discovered in 2010, but major projects are already underway and production should begin in 2020. Most of the gas will be exported, mainly to Asia, in the form of Liquefied Natural Gas (LNG). The production, processing and export of the gas will be done by major international corporations with sufficient technical and financial capacity. Tens of billions of dollars of investments will be made over the next decade for wells, pipelines, and processing and transport facilities. This is a scale of investment unprecedented in Mozambique, and by 2025 Mozambique will be earning billions of dollars in taxes and profits, transforming the state budget.

However, as well as receiving money in taxes and profits, Mozambique also receives a share of the actual gas, and decisions are being taken this year as to how that gas will be used. Proposals from international corporations for multi-billion dollar mega-projects to produce fertiliser, diesel, and methanol, as well as a pipeline to export gas to South Africa, are already under discussion.

Most of the fertiliser, diesel and methanol will be exported, to pay the investment costs and profits of the multi-national companies building these installations. Mozambique will gain further revenues in taxes and a share of profits.

In its negotiations, international investors will argue that revenue to the government will be maximised by exporting the largest possible amount of gas, fertiliser, methanol and other products. And this is true in the short term. In this paper, we argue that the government should divert more of the gas for local use - fertilizer for Mozambican small farmers, methanol to create a national chemicals and plastics industry, and gas for local fuel. This will reduce the initial government revenue, so this requires a decision of the Council of Ministers to accept a reduction in short term money in order to promote longer term investment in Mozambican industrialisation. Critical decisions must be taken this year to direct the negotiations with investors, about phasing and which projects come first, and about the allocation of domestic gas between different types of users. Failing to

take those decisions, or deferring them until later, is, in fact, to take a decision to maximize cash and minimize national development.

Mozambique's history with mega-projects aimed at maximizing revenue have so far not been good. Mozal, Pande gas, Tete coal, and heavy titanium sands all generate less money than promised, create few jobs, and do little to reduce poverty and promote development. Natural gas is probably the last chance Mozambique has to use its natural resources to promote development. That requires a political choice which must be taken soon by the new government.

The Gas Master Plan (*Plano Director do Gás Natural*) approved by the Council of Ministers in June 2014 says that "this is a unique opportunity for the industrialisation of the country" and it is essential that the gas "be used to industrialise the country at a price that permits the viability and competitiveness of industries." And it warns that "the mega-projects proposed, with the exception of electricity generation, are all for export."¹

Mozambique's gas

Discoveries in the Rovuma Basin off-shore from Cabo Delgado have established that Mozambique has one of the largest gas reserves in Africa. The two connected gas fields are Area 1, controlled by a consortium headed by Anadarko of the United States, and Area 4, controlled by a consortium headed by ENI of Italy.

Gas is normally measured in the US² unit of a trillion cubic feet (Tcf), which is equivalent to 28.3 cubic kilometres. Thus one Tcf would cover the city of Maputo to a height of 82 metres, roughly the height of a 23 storey building.³ Mozambique's

1 República de Moçambique, Conselho de Ministros, "Plano Director do Gás Natural", 2014, p 24.

2 US convention is used for gas: 1 million = 1,000,000. 1 billion = 1000 million. 1 trillion = 1000 billion. The normal energy units used are British thermal units (Btu) and 1 cubic foot of gas is approximately 1000 Btu or 1000 kilojoules. 1 Tcf of gas produces 21 million tonnes of LNG.

3 Maputo city has an area of 346 square kilometres. Predio 33 andares has a height to 120 metres, or 3.6

two on-shore producing gas fields, at Pande and Temane, Inhambane, have reserves of 3.7 Tcf.⁴ The gas field in Cabo Delgado is more than 25 times larger; officially declared reserves are 100 Tcf, but industry sources estimate recoverable reserves at over 150 Tcf.⁵

The market for this huge amount of gas is largely in Asia, and it will be transported as Liquefied Natural Gas (LNG) in large tankers. The natural gas is cooled to -162° C, which reduces it to 1/600th of the volume of ordinary gas, and thus can be easily transported. The process, however, is complex and it is necessary to remove water, hydrogen sulphide, carbon dioxide and other impurities before the gas can be cooled. This is a step by step process with a series of processing plants, one after the other, like carriages in a train. Thus a complete LNG plant is called a "train" and a typical train produces 5 million tonnes of LNG per year and would cost up to \$8 billion.

The decree-law of 2 December 2014 authorises Anadarko and ENI to each build an initial two trains and each develop 12 Tcf of gas.⁶ All projects assume the gas field has a 30 year life, and each project is assigned its share of the gas for the full 30 years. Thus the decree-law assumes each train would require 6 Tcf of gas reserves to be used up over three decades. It is projected that 12 trains or more might be constructed. Anadarko has Area 1 which adjoins the coast. It will pipe its gas to a facility to be constructed near Palma.

metres per storey.

