Capacity Development for strengthening the gas sector in Mozambique

NICHE Country programme

Quick Scan of capacity needs and potential programme partners

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Summary

Mozambique is an energy resource rich country with abundant, mostly unexploited, coal reserves and proven onshore and offshore natural gas reserves. Mozambique also has a large hydropower potential which is only partially tapped. The Cahora Bassa hydro dam -with 2,075 MW one of the largest hydropower installations in Africa- produced some 16.4 TWh in 2010, almost two-thirds of which was fed into the South Africa electricity grid. Additionally, due to its geographical location, the country also has large solar, wind and sustainable biomass and biofuels potentials.

The exploitation of the huge gas reserves discovered in the Mozambique and Rovuma basins can be the key driver for moving Mozambique from a low income to a middle-income country in the next decade. However, to be able to exploit these gas reserves a variety of adequately trained and skilled professionals and sufficiently strong human capacity is needed in areas such as resource exploration, sound project development, financing, research, engineering, legislation, maintenance and the preparation of long-term visions, policy and planning.

The Netherlands Initiative for Capacity development in Higher Education (NICHE) programme, administrated by NUFFIC, has taken up the challenge of building a core of sustainable and institutionalized capacity development in the energy sector with particular focus on the gas subsector. NICHE is a capacity development programme for sustainable strengthening of higher education and technical vocational education.

This report presents the results of a quick scan conducted on behalf of Nuffic in February 2014 by ECN and GGNI to assess the capacity needs in Mozambique, to identify potential NICHE programme partners and to present a framework that can be used to develop the NICHE gas development programme. The main conclusions were to:

- Not solely focus on the gas industry in the envisaged NICHE programme but to also allocate resources for other energy subsectors with high potential such as solar, wind and hydro.
- Embed NICHE activities in existing structures in Mozambique that will remain in tact for the foreseeable time to guarantee the continuation of the building of capacity also after NICHE programme has ended.

- Attract more companies to downstream business would offer opportunities for longer-term cooperation on gas between the Netherlands and Mozambique

1 Introduction

The Government of Mozambique has high expectations with regard to the gas sector development. According to the Ministry of Mineral Resources, the contribution of this sector to GDP could reach 13% as soon as the LNG exports start in 2018. Meeting these high expectations is an impressive task that requires a tremendous growth in skilled professionals in the coming years, at all levels varying from technical maintenance staff to policy makers.

At the basis of energy sector development and strengthening lie the availability and the quality of sufficient human resources. A variety of adequately trained and skilled professionals and sufficiently strong human capacity is needed in areas such as resource exploration, sound project development, financing, research, engineering, legislation, maintenance and the preparation of long-term visions, policy and planning. This is especially true when new sectors need to be developed, which is essentially the case for the gas sector in Mozambique.

The Netherlands Initiative for Capacity development in Higher Education (NICHE) programme, administrated by NUFFIC, has taken up the challenge of building a core of sustainable and institutionalized capacity development in the energy sector with particular focus on the gas subsector. NICHE is a capacity development programme for sustainable strengthening of higher education and technical vocational education. NICHE focuses on the partner countries with which the Netherlands has established a multi-annual partnership. Mozambique is the first partner country for which NICHE is planning to implement a capacity building programme on energy.

This report presents the results of a quick scan conducted in February 2014 by ECN, GGNI and local expertsto assess the capacity needs in Mozambique, to identify potential programme partners and to present a framework that can be used to develop the NICHE gas capacity development programme.

The report is structured as follows. Chapter 2 presents an overview of the Mozambican energy sector with particular emphasis on the gas subsector. Chapter 3 provides the results of a survey conducted among Dutch companies operating in the international gas industry to assess their interest to work in Mozambique and their needs for local

gas-related expertise. Chapter 4 presents the framework for a long-term capacity development programme on gas/energy and describes how such a programme could be set-up and, finally, Chapter 5 draws some main conclusions and offers recommendations.

2

The energy sector in Mozambique

2.1 Country context

Mozambique is a lower income country, located in Sub-Saharan Africa, with a population of 25.2 million in 2012. The Gross National Income (GNI)[1] per capita in 2012 amounted to USD 510 in current prices and USD 1,000 in purchasing power parity. Mozambique's economy has developed well after the civil war ended in 1992 and the multi-party elections in 1994 created political stability, and has since experienced high economic growth rates in the rage of 6 to 8% annually.

Mozambique's economy is predominantly services-based and remains narrow. In 2012 the services sector accounted for 47% of the GDP, followed by agriculture and industry with 30% and 23% respectively. Industry comprises value added in mining (1.4%), manufacturing (11%), construction (6%), and electricity, water, and gas (5.7%). The main drivers for economic growth over the past decades were Official Development Assistance (nearly 17% of GNI), Foreign Direct Investments (41% of GNI) and strong growth in agriculture. Mozambique's total exports in 2012 amounted to USD 4.2 billion while its total imports were USD 10.1 billion in the same year.

Mozambique is an energy resource rich country with abundant, mostly unexploited, coal reserves and proven onshore and offshore natural gas reserves. Mozambique also has a large hydropower potential which is only partially tapped. The Cahora Bassa hydro dam -with 2,075 MW one of the largest hydropower installations in Africa- produced some 16.4 GWh in 2010, almost two-thirds of which was fed into the South Africa electricity grid. Additionally, due to its geographical location, the country also has large solar, wind and sustainable biomass and biofuels potentials.

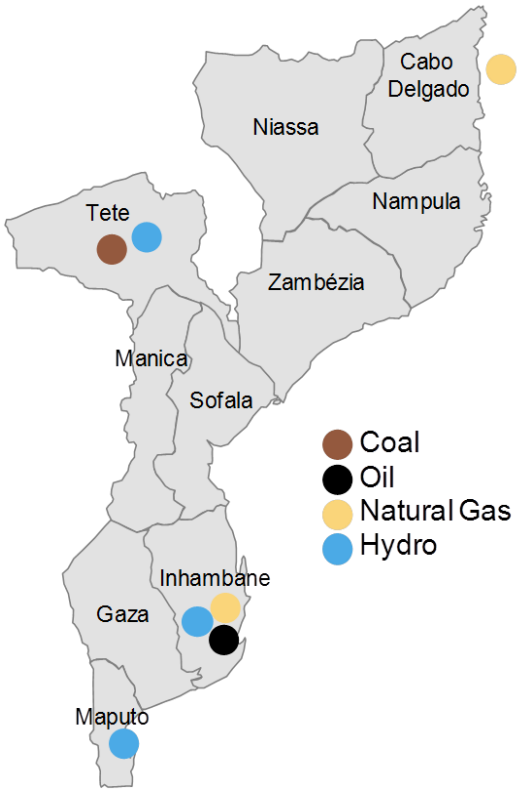
1 Formerly GNP.

Despite these abundantly available energy resources, only 18% of the households currently has access to electricity and Mozambique's Human Development Index ranks third lowest of 186 countries surveyed by the UNDP in 2012. Sustained economic growth is an essential condition for reducing absolute poverty, and exploiting the newly discovered gas and coal reserves can create new economic opportunities that increase employment and income. Energy is likely to play an increasingly important role in the economic development of Mozambique in the coming decades and strengthening the energy sector therefore is of utmost importance.