4 In 2012, Pande and Temane produced 154 billion cubic feet (Bcf) of natural gas of which 127 Bcf was exported by pipeline to Sasol in South Africa and 27 Bcf was used domestically. US Energy Administration. 1000 Bcf = 1 Tcf.

5 100 Tcf would make this the third largest gas reserve in Africa, after Nigeria and Algeria, but the *Financial Times* (18 October 2014) suggests double that, making it the largest reserve in Africa and 8th largest in the world. <http://www.ft.com/cms/s/0/678102c2-59e0-11e4-9787-00144feab7de.html#axzz3aZZY53ow>

6 Decreto-Lei n.º 2/2014 de 2 de Dezembro que estabelece o regime jurídico e contratual especial aplicável ao Projecto de Gás Natural Liquefeito nas Áreas 1 e 4 da Bacia do Rovuma, art 7 e 9 e Anexo A.

Initially ENI will start with a floating LNG plant offshore, with no pipe connection to the shore. But floating LNG plants are more expensive to operate and ENI will probably later construct a pipeline and put further trains on shore. First production and export are scheduled for 2019 or 2020. Virtually all LNG would be exported, although Mozambique might use a very small amount. Standard Bank⁷ estimates that by 2025 if six trains were operating the government's income could be nearly \$5 billion per year.

What is important for this study is that in addition to taxes and profits, Mozambique also has a right to some of the gas. The original Exploration and Production Concession Contracts (EPCCs) signed in 2006 include a range of payments if petroleum is produced. On both contracts the government receives a 2% royalty on all gas. In addition it receives a profit share which increases over time. For Anadarko, it is 10% of production initially, until all the capital cost has been paid off, and then rising steadily to 60%; for ENI it is 15% initially, but rising only to 50%.

The EPCCs do not specify how this is to be paid, in cash or kind. Mozambique has opted to be paid in kind, with physical gas to be used within the country. The decree-law authorising the first LNG plants requires that Anadarko and ENI submit detailed development plans, which must include "allocation of quantities of natural gas for the domestic market for the implementation of projects."⁸ This makes clear that the decree-law assumes that the companies will deliver the royalty and profit gas as physical gas by pipeline onshore.

But the development plans are subject to negotiation and the EPCC is not specific, so the delivery of the royalty and profit gas, known as "domestic gas" or "DomGas" for short, will also be subject to negotiation.⁹ The government could

⁷ Standard Bank, *Mozambique LNG: Macroeconomic Study*, 31 July 2014, p 67 .

⁸ Decreto-Lei n.º 2/2014, Anexo B e)

⁹ This is underlined by the *Plano Director do Gás Natural* (Tabela 10) which sets out an action plan which includes "Assure the gas supply for the national market: Negotiate and agree a plan to transfer the royalty gas in kind to the government."

negotiate to take its share in cash rather than gas, or sell the domestic gas back to Anadarko and ENI to be turned into LNG. Or, conversely, government could agree to buy more than its 10% of gas. Anadarko has already indicated that it is happy to talk, but it would prefer to delay the delivery of domestic gas until it has at least two trains fully operating. Technicians comment that it is usually possible to squeeze up to 10% extra gas into the pipe, and Anadarko might choose to do this. There is clearly room for negotiation. With ENI starting with a floating off-shore LNG plant with no connection to the coast, it will be harder for Mozambique to take its share as gas and it may be forced to take cash or LNG.

Key to this will be the state company ENH (Empresa Nacional de Hidrocarbonetos; National Hydrocarbons Company). ENH owns 15% of Area 1 (with Anadarko) and 10% of Area 4 (with ENI) and predicts its must raise \$4.5 bn as its share of the investments being made.

What is important for this report is that all domestic gas goes to ENH, which means that all contracts with downstream users will be signed by ENH. A high priority for ENH is generating revenue for the government, but it also cites promoting employment and developing industry and infrastructure. Although ENH will negotiate the contracts with domestic gas users, it will be directed by President Filipe Nyusi and the Council of Ministers.

Using the domestic gas

Natural gas has four groups of uses. Two uses are as an energy source and fuel: importance is to reduce domestic costs as well as providing exports:

- 1) It can be burned directly, for cooking, industry, and electricity generation.
- 2) It can be turned into diesel fuel.

The other two uses are the basis of local industrialisation:

- 3) To produce nitrogen fertilizers.
- 4) To produce methanol and the basic chemicals for plastics and other chemical

industries.

ENH has prioritised three of these: electricity, diesel and fertiliser. They would generate the most rapid income. Diesel and fertiliser would be important exports. Electricity and diesel would reduce fuel import costs and could provide cheaper energy for industry.

But the government's Gas Master Plan approved last year wants to move forward on all four. It calls for the production of methanol and petrochemicals, and for a north-south gas pipeline. These are not high priorities for ENH, but are particularly important for domestic industrialization. Choices will need to be made as domestic gas will need to be allocated to some uses in preference to others, at least in the next decade.

Each domestic gas project is developed assuming that it has an allocated share of the reserve. Initially there will be four LNG trains in operation, each with 6 Tcf of reserve; if Mozambique has 12% of Area 1 production and 17% of Area 2 production as domestic gas, its first projects would be able to assume 3.5 Tcf of reserves. This is almost the size of the Pande and Temane gas fields. With just the two initial Anadarko trains, Mozambique could allocate 1.4 Tcf to domestic gas uses. How Mozambique uses that gas is the subject of this report. After 2025, there could be 12 trains operating, which would make 10.4 Tcf of reserves available for domestic gas use.

The government and ENH plan to construct an industrial city of 250,000 people on Cape Afungi, just south of Palma, Cabo Delgado. This will have 7,000 ha for the LNG plants, a 5,000 ha industrial park, and 13,000 ha of other developments. This area has no infrastructure and ENH wants the first domestic gas projects to be in the Palma industrial park and wants these initial investors to pay the \$1 billion infrastructure costs of roads, water, electricity, etc. ENH itself plans to build by 2018 a 75 MW electricity generating station to serve this area; it will initially use diesel fuel but will move to use gas as soon as it becomes available.

In what follows we look at the three sectors

which require processing - fertilizer, diesel and chemicals. Then we look at the pipeline and use of gas as fuel.

First, we must consider gas chemistry. Natural gas is mainly methane (CH_4) plus smaller amounts of ethane (C_2H_6), propane (C_3H_8) and, butane (C_4H_{10}). Mozambican gas is more than 97% methane (and is called "dry"). This is excellent for producing LNG, but makes the use of domestic gas for industrial processes more difficult. Elsewhere in the world, the ethane and propane are taken out of the gas and used to produce chemicals, plastics and other products. Methane is a very stable molecule and to use it for chemical processes it must first be broken apart and reformed. The methane (CH_4) is mixed with steam (H_2O) at very high temperature and pressure to produce a mixture of hydrogen (H_2) and carbon monoxide (CO). This is often known as synthesis gas or syngas, because it is the basis for all the other processes.

Some of the gas is burned to create the heat and energy necessary for the high temperatures and pressures needed to break apart and restructure the methane. This is true not just for syngas, but for all the processes described.

Fertilizer

Fertilizer production is at the top of everyone's list. It is the easiest chemical process and it has a world market. Fertilizer starts with syngas and requires two more steps. The first step is to combine the hydrogen with ordinary air¹⁰, which is 78% nitrogen, again at high temperature and pressure and with a catalyst, to form ammonia (NH_3). Some of this is used directly in various ammonia fertilizer compounds, but the most common final step is to combine the ammonia with the carbon monoxide from the syngas process to create urea $\text{CO}(\text{NH}_2)_2$ which is the most common nitrogen fertiliser. Approximately one-quarter of the gas is used for heat for the process to turn the other three-quarters into fertiliser

¹⁰ Known as the Haber-Bosch process first developed in 1909. Fritz Haber and Carl Bosch were later awarded Nobel prizes, in 1918 and 1931.

Most of the fertilizer produced would be for export. The Gas Master Plan lists four proposed fertilizer projects including from Norway (Yara) and Japan (Toyo and Sumitomo). A typical plant could produce 1.3 million tonnes per year of urea, would require 0.7 Tcf of reserves, and would cost more than \$1 billion.

Mozambique uses little fertilizer and should use much more. The 2012 proposed National Fertiliser Strategy¹¹ showed that in 2010 Mozambique used only 50,000 tonnes of fertiliser, or which less than 5,000 tonnes was used on food crops - 95% was used on tobacco and sugar. The draft strategy called for an increase of 100,000 tonnes of fertiliser per year. Even 150,000 tonnes per year of domestic consumption would be a small part of the production, so most would be for export.

Fertiliser is very expensive in Mozambique, which is one reason so little is used - the creates a negative cycle in which little is used so small quantities are imported and small quantities are more expensive, so the price remains high, so little is used. Local production would halve the price, but there is still no distribution system. Having a local fertiliser industry could benefit Mozambican farmers, but not without significant changes to the market.

As part of any contract with a fertiliser company, the government of Mozambique could make two demands which would have a major impact on local industry and agriculture.

First, government could demand that 10% of production was sold on the national market at cost price, and that the fertiliser company set up a system of distributors and local dealers to make the fertiliser available. Yara, the world's largest producer and marketer of mineral fertilizers, already does this in some countries.

Second, the government should demand that whoever wins the contract must develop a local fertilizer industry. Fertilizer provides three main nutrients – nitrogen (N), phosphorus (P), and Potassium (K). Nitrogen increases yield and

accounts for 63% of total world consumption, usually as urea. P and K improve crop quality. Mozambique has phosphate rock which can be used to produce P, while the K must be imported. But a global fertilizer company could develop the phosphate production and compounding of standard NPK fertilizers, or be prepared to subcontract it.