2.2 Overview of the energy sector

Mozambique has a large and diverse energy resource base including 4.5 trillion cubic feet (Tcf) of proven natural gas reserves, annual average solar insolation of 5kWh/m2/day, 16 GW of hydropower potential, as well as proven coal reserves that can produce 8000 MW.

Figure 1: Current map of main energy sources



Source: Ministry of Energy

Based on the limited capacity that exists to exploit the above, Mozambique generated 12,77 million tonnes oil equivalent of energy in 2011. One-third of this energy, however, was exported. Over 80% of the population is not connected to the grid and lacks access to modern forms of energy. While low investments in infrastructure are the immediate reason for this low grid penetration across the nation, the lack of affordability for such

electricity remains the main bone of contention even if grid access is provided, with poverty headcount ratio remaining over 50% in Mozambique.[2]

As a result, the vast majority of the population remains dependent on biomass for energy sustenance, and this lack of energy access remains a precursor to development and economic struggles that the country faces. Despite such low access rates within the country, it's a large exporter of energy and electricity within the region.

In terms of electricity generation the country depends mostly on Cahora Bassa (HCB), which accounts for ~ 90% of the installed capacity. Due to low infrastructure development, Mozambique exports electricity from Cahora Bassa via the RSA Eskom transmission system, and re-imports it for use in the southern part of the country, namely Maputo.

Table 1: Mozambique: Production, Imports and Exports of Energy (ktoe), 2011

Source type	Production (2011)	Exports (2011)	Imports (2011)	Consumption (2011)
Coal	408	368	0	13
Oil	31	31	0	0
Oil Products	0	0	888	824
Natural Gas	2,812	2,682	0	123
Hydro	1,446	1,029	0	0
Biomass	8,077	0	0	6,246
Electricity	0	0	737	872
Total	12,774	4,110	1,625	8,078

Note: 2011 data in thousand tons of oil equivalent (ktoe) on a net calorific basis

Source: Data from International Energy Agency

Stakeholders in the Energy sector in Mozambique include:

- The **Ministry of Energy** within the Government of Mozambique is overall responsible for the energy sector, following it in three particular thematic streams: liquid fuels, power sector, and renewable energy.
- Another critical stakeholder in the energy sector is the state-owned **Electricidade de Moçambique (EdM)**, Mozambique's national power utility and has the responsibility to generate, transport, commercialize, and distribute energy throughout the country.
- The former buys most of its electricity from **Hidroelectrica de Cahora Bassa (HCB)**, which has a majority ownership by the Government of Mozambique. Most of the electricity that is generated between EdM and HCB is exported to South Africa.
- **Motraco** is a joint venture company formed by the state power companies in Mozambique, South Africa and Swaziland to transmit power from South Africa to the Maputo-based aluminium smelter (Mozal).
- **Fundo Nacional de Energia (FUNAE)**, the National Energy Fund was established as a public institution focusing on rural electrification. Since its inception it has facilitated and undertaken several off-grid renewable energy projects in communities.

2 This is the percentage of population at national poverty line. Source: World Bank (2009 data, accessible at http://data.worldbank.org/country/mozambique)

Donor Activities[3]

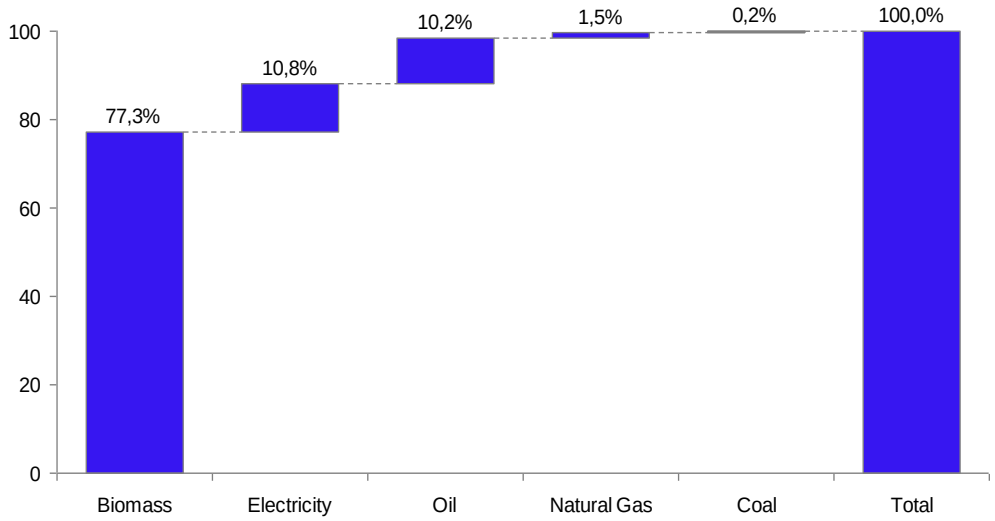
- The World Bank is one of the main donors in the energy sector in Mozambique. Since July 2007, it has worked closely with the Government in Mozambique, and is a co-Chair with the latter in developing Mozambique's Energy Development and Access Programme. For more information, please see http://www.worldbank.org/en/country/mozambique/projects/all?countrycode=MZ&qterm=energy
- Belgium, since 2010, has been providing grants towards off-grid renewable energy systems for electrification of infrastructure (such as schools, health care centres, water pumps, public lighting etc.) in remote rural communities. This is part of a larger programme set up in partnership with FUNAE, with a budget of € 18 mln. The Dutch government is supporting this partnership with an addition € 9 mln.
- The European Commission, Sweden, Norway and Denmark are financing rural electrification projects in various provinces in the country.
- Sweden is also assisting in rehabilitation projects related to hydropower.
- Norway is providing technical and capacity assistance to the Ministry of Energy as well as to state-owned EdM involved in a mega power project on natural gas.

2.3 Energy Demand

With almost half of the country's land under forest cover, the majority of people in Mozambique depend on biomass fuels that include firewood, charcoal, crop and animal wastes. The graph below demonstrates the enormous dependence on biomass for energy demand. Due to this the environmental degradation and health costs associated with the usage of biomass, especially charcoal, are quite high in Mozambique.

3 This is only an indicative list. The source and more information on these programs can be accessed here: http://tinyurl.com/o6rblor.

Figure 2: Energy consumption by source type (%), 2011



Source: IEA – International Energy Agency

In terms of electricity demand, EDM is responsible for supplying electricity throughout the country, which is divided into three sections, the Northern, Central and Southern. The country's demand is projected to increase from 559 MW in 2010 to 2,435 MW in 2030, which is approximately 4 times the present demand.

The demand can broadly be divided into low-voltage consumers and the industrial markets which account for medium- and high-voltage consumers. Industry accounts for 85% of electricity consumptions in Mozambique and Mozal, the aluminium smelting company is responsible for 97% of this consumption.