Interviews have made clear that at least some fertilizer companies would agree to both demands. Although exporting bulk urea onto the world market would be the easiest option, they would also gain from developing the domestic market. In exchange, they would probably demand a lower gas price, at least for an initial period. ENH would probably have to offer the gas at the price at which it is delivered by Anadarko, and not initially take a profit on the actual gas. But the developmental gain to Mozambique would be substantial, and worth the initial investment of a lower price.

Methanol, chemicals and plastics

Natural gas has often been used at the basis of a petrochemicals and plastics industry. This could be the basis for a major industrialisation in Mozambique and should be a priority. But Mozambican “dry” gas is more difficult to use for this purpose. Only a few big companies have the technology. But it is possible and practical.

The first step is to recombine the components of the syngas, the hydrogen with the carbon monoxide, to produce methanol (CH₃OH). Mitsui of Japan, which has 20% interest of Offshore Area 1, with Japanese companies Mitsubishi and Marubeni, proposes to produce methanol for export to Japan. A Japanese Ministry of Economy study¹² suggests that a plant to produce 850,000 tonnes per year would cost \$780 million and would require reserves of 0,5 Tcf,

12 Marubeni Corporation, “Study on the Methanol production Project Utilizing Indigenous Natural Gas in the Republic of Mozambique”, 2013 http://www.jetro.go.jp/ext_images/jetro/activities/contribution/oda/model_study/infra_system/pdf/h24_report14_en.pdf

11 <http://www.speed-program.com/wp-content/uploads/2014/03/Fertilizer-strategy-ENG.pdf>

One next step is to produce alkenes (also known as olefins) which are unsaturated hydrocarbons containing a carbon-carbon double bond. The simplest alkene is ethylene (C_2H_4), which is also called ethene. Another important alkene is propylene (C_3H_6 , also called propene). These require complex processes based on either syngas or methanol. But rapidly expanding consumption of ethylene and propylene have led to warnings of rising prices which have triggered new developments, and several new methanol to olefins processes from major companies including BASF and Honeywell UOP, as well as Chinese companies, are coming into production.¹³ Direct methane to ethylene processes are also being tested. An alternative next step is to produce formaldehyde (CH_2O) by oxidizing methanol in the presence of a silver catalyst. From there, one can move onto a whole range of industrial productions. Ethylene and propylene can undergo polymerization to produce polyethylene and polypropylene, two of the most common plastics. Formaldehyde is the precursor of resins and plastics

This is a rapidly changing area of chemistry. There are experimental methane to methanol processes being developed as a way of dealing with methane from waste, which is an important greenhouse gas. And as gas becomes more important as a feedstock to produce chemicals, there is substantial research to try to produce alkenes directly from methane. Methanol can be added to gasoline (petrol) and Marubeni is looking at the conversion of methanol to gasoline.

Insitec of Mozambique (25%) and GigaMethanol of Germany (75%) have tabled a \$3.5 billion proposal to produce 3.5 million tonnes of methanol per year.¹⁴ Of that, 2.5 million tons

would be exported, 500,000 tons would be set aside to be transformed into gasoline (petrol) and the remaining 500,000 tons would be used as a raw material to manufacture glue, adhesives, solvents and plastics. It would require 2 Tcf of gas reserves. Various other proposals are also on the table.

There is little gain for Mozambique in simply producing methanol for export, but huge gains if downstream processes are developed to produce chemicals and plastics. These could form the basis of a major industrial complex, including small industries, and would have a regional market.

ENH does not give a high priority to methanol and chemicals, but in terms of potential industrial development this should be the highest priority. From the start, some domestic gas should be reserved for this. Unlike GTL and fertilizer where the technologies are well known, this is a rapidly changing area and some companies will offer new and experimental technologies. China has taken a lead in developing catalyst-based methane to olefin technologies, and might be interested in developing plants in Mozambique. Companies would need to export methanol to pay for the process. But this is a chance for Mozambique to industrialize and be on the cutting edge of new technologies.

Diesel - GTL (gas to liquids)

The well known Fischer-Tropsch process was developed in 1922 to convert coal to liquid fuels and was used by Germany in the Second World War and by Sasol in South Africa since 1955. It has since been modified as gas to liquids (GTL). At high pressure and with the aid of a catalyst, syngas is converted to long-chained waxy hydrocarbons - like candle wax - which is then converted to diesel fuel.¹⁵ Most would be exported,

celso-correia/

15 <http://www.shell.com/global/future-energy/natural-gas/gtl/acc-gtl-processes.html> The mixed hydrocarbons which are left are called naphtha. The naphtha from Mozambique's methane will have no possible use in Mozambique so would be exported, mainly to be mixed with heavy oils in petroleum

13 New methanol to ethylene/propylene processes are described in a *Hydrocarbon Engineering* (December 2013) article. http://www.uop.com/wp-content/uploads/2013/12/Methanol-to-Olefins-Technology_Hydrocarbon-Engineering-Dec-2013.pdf and *Hydrocarbon Processing* (27 Feb 2015) <http://www.hydrocarbonprocessing.com/Article/3431249/UOP-sees-methanol-to-olefins-as-solution-to-rising-global-propylene-gap.html>

14 <https://celsocorreia.wordpress.com/2013/03/14/insitec-and-mozambiques-methanol-production-by->

but some would be sold locally. The main benefits to Mozambique are financial: adding value to the gas, improving Mozambique's balance of payments by ending the import of diesel, and earning revenues on the diesel exports. Diesel is important not just for vehicles, but for running pumps and other machinery; diesel for Mozambican users would be slightly cheaper than imported fuel, but not much.

ENH will face three questions. First, can more money be earned by exporting gas in pipelines and as LNG, or by converting it to diesel? Second, are their synergies? For example, Fertiliser production needs a lot of water, and the GTL process produces surplus water. Third, can GTL projects be used to develop the Palma industrial park.

ENH signed memoranda of understanding with both Shell and Sasol in June 2014, to allow them to carry out detailed feasibility studies. Both are world leaders with the most advanced catalyst technology. But GTL is an established technology, and Japan and South Korea have also made proposals.

Sasol already has an agreement with ENI and is likely to be studying something similar to its US project, a \$15 billion investment to produce 2.5 million tonnes of diesel per year. This would require 7.5 Tcf of reserves. Shell is looking at something smaller, onshore and linked to Anadarko, said to be a \$5-7 billion investment to produce 1 million tonnes per year diesel. This would require 3 Tcf of reserves. These are both very large projects, and would require decisions to be made now because they would require more wells and larger pipelines to bring the gas onshore.

The Shell project would take all of the royalty gas from the first four trains in Anadarko's Area 1, not even allowing gas for fertilizer. A project the size of the Sasol one would use the domestic gas share from 10 LNG trains, and could exclude all other domestic gas projects for the next decade.

GTL is being promoted as the most obvious and profitable priority use of domestic gas, because

refineries.

it is a proven technology and there is a market for the diesel. But this raises a question: If GTL is so profitable, why are Anadarko and ENI only proposing LNG and not GTL? The Sasol proposal would use approximately the same amount of gas as one LNG train. Why not use ENI's gas for GTL instead of Mozambique's domestic gas? The decree law only applies to LNG, but there seems no reason why it could not be amended to include GTL. Standard Bank¹⁶ suggests that after the first two trains are in operation, Anadarko would be prepared to sell additional gas to ENH, and this could be another option for the large amounts of gas needed for GTL. Buying extra gas or replacing one LNG train with a GTL facility are both options which would not use domestic gas.

Questions should be raised about the rush to use most or all of Mozambique's initial domestic gas for GTL instead of other uses such as fertiliser and methanol that could do more to develop Mozambique and create jobs.

Using the gas directly

So far we have discussed processes which reformulate the gas. There are several proposals to use the gas directly. It will definitely be used for electricity generation in Palma. There have been discussions, but no firm proposals, to use it for energy-intensive processes such as cement and iron & steel. (Gas from the Pande and Temane fields in the south is used by the Mozal aluminum smelter and a cement factory in Matola.)

The most advanced proposal is for a pipeline down the coast to South Africa (probably on to Richard's Bay), with branches to major cities and at least one point in each province. The goal would be to provide a lower cost energy source for industries in the main cities. Industries such as food processing that depend on heating and cooking would be less costly and more internationally competitive if they could use gas instead of diesel or electricity.

¹⁶ Standard Bank, Mozambique LNG: Macroeconomic Study, 31 July 2014. p 75.

The South Africa company Gigajoule has signed a memorandum of understanding with ENH to investigate the proposed pipeline. Gigajoule (49.6%) and ENH (50.4%) already own Matola Gas Company, which distributes gas from Pande and Temane in Maputo and Matola. The gas pipeline would cost \$3-5 billion and require reserves of 7-10 Tcf. Its promoters believe gas sold in South Africa would pay for the pipeline. The project is being promoted as “gasnosu”¹⁷ - short for gas north-south, but pronounced in Portuguese as “gás nosso” - “our gas”

Because of its relatively large demand for gas, ENH only proposes a pipeline at a later stage. But it also suggests that LNG might be reimported as part of ENI’s domestic gas requirement. Regasification plants cost \$50-100 million and could be established now in ports such as Beira and Nacala. This would allow the establishment of a pipe network in those cities to support local industry, which would be linked to a later north-south pipeline.

The main argument for the pipeline is to lower energy costs for Mozambican industry and thus promote the development of industry.

Three way negotiation

Decisions will need to be taken soon, and involve a three way negotiation between ENH, gas producers, and possible gas users. ENH will negotiate with the two producers, led by Anadarko and ENI, as to how much domestic gas will be delivered, when and at what price. Potential users will negotiate for domestic gas with ENH, but they can also negotiate long term contracts with Anadarko and ENI for gas supplies which would provide a base load; the producers may actually prefer other anchor customers as a partial alternative to complete dependence on LNG. Decisions must be made soon because they will determine the number of wells drilled and the size of the pipes bringing gas to Palma.