The electricity demand in Mozambique is forecasted to grow by 11% per annum until 2015 as a result of the boom in the agricultural sector, robust manufacturing output, as well as the increasing focus on rural electrification. The energy intensive industrial consumption is expected to reach 1,700 MW by 2010.

2.4 Energy Supply

Charcoal remains the dominant commercial fuel in terms of volume and value, which exceeded US$ 250m in 2011. As mentioned above, over 80% of the population is dependent on biomass for their energy sustenance. Electricity net generation in Mozambique was 16.81 billion kilowatt-hours in 2011, of which over 99% was from hydropower and the remaining from fossil fuels.

Mozambique has recently discovered large reserves of natural gas. In 2011, Mozambique produced 135 billion cubic feet (Bcf) of natural gas from two onshore gas fields, of which only 18 Bcf was consumed domestically. Along with natural gas, Mozambique also produces coal. In 2011, the country produced 42 thousand short tons of coal, of which 36 thousand short tons were consumed locally and the remainder was

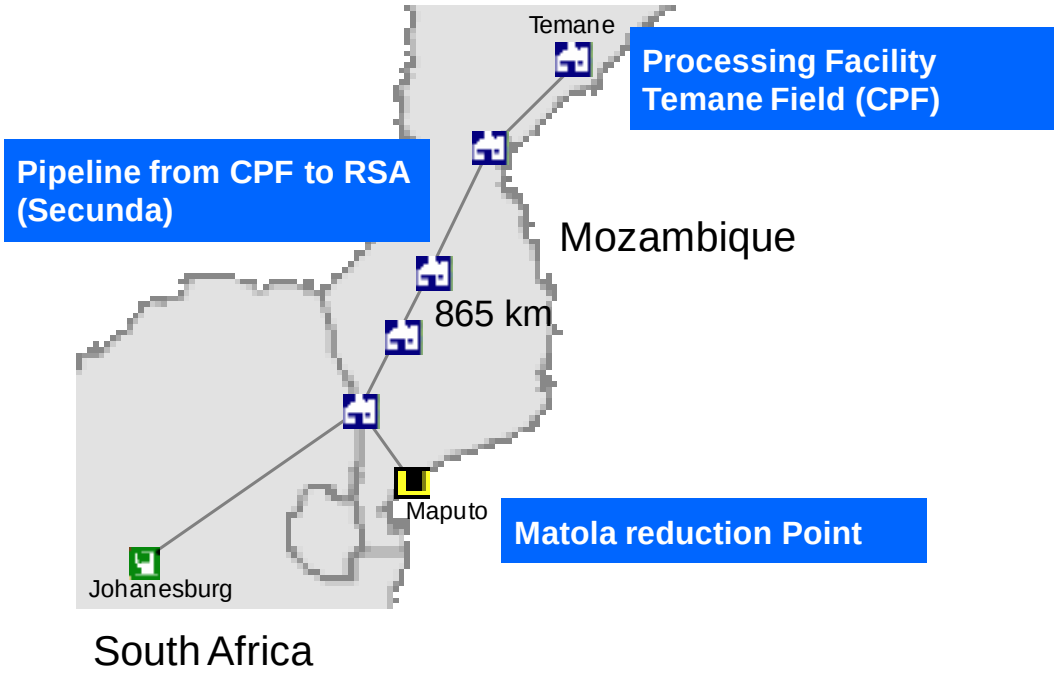
exported. The government recently announced that coal production in 2012 increased to its highest level (EIA 2011).

2.5 Development of the gas sector

Potential

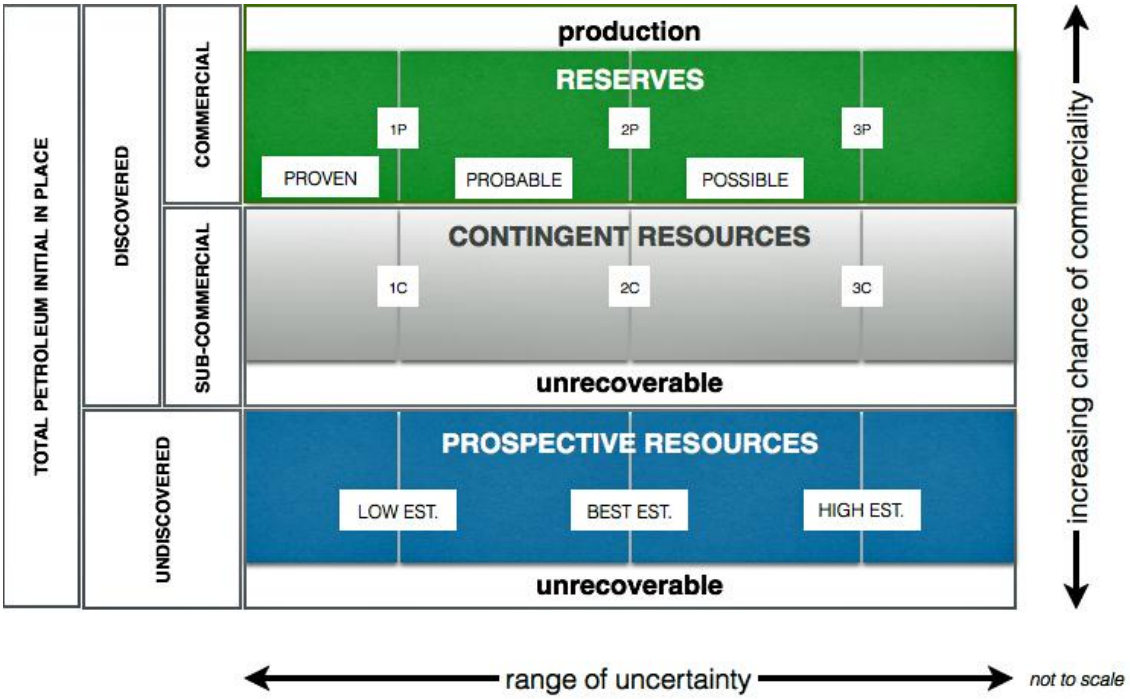
The first discovery of natural gas in Mozambique dates 1961, in Pande, followed by the Temane and Buzi fields. In 2000, Sasol committed to buy 120 million GJ of natural gas over 25 years for its own consumption and commercialization in South Africa. This commitment made it viable to produce natural gas from the Pande and Temane fields and to build a gas pipeline to Secunda in South Africa.

Figure 3: Map of Sasol operation in Mozambique



Source: Sasol

More recently and since 2010, operators in Mozambique have discovered over 100 trillion cubic feet (Tcf) of natural gas. Appraisal of the discoveries is still on-going. The discoveries give reasonable support to assess the development of installations for natural gas liquefaction for export of Liquefied Natural Gas (LNG).



According to the US Energy Information Administration (EIA), Mozambique has 4.5 Tcf of proven reserves[4]. The World Bank, a close partner in leading the development of Mozambique's natural gas sector estimated that the total amount of gas in place could be as much as 275 Tcf, of which 128 Tcf has so far been discovered (Wb/ifc).