But there will be an entirely different three way negotiation between users, ENH and the

¹⁷ <http://www.gasnosu.co.mz/>

government. Government and ENH will need to decide the balance between money coming in to the government and longer term investments which promote development. In the first years, when only a limited amount of gas is being produced, choices will need to be made about which users should be given domestic gas. Choices will also need to be made in contract negotiations with these users: Should companies be pushed to invest in downstream links such as fertiliser distribution and plastics manufacture, or should they be allowed to maximize exports and thus short term government revenue?

As the past mega-projects have shown, foreign investors simply want to take resources out of Mozambique; they have little interest in local development or poverty reduction. They pay the money demanded and take their coal or aluminium. One senior person we interviewed commented that “it is no different than the colonial period.”

These negotiations will be complex and technical. They involve billions of dollars for construction, revenues for the government, and development of an industrial zone. Sequencing and allocation of the initial domestic gas will be important. But these are not purely technical decisions - they are political as well, in that choices will be made about Mozambique’s industrial development, and about the balance between government revenue and investment. Historically the mega-projects have been negotiated in secret, on grounds of commercial confidence. But this is not necessary - negotiations are more open in other countries.

Negotiations will involve a give and take between government and the large international petroleum and chemical companies. But the debates, decisions and final contracts must be public. Transparency is essential, to ensure integrity and to ensure the best deal for Mozambique.

Can Mozambique demand more?

The globalisation of trade and investment over the past two decades has dramatically changed what is possible for smaller developing countries

such as Mozambique. Import substitution industrialisation is no longer sensible. The development of global value chains in areas such as textiles, where production can be switched from Bangladesh to Ethiopia overnight, limits the ability of Mozambique to profit from production of consumer goods controlled by global trading companies.

But the United Nations Industrial Development Organization (UNIDO) in its report *Promoting Industrial Diversification in Resource Intensive Economies*¹⁸ points to two lessons of globalisation that can benefit Mozambique. First, unlike textile production, natural resources such as land or gas cannot be moved, and therefore it is possible to use them as a basis for industrialisation through production of inputs for the production process (backward or upstream linkages) and processing of the commodities (forward or downstream linkages). Fertilizer is a downstream linkage for the gas, but an upstream linkage for agriculture. Second, the free market is not enough. The lesson of both late industrialising economies and the historical development of now-high-income economies is that getting the macro-economic parameters right is necessary but not sufficient. Government must also intervene to promote industrial growth and diversification in key sectors, such as those linked to resources. The report also cites the importance of creating “industrial clusters” - such as in Palma and Nacala.

Of course, this will always be subject to negotiation, as both sides want to take the largest share of the profits from the resource. Foreign investors want to maximise their gains by taking minimally processed resources out of Mozambique, while Mozambique wants to maximise industrialisation and skilled jobs. The UNIDO report provides some useful guidelines on how Mozambique can increase its gains and how it can learn lessons from successful resource-based economies in Asia and Africa.

There are two reasons why major global corporations will be willing to negotiate and agree increased local links. First, the project is expected to operate for 30 years and therefore through many generations of managers and owners. Some companies will feel that it is better to be integrated into the local economy rather than operate as an enclave cut off from the rest of Mozambique. Established local staff, suppliers and markets leads to smoother operation. Second, out-sourcing is becoming more common, but this is often matched by an attempt to do “near-sourcing” - to have the suppliers as close as possible to improve delivery reliability and local knowledge. This can be linked to the sort of out-sourcing developed by the Japanese car industry which was built on creating long-term relationships based on supporting suppliers who delivered on time with “zero defects”. But attitudes change as companies are further from home. As has already become clear, Johannesburg is seen by companies as being “near” to Palma and with an interchangeable range of suppliers. So contracts will need to be explicit on local content.

On the input, upstream or backward linkage side the demand is that the various industries use local workers and local inputs, and provide training and support to develop suppliers. UNIDO in its report stresses the importance of specifying local content rather than local contractors; it is too easy for a local contractor to import food and other goods from South Africa as has happened with the mines and other projects. The decree-law on LNG only says that preference must be given to “Mozambican people and companies” in the supply of goods and services, and that “preference must be given to goods and services available in Mozambique.”¹⁹ The use of the word “available” instead of “produced” will only encourage the use of brief-case business people - Mozambicans who simply serve as intermediaries for South African suppliers.

18 Raphael Kaplinsky and Masuma Farooki, *Promoting Industrial Diversification in Resource Intensive Economies*, Vienna: UNIDO, 2012.

19 Decreto-Lei n.º 2/2014, art 9 3.a) e 8.

Not Corporate Social Responsibility

Too often local links are treated as Corporate Social Responsibility (CSR) - part of creating good will in Mozambique but entirely at the whim of the company. Northern based firms do come under civil society pressure to expand CSR, but in a globalised economy companies are bought and sold. One Mozambican coal mine has been sold twice. And Indian and Brazilian companies come under less pressure from their civil society. The only way to guarantee local links and Mozambican industrialization is through explicit and enforceable clauses in contracts.

The UNIDO report and other studies²⁰ make clear that there are important divisions within corporate strategies. One debate is between keeping things “in house” or out-sourcing. Some international companies try to remain vertically integrated and keep as many operations as possible within the company and its subsidiaries. But there has been an important shift with more global companies concentrating on a few key capabilities and outsourcing other non-core activities. The second debate is about local links. Some international mining and other companies prefer to operate in a fenced-off enclave with as few local links as possible, while others want to integrate with the local economy. These debates and divisions about corporate strategies are important, because companies are bought and sold and management strategies change. Mozambique has already seen local managers who make fulsome promises of local benefits and links being replaced by others who have a very different approach.

Thus Mozambique cannot depend on good will and vague promises of corporate social responsibility. Instead, as the initial owner of the gas, Mozambique can choose to make integration in the local economy a clearly defined part of the contract. This will prioritise investors which want to build local links and force those links to be maintained even if the company is sold.

UNIDO also warns that “individual purchasing officers are generally offered bonuses which reward short term cost minimisation and revenue maximization, rather than medium and long-term supplier and customer development. Additionally, in countries where commodities are mined in distant locations, procurement staff often work on short rotation cycles and, compounding this, may not speak the local languages. All of these factors together militate against linkage development.”

To counter this UNIDO calls for sanctions, incentives, and cooperation. Contracts must be clear and explicit, with defined rewards for good performance (for example, access to additional gas or other resources) and enforceable penalties for poor performance. Serious discussions are required with the foreign company to see what is feasible for local suppliers, as was done, for example, in Ghana. The next step is to see how the company can support local suppliers, for example to increase their product range and meet required standards and deadlines.

Many companies prefer to “localise” - to increase the percentage of Mozambican staff because expatriate staff are more expensive, and so will support local training. But this cannot be left purely up to the company. And there is a particular problem with the large number of workers hired for shorter periods during construction. Training should be required to meet South African or European apprenticeship standards, so that workers have a recognised qualification when the construction work finishes. This may require starting training before the actual construction starts.

Many companies will try to leave responsibilities for local content, downstream processing, and training to sub-contractors and sub-sub-contractors. But the initial contract must be clear and enforceable; it cannot be left to the good will or corporate social responsibility of an obscure sub-contractor.

20 Raphael Kaplinsky and Mike Morris, “Thinning and Thickening: Productive Sector Policies in the Era of Global Value Chains”, *European Journal of Development Research*, forthcoming 2015.

Mozambique can use its gas to industrialise

Mozambique can maximise its exports of LNG, diesel, fertilizer and methanol with a series of mega-projects promising billions of dollars in government revenue. But as with the other mega-projects, what will be left behind?

Instead, Mozambique's huge gas reserve should not just be seen as a source of money, but as a unique opportunity to spur industrialisation and development. To do this, decisions must be taken now to give a higher priority to industry, even if it means deferring much needed revenue. Domestic industrialisation will also be dependent on mega-projects and huge exports, but will require different sequencing of projects and a different balance within the projects.

The first step is to choose how to use the 12-17% of gas which is available as domestic gas. In the first years there will not be enough domestic gas to satisfy all proposals on the table. The second step is to be clearer in contracts about local supplies and training. In this study we reach five conclusions:

- 1) Clearly fertiliser is a priority, but any fertiliser contract should include the development of a domestic market and later domestic compounding using local phosphate.
- 2) The second priority should be development of methanol, chemicals and plastics production. This would create an industrial base of a scale different from anything Mozambique has done before. Methane-based chemicals is a new and rapidly growing area, and it offers Mozambique a unique chance to enter an industry at the start. The Gas Master Plan says "priority must be given to methanol projects that produce within the country other derived sub-products." From the start of LNG production, there will be adequate gas for both fertiliser and chemicals. Any investor must be committed to the entire value chain. The domestic gas linked to the first two Area 1 (Anadarko) trains should be

enough to start fertiliser and methanol production.

- 3) Production of diesel (gas to liquids, GTL) should be limited initially. After LNG, GTL is the main interest of foreign investors and these mega-projects promise a reduction in diesel imports as well as increased government revenues. However the GTL proposals would use all the gas available in the early years, delaying other more important projects. It would make sense to instruct those proposing GTL to negotiate directly with the gas producers for long term contracts for GTL as an alternative to some LNG production.

We note that Standard Bank in its macroeconomic study²¹ uses a scenario of fertilizer and electricity production first (in 2020), methanol next (2025), and delays GTL until 2030.

If Anadarko or ENI were to opt for GTL instead of one LNG train, or agree to sell a large amount of gas to ENH for GTL, this would change the picture.

- 4) A national gas pipeline would be a large user of gas so would need to be deferred for a few years. There would be probably be more benefit to local industry than GTL, and this should be considered be an alternative to a large GTL plant.
- 5) Local sourcing and skills training cannot be left to Corporate Social Responsibility and must be defined in detail in contracts. Enforcement responsibility must be defined. Contracts should demand local content rather than simply require local suppliers.