So far, Mozambique and Tanzania are the only countries that produce natural gas in East Africa. Given these large estimated reserves within Mozambique, as well as power deficit within the region of East and South Africa (> 4000 MW) (IISD paper), companies and the government are expediting investments to build this sector up.

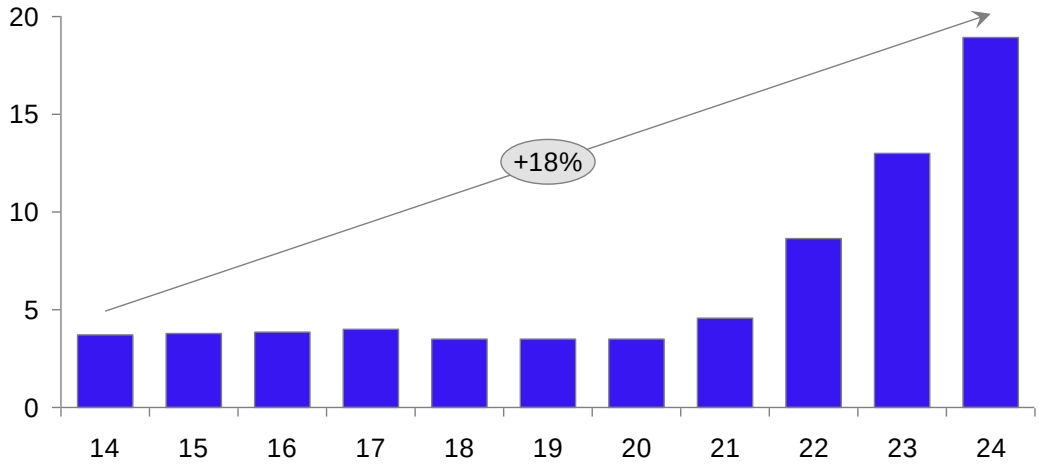
The Mozambican Government is promoting the race for its natural resources while, at the same time, encouraging sustainability through contributions from investors for development sectors, from infrastructures to health and education.

The World Bank has estimated that given all capital costs, Mozambique offers investment opportunities that would fall in the bottom quartile of costs relative to other LNG projects around the world.

A strong acceleration in the gas sector in Mozambique is expected in the coming years largely resulting from discoveries in the North of the country.

4 Source: http://www.eia.gov/countries/country-data.cfm?fips=mz

Figure 4: Estimated Gas Production (bcm), 2014-2024



Source: Rystad

Stakeholders in the Gas sector

Stakeholders in the Gas sector in Mozambique include:

- The **Ministry of Natural Resources** within the Government of Mozambique is overall responsible for the gas sector. Within the Ministry, **Instituto Nacional de Petróleo (INP)** is the regulatory authority for the petroleum and gas operations (exploration, production and transport of hydrocarbons.
- Another critical stakeholder in the gas sector is the state-owned **Empresa Nacional de Hidrocarbonetos (ENH)**. Formerly with exclusivity rights, is now mainly commercially focused and participates as a stakeholder, in the natural gas projects.
- ENH has two affiliated companies **Companhia Moçambicana de Hidrocarbonetos (CMH)** a vehicle of participation in the Natural Gas Project in Pande and Temane, and **Companhia Moçambicana de Gasodutos (CMG)** a vehicle for participation in the transport component of the Pande and Temane projects.
- **Petromoc** is the national market leader in the distribution of petroleum products. It owns the largest retail network spread throughout the country. This consists of 119 filling stations and supply posts and 300 local consumer positions. The company owns and operates storage facilities and pipelines in all the main Mozambican ports.

Petromoc has begun developing CNG filling stations in Maputo and plans to develop stations in Beira and in between the two cities. The market in Mozambique is expected to be relatively small and will depend on access. The filling stations are planned to be located within cities and along high travel corridors.

Key Legislation

In 2009, the Government enacted the National Strategy for Petroleum Operations Concessions, the objective of which is to ensure the systematic and continuous petroleum exploration in the country's basins, while stimulating the investment of the national private sector in oil exploration and production.

Key legislation and regulatory structure relating to the upstream oil and gas sector include :

- Law No. 3/2001 of 21 February - Petroleum Law (the Petroleum Law).
- Decree No. 24/2004 of 20 August – Regulation of Petroleum Operations (Petroleum Regulations).
- Law No. 12/2007 of 27 June – Taxation of Petroleum Operations (Petroleum Tax Law); and Law No. 13/2007 of 27 June – fiscal and taxations incentives for mining and Petroleum Operations (Fiscal Incentives Law).

In 2012, the government published a revised draft of the Petroleum Law, which it is currently anticipated to become law in the first half of 2013. Key changes proposed by the draft law include, for example, the introduction of a new type of concession agreement for the construction of offshore facilities and a requirement for government approval on any transfer of an interest in a concession agreement, whether directly or indirectly.

The key institutions involved in regulating the upstream oil and gas sector are:

- Council of Ministers.
- Ministry of Mineral Resources (MIREM).
- INP (National Petroleum Institute).

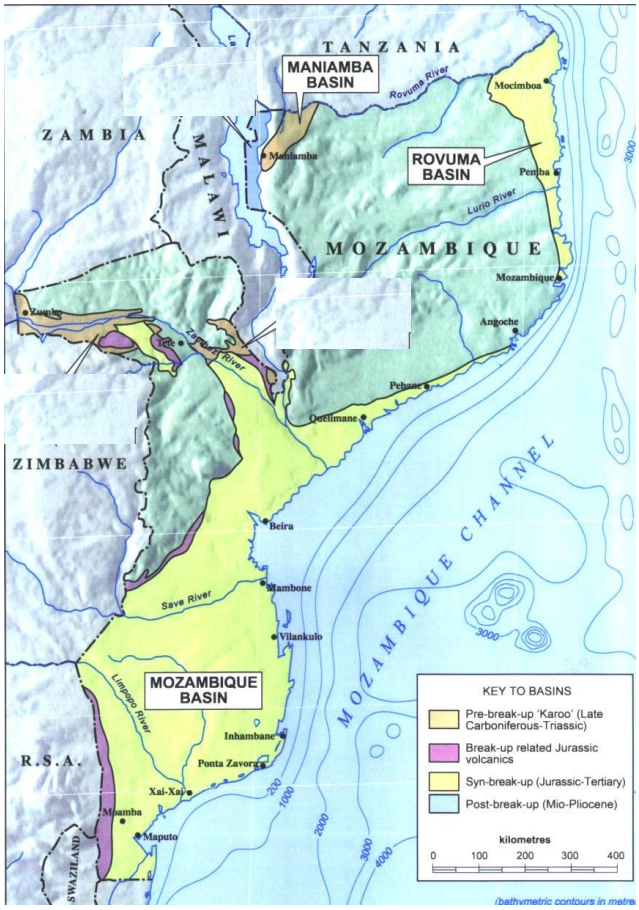
MIREM and INP are relatively new bodies, having been established by decree in 2005 and 2004 respectively.

Private Sector

In Mozambique there are 3 major areas on the map for Gas exploration:

- Mozambique Basin.
- Rovuma Basin.
- Maniamba Basin.

Figure 5: Mozambique Gas Exploration Map



Source: INP

Prospecting concessions have been awarded at both Mozambique and Rovuma Basin. For Maniamba Basin, prospecting licenses are yet to be granted. The table below provides a summary of the exploration history for both the Mozambican and Rovuma basins.

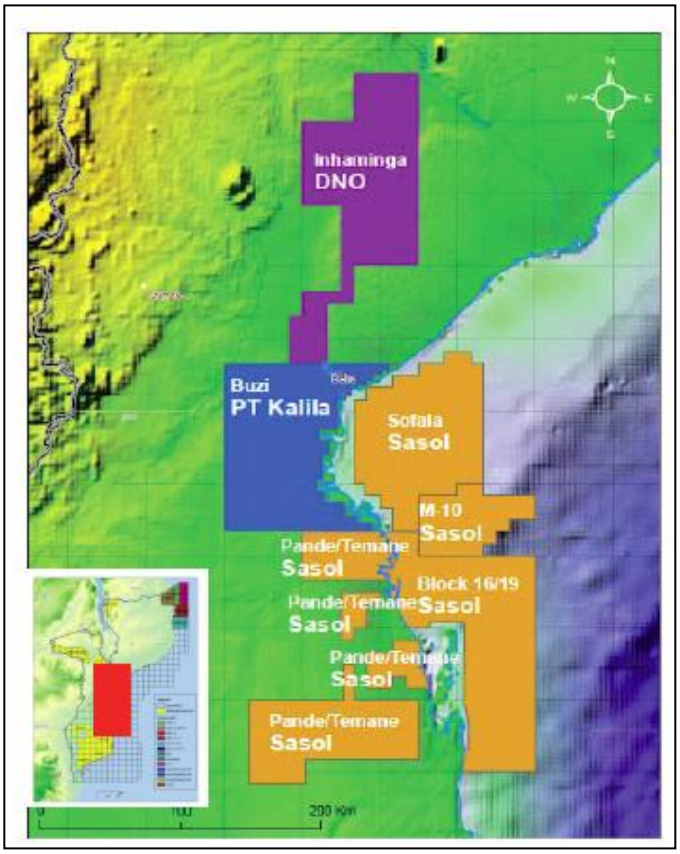
Table 2: Exploration History at the Mozambique and Rovuma Basin

MOZAMBIQUE BASIN	ROVUMA BASIN
1904-1920 - Early Exploration	**1983-1987-** ESSO/SHELL joint concession.
1948-1974 - Concessions to GULF, AMOCO, SUNRAY, HUNT and AQUITAINE	**1994-1995-** NL (Mopet) onshore/offshore concession of about 38,000 sq km
1981-1982 - First Spec seismic campaigns (Western/Geco) and establishment of ENH	**1995-2001-** LONROPET onshore/offshore concession (30,000 sq km)20002000–Offshore deep water speculative seismic (Western/Geco)
1984-1986 - PSA's with BP, AMOCO, ESSO/Shell	**2005-** Licensing Round
1998 - PSA's with BP, Norbay, Scimitar, ARCO, SASOL	**2006-** EPC with Hydro/ Anadarko, ENI, Artumas
1999-2004 - PSA with SASOL	**2007-** EPC with Artumas
2002-2005 - EPC withPetronas/ ENH, DNO & SASOL/ENH	**2008-** EPC for areas 3 & 6
2006 – 2009 - EPC with BANG and ENH	
2010 - EPC with SASOL	

Source: INP

The current exploration concessions of both active basins have been provided on the tables below and geographically illustrated.

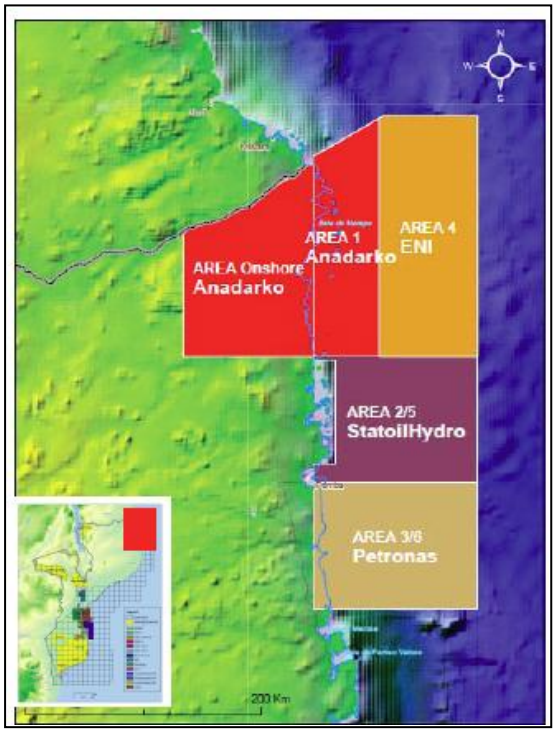
Figure 6: Concession Areas at Mozambique Basin



Source: INP

Concession	Partners
Pande/Temane (PSA)	Sasol (100%)
Pande/Temane (PPA)	Sasol (70%), ENH (25%) & IFC (5%)
16 & 19	Sasol (50%), Petronas (35%) & ENH (15%)
Inhaminga	DNO (55%), Harmattan (5%), New Age (40%)
Baia de Sofala	Sasol (85%) & ENH (15%)
M-10	Sasol (42.5%), Petronas (42.5%) & ENH (15%)
Buzi	PT Kalila (70%) & ENH (30%)

Figure 7: Concession Areas at Rovuma Basin



Source: INP

Concession	Partners
Area Onshore	Anadarko (35.7%), Artumas (15.3%), Maurel & Pron (24%), ENH (15%) & Cove Energy (10%)
Area 1	Anadarko (36.5%), Mitsui (20%), ENH (15%), BPRL (10%), Videcon (10%) & Cove Energy (8.5%)
Area 4	ENI (70%), ENH (10%), KOGAS (10%) & Galp Energia (10%)
Area 2 & 5	Statoil (90%) & ENH (10%)
Area 3 & 6	Petronas (90%) & ENH (10%)
M-10	Sasol (42.5%), Petronas (42.5%) & ENH (15%)
Buzi	PT Kalila (70%) & ENH (30%)

ENH, Anadarko and ENI are promoting the recent developments in the Rovuma basin. In early 2012, U.S.-based Anadarko and Italy-based ENI led successful explorations for natural gas reserves in the offshore Rovuma Basin region:

- Anadarko made several discoveries within the Prosperidade and Golfinho/Atum complexes, each of which contain between 17 to 30 Tcf and 15 to 35 Tcf of recoverable natural gas resources, respectively.
- ENI's natural gas discoveries are in the Mamba complex and the Coral site, of which each contain 62 Tcf and 13 Tcf of recoverable natural gas, respectively.