Mozambique's gas can be used to promote industrialisation and rural development, but only if key choices are made now. Export-based mega-projects may promise high revenues, but like past mega-projects they will do little to create jobs or reduce poverty; international investors will give priority to exporting gas

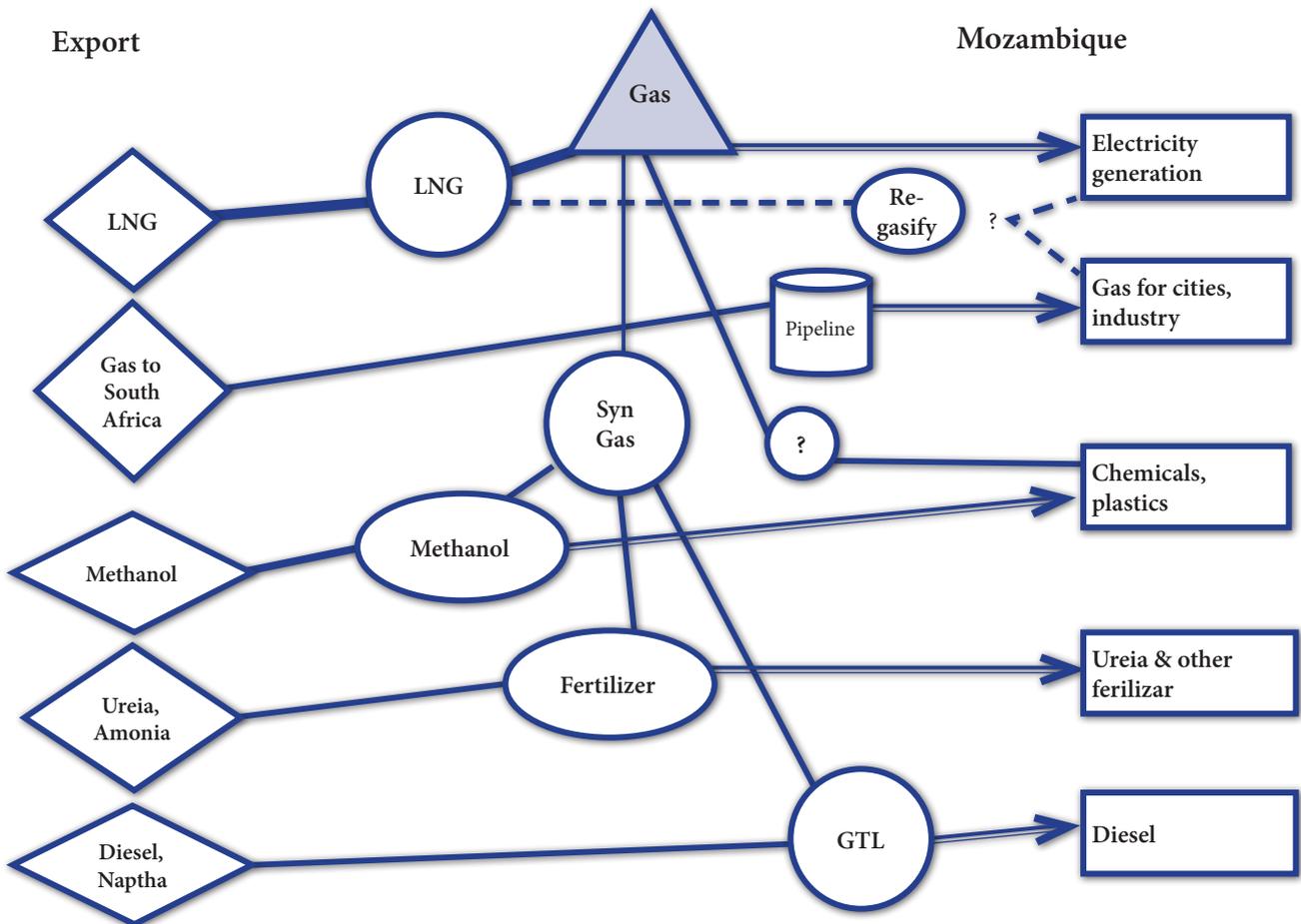
²¹ Standard Bank, *Mozambique LNG: Macroeconomic Study*, 31 July 2014. pp 77-78.

with the minimum of local processing as LNG, diesel, or methanol. The Council of Ministers can instruct that negotiations on these mega-projects to give a higher priority to using the gas to create a domestic industry and jobs, even if it reduces short term income.

The Gas Master Plan says that “Mozambique cannot be just an exporter of raw materials” and

that “priority must be given to projects that add value to the gas and assure the greatest benefits for Mozambican development.”

Mozambique has a unique opportunity to create a gas-based industry which should not be missed.



CIP

Good Governance, Transparency and Integrity

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