Since then, there has been a lot of dynamics amongst international players looking into investing in this sector. Most of the international players in this sector are export-oriented but the Government is increasingly incentivizing the development of adjacent local projects, including power generation, steel production, aluminium smelting,

amongst others industry types. The government has brought in policies that try and limit domestic resource exploitation and are attempting to create a policy ecosystem that incentivizes development in Mozambique. For example, foreign companies undertaking rural electrification and grid expansion are exempt from paying any corporate profit tax; and are required to pay extra taxes on any subcontracting and further sales and mergers relating to discovered natural gas reserves.

Export orientation vs. Domestic Consumption

There are also quite strong views that instead of undertaking this export-oriented view, the reserves should be used to substitute biomass as a subsistence energy form with natural gas, in order to reduce deforestation and improve health concerns arising out of excessive charcoal burning. For example, the EU Energy Initiative states: ''In 2011 energy produced before imports amounts to around 13m toe. Energy use in the same year amounts to less than 10m toe. Mozambique could well be able to cover its own energy needs with its current gas and electricity infrastructure, whilst reducing biomass consumption by 2m toe. This is a strong argument in favour of in-country use of natural gas in order to reduce deforestation.''

Domestic Consumption

Since 1992, the ENH has been providing natural gas to 3 districts in the north of the province of Inhambane namely Vilankulos, Inhassoro and in particular Govuro. The implementation of this network has enabled the creation of a system of power supply through a gas generator for the whole northern part of the province. This pioneering project, implemented long before the macro project such as Pande and Temane had as objectives:

- Create awareness of the importance of NG, a national resource.
- Train technical personnel in the handling of the NG and its technology.
- Reduce in consumption of imported fuel.
- Reduction of deforestation in the region with the decrease of use of wood fuels used for cooking and heating.

In the context of maximizing the use of natural gas in Mozambique, ENH is developing a natural gas distribution project in Maputo and in the District of Marracuene. This project encompasses the construction and operation of a pipeline Matola-Maputo for the supply of natural gas for a thermal power station, which will see the city of Maputo as its largest consumer of power to the industrial, commercial and domestic sector.

ENH is a partnership with the Korea Gas Corporation (Kogas) and the Maputo City Council. Energy Minister Salvador Namburete said that the project is a landmark and will be a reference in the country at a time when fossil fuels consumption increases imports with significant implications in the balance of payment.

The first phase of the project is budgeted at 38.2 million US dollars, and consists in the construction of a high-pressure gas pipeline, with 11 miles, from the Beluluane Industrial Park, in Maputo to Marracuene. KOGAs will finance 100% of the project and in partnership with ENH will own and operate the pipeline and gas distribution network in Maputo and Marracuene.

Advantages of using gas in Mozambique

Government of Mozambique sees a number of advantages in the domestic consumption of natural gas :

- Rapid industrialisation in the country, with the installation of petrochemical industry.
- Increase in the amount of potential power supply quality and attractive price.
- Reduction in the import of fuel, moving towards energy self-sufficiency.
- Job creation and training of local expertise.
- Development of infrastructures.
- Reduction of pollutant emissions, improving environmental conditions.

Social impact

The advantages for families and for the country as a whole can be translated in a reduction of monthly expenses related to energy consumption and contribution to environmental protection.

Per unit of energy it is estimated that natural gas will cost to families 36% less in comparison to LPG and 14% less compared to electricity (assuming consumption of 300 kWh per month on domestic fare)[5].

Macroeconomic impact

The feasibility of this project predicted that Mozambique was able to save ~ 2.3 USD million annually leading to a total cost saving of ~ 35 USD million in 2030 in liquid fuel imports and an addition ~ 25 USD million in imports of electricity. The project is also expected to create about 150 temporary jobs during the construction phase and leading to as many as 80 permanent jobs.

5 Information extracted from ENH homepage (www.enh.co.mz)

3

Survey among Dutch companies working in the international gas industry

3.1 Introduction

During the past 100 years, oil & gas resources have been successfully exploited in the Netherlands. The model used by the Dutch government was to maximize the amount of gas that can be extracted from a reservoir, whilst keeping big and small oil & gas operators interested in exploring and extracting hydrocarbon resources. This model of managing exploration and extraction became the blueprint for many countries where hydrocarbon resources have been discovered in the underground of their territory.

Much of the Dutch model is based on experience and scientific research. Much is based on generic education and skills development at all levels. It is the scientific effort that strengthens the Dutch in supporting the new 'hydrocarbon resource rich' in organising the administration, legislation and education effectively, whilst respecting the need for cultural alignment.

This Chapter presents the results of a survey conducted amongst Dutch companies working in the international gas industry, in particular in Southern Africa. The survey aimed to assess which companies would be interested in starting (expanding) business in the gas industry in Mozambique, what contributions -in terms of investment and training and education- the companies are willing to make and what local expertise is required for long lasting cooperation between Mozambican and Dutch companies.

The survey has been conducted by means of a questionnaire, which was sent to a list of companies provided by the Dutch Embassy in Maputo and a list drawn up by GGNI of companies working in the international gas industry. Some of the companies have been

contacted by GGNI to check and to get further clarification on the answers given in the questionnaire.

3.2 Survey results

The following fourteen companies were surveyed.

Table 3: Overview of surveyed companies

No.	Company	Type of business
1	AA-Service	Waste processor
2	A. Hak	Pipeline construction
3	BAM International BV	Construction EPC
4	Fabricam B.V. (GDF SUEZ) International Operations	Installation & construction EPC
5	IOC	International oil company
6	Iv-Oil & Gas	Engineering
7	Magnatech	Automatic welding equipment
8	Merford	Acoustic engineering + special doors
9	Ortec	Business logistics optimisation
10	RoyalHaskoningDHV	Engineering
11	Smit Lamnalco	(shuttle tanker) handling
12	Tideway	Offshore construction contractor
13	van Oord	Offshore construction contractor
14	Witteveen+Bos	Engineering

The questionnaire consisted of seven questions and below the answers are presented for each question.

1. Which companies are interested in playing a role in the gas industry in Mozambique? (1= high interest, 5 = low interest).

Company	financial	local office	local staff	local project	local JV
AA-Service	5	4	3	1	2
A.Hak	5	4	3	1	2
BAM International BV	-	3	2	-	1
Fabricam B.V. (GDF SUEZ) International Operations	5	1	3	4	2
IOC	5	2	3	1	4
Iv-Oil & Gas	5	4	3	2	1
Magnatech	5	4	3	1	2
Merford	5	4	3	2	1
Ortec	5	3	4	1	2
RoyalHaskoningDHV	0	1	2	3	5
Smit Lamnalco	5	4	1	2	3
Tideway	5	3	3	2	3
van Oord	5	5	3	1	1
Witteveen+Bos	5	3	3	2	1

All the companies interviewed are interested to play a role in Africa. The companies focusses mostly on a specific region in order to combine their activities and to try to spread their risk. The companies are, as indicated in question 2, working in upstream and midstream projects. The companies tend to follow the large international projects. For a stable long-term relationship the Dutch government should also try to get downstream interest focussing on for example power production and chemical industry in Mozambique.

2. What is the position of your business activity in the gas value chain? (1 =high focus, 3 =low focus)

Company	upstream	midstream	downstream
AA-Service	1	2	3
A.Hak	3	1	2
BAM International BV	-	1	2
Fabricam B.V. (GDF SUEZ) International Operations	1	2	3
IOC	1	2	3
Iv-Oil & Gas	1	2	3
Magnatech	3	1	2
Merford	1	2	3
Ortec	1	1	1
RoyalHaskoningDHV	1	2	3
Smit Lamnalco	2	1	3
Tideway	1	2	3
van Oord	1	3	3
Witteveen+Bos	1	2	3

The above table shows that the focus of most companies is on upstream (8 out of 11) and midstream (3 out of 11 companies).

3. What is your company willing to invest in education and training in Mozambique and what are the conditions and restrictions? (1 =high willingness, 4=low willingness)

Company	financial	legal	business	oil&gas
AA-Service	3	4	1	2
A.Hak	4	3	2	1
BAM International BV	-	-	1	2
Fabricam B.V. (GDF SUEZ) International Operations	3	4	2	1
IOC	4	2	3	1
Iv-Oil & Gas	4	3	2	1
Magnatech	4	3	2	1
Merford	4	3	2	1
Ortec	3	4	1	1
RoyalHaskoningDHV	0	0	1	2
Smit Lamnalco	-	-	1	2
Tideway	4	4	4	3
van Oord	4	4	2	4
Witteveen+Bos	2	2	4	1

The companies are all used to invest in training and education of their staff as soon as they have made the decision to do business in the East African region or countries like Mozambique and Tanzania. A clear example is Shell(not included in the tables) having as

part of their contractual obligation, education and training of local staff. Shell is currently doing this in Tanzania. We could not get the confirmation if a similar programme for Mozambique is under way. The focus of training programmes is mainly oil & gas knowledge and business skills.

4. How will your company invest in training and education of business partners until 2017? (1 =high willingness, 5 = low willingness)

Company	financial	knowledge	skills	training fac.	workforce
AA-Service	5	2	1	3	4
A.Hak	5	4	2	1	3
BAM International BV	5	1	2	3	4
Fabricam B.V. (GDF SUEZ) International Operations	5	4	2	3	1
IOC	5	1	2	3	4
Iv-Oil & Gas	5	1	2	4	3
Magnatech	5	2	1	4	3
Merford	4	2	1	3	5
Ortec	5	4	3	2	1
RoyalHaskoningDHV	5	1	2	4	3
Smit Lamnalco	4	3	2	5	1
Tideway	5	3	3	3	3
van Oord	5	3-4	2-4	5	5
Witteveen+Bos	5	2	2	1	4

Investment in skills, knowledge and training facilities are clearly part of the investment policies of the companies. Most of the companies have experience in similar projects around the world. It shows that most companies do invest primarily in knowledge, skills and training facilities, whereas, financial support and additional work force is less frequently done.

5. Which capacity is according to your company needed to create a balanced partnership with companies in Mozambique? (1 = high need, 4 = low need)

Company	acadamic	vocational	Technical	skill specific
AA-Service	4	3	2	1
A.Hak	4	3	2	1
BAM International BV	4	1	2	3
Fabricam B.V. (GDF SUEZ) International Operations	2	1	3	4
IOC	4	3	1	2
Iv-Oil & Gas	4	2	3	1
Magnatech	4	3	1	2
Merford	4	3	1	2
Ortec	1	1	2	2
RoyalHaskoningDHV	4	3	1	2
Smit Lamnalco	4	3	1	2
Tideway	3	3	2	3
van Oord	3	3	3	3
Witteveen+Bos	4	1	2	3

The level of training varies. Of course especially engineering companies focus on technical training.

6. What should in your opinion be the contribution of the NICHE programme regarding higher education and technical and vocational education and training?
This could not be determined by the answers from the questionnaire. But the companies indicated that their workforce and partners need general business skills and knowledge such as:

- interpersonal effectiveness (communication, networking, building trust, etc.);
- team work (cooperation, coaching, leadership, etc);
- goal orientation (planning, organising, flexibility, stress tolerance, etc.;
- analytical skills (conceptual thinking, analysing, creativity, quality awareness, etc.);
- external orientation (stakeholder management, initiative entrepreneurship, etc.);
- HSE awareness (health safety and environment).

Given these skills set and a basic training in the oil & gas business, there should be a possibility to get certified for certain specialized jobs. It is clear that are opportunities in

- operational workforce;
- engineering;
- business management;
- government functions (outside the scope of the companies).

Most of the experts combine their specialism with knowledge of the energy business. This starts with a thorough introduction to the energy value chain and the oil & gas value chain. This is combined with more specialised programmes.

The companies obviously are looking for people with the proper skill sets and educational background. The NICHE programme should focus on how to get a bigger group of student prepared to enter.

4

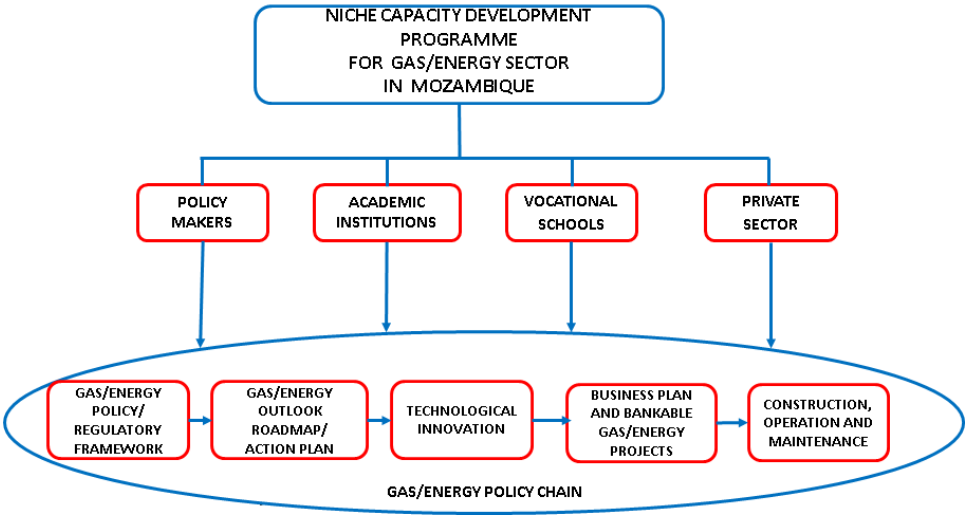
Framework for capacity building programme

4.1 Introduction

In the coming decades the gas and energy sector in Mozambique will face the challenging tasks of simultaneously meeting a rapidly growing industrial and residential gas/energy demand, helping to reduce absolute poverty, defining the role of gas and coal in the Mozambican energy sector and reducing the sector's impact on environment, health and deforestation. According to the World Bank, the emerging gas and coal industries could be the key drivers of Mozambique to reach the status of middle-income country by 2025. However, Mozambique cannot develop without further strengthening its gas/energy sector and to be able to address all the technical, economic, social and institutional aspects, sufficient human capacity will be essential.

4.2 General Framework

Effective capacity building programmes for the gas and energy sector are based on current and future gas/energy policy issues and priorities in the country, address the whole gas/energy policy chain and should be embedded within the country's organizations and institutions to become a self-sustaining structure that serves to continue the building of human capacity after the programme has ended. In such an approach the capacity development programme focuses on four target groups: (1) national/regional policy makers;(2) university education; (3) technical education and training; and (4) the private sector.



1. **National/regional policy makers** are trained in energy planning analysis and formulating sound energy policies, making optimal use of available domestic gas, coal and oil and renewable resources, promoting renewable energy and energy efficiency, increasing access to electricity, environmental analysis, accessing climate finance, and social and intuitional issues. The uncertainties related to future GDP growth and the expected change in economic structure with a much higher share of extractive industries makes proper and continuous energy planning even more necessary.

2. **Universities and Polytechnics** are assisted in expanding existing, or setting-up new, education programmes on energy, with particular focus on gas. This may comprise developing new curricula and educational material, training lectures on new topics and running the new educational programmes. To strengthen the sustainability it is important that the research conducted at the universities becomes applicable and that universities establish long lasting cooperative relationships with private sector companies and governments to stimulate the commercial development of successful research projects and the commercial exploitation of gas/energy expertise available at the university in consultancy work.

3. **Technical/vocational schools** are assisted in developing new training modules on gas and other energy technologies relevant for the Mozambican situation. Both the Ministry of Labour and the Ministry of Education have training programmes aimed at improving vocational training and technical education in Mozambique. The Ministry of Labour focuses its training efforts on those who did not obtain minimum skills through the educational system. Training programmes usually last 3 to 6 months, and some last up to 1 year. The persons trained are mostly below 35 years of age. There are 13 public training centres (‘Centros de Formação Profissional’) spread throughout the country. These are managed by INEFP (‘Instituto Nacional do Emprego e Formação Profissional’) under the Ministry of Labour. There are also private training centres (about 100), mostly in the city of Maputo. A 2006-2015 strategy for employment and professional training is in place and it defines objectives for labour training and results indicators. The Ministry of Education leads a programme of reform of secondary education called PIREP (‘Programa Integrado de Reforma da Educação Profissional’). This programme created sectoral technical

advisory committees (STACs) including representatives of the private sector and educators, which create curricula for secondary technical education for specific sectors (e.g. tourism or agriculture).

4. **Private sector** energy entrepreneurs are trained in the technical aspects of gas technologies and how to establish a business, develop bankable projects and deal with financial institutes. This may involve training in cost-benefit analysis, business plan development and risk analysis. Financial institutes may be trained in technical, financial and energy policy issues to enable them to better underpin decisions on investments in the energy sector.

The energy policy chain, depicted in the above figure, is defined as a path starting from the formulation of energy policies and development of a regulatory framework to energy actions plans and technological innovation, to development of bankable energy projects and, finally, the construction of the energy project.

It is important that the capacity development programme addresses the whole energy policy chain and that synergies are created between the training activities for the four target groups through, for example, alignment of training materials, the sharing of facilities and regular interactions between policy makers, universities and vocational schools, private sector and other stakeholders.

It is also important that the programme is embedded in existing structures that are part of annual planning and budget cycles and will remain intact in the foreseeable future. Working together with existing knowledge institutes in Mozambique is likely to be more sustainable than creating new institutional entities.

4.3 How to develop NICHE gas/energy capacity development programme in Mozambique

Based on the framework presented above the implementation of the NICHE Capacity Development programme could consist of the following steps:

1. Conduct a detailed needs assessment to gain better insight into:
    a. The number of university and vocational school graduates in the field of gas/energy sector needed in the coming decades in both the public and private sector in Mozambique.
    b. The specific training needs of the universities/polytechnics, vocational schools and government departments in Mozambique.

This assessment will be conducted through interviews with selected industry, policy makers and knowledge institutes. The outcome of the assessment will result in a detailed institution-specific knowledge work plan.

2. Initiate a long-term co-operation between suitable Mozambican and Dutch knowledge institutes and companies that aims to address the gaps in gas/energy expertise and the training needs in Mozambique as identified in the first step.

3. Develop new curricula and training materials, train lecturers, teachers and policy makers, organize workshops and seminars, explore the possibilities for internships, analyse the legal, institutional and financial aspects of introducing new curricula, organise an information campaign and launch the new/expanded education/training programme.

4. Introduce the new education/training programme in the Mozambican knowledge institute, monitor the number of students and conduct surveys among students to assess whether the programme meets their expectations. Based on the outcome of the survey, revise the set-up of the programme (duration, content) and/or the training material where necessary.

5. Discuss with government authorities (Ministry of Education, Ministry of Labour, Ministry of Energy) how to institutionalize the new education/training programme and how to embed it in the existing institutional structure to facilitate rollout to other knowledge institutes.

It is proposed that the NICHE four-year programme starts with an inception phase with a duration of 4 months, which will basically cover steps 1 and 2. Next, 36 months will be needed to develop, introduce and evaluate the education/training programmes (steps 3 and 4); and, finally, the last eight months of the programme are needed to prepare roll-out of the programme(step 5) to other knowledge institutes and regions in Mozambique and to wrap up the programme.

5

Conclusions and recommendations

The quick scan presented in this report had to be carried out within a short timeframe. It provides an analysis of the main energy and gas issues and priorities, the main stakeholders in the gas industry, the (future) capacity needs, an overview of potential NICHE programme partners and a first, preliminary set-up of the NICHE programme. A more detailed assessment of the training needs of knowledge institutes in Mozambique is needed. Based on the quick scan presented in this report the following conclusions and recommendations can be drawn:

1. The exploitation of the huge gas reserves discovered in the Mozambique and Rovuma basins can be the key driver for moving Mozambique from a low income to a middle-income country in the next decade. However, despite the fact that the outlook for the gas industry is looking bright, the present reality is that more than 80% of the households has no access to electricity or modern energy and that traditional biomass constitutes more than 77% of total primary energy supply. Great uncertainties exist about the future role of gas in the domestic energy sector and to what extent and within what timeframe it can help increase the access to modern energy and provide economic opportunities for large sections of the population. It is therefore recommended to not solely focus on the gas industry in the envisaged NICHE programme but to also allocate resources for strengthening other subsectors with high potential such as solar, wind, hydro and sustainable biomass and biofuels. A more diversified approach seems justified to be able to mitigate the current uncertainties regarding future gas sector development and to facilitate a smooth transition towards a more gas-dominated energy sector. It would also make sense from a national energy policy perspective not to analyse the gas sector in isolation but to adopt a more integrated strategy that takes into account the many interactions between the gas sector and other subsectors. Finally, broadening the scope of NICHE to also include renewable energy could help the Mozambican government in their efforts to pursue a more climate resilient economic development.

2. The development of the Mozambican gas/energy sector is an impressive task that requires a tremendous growth of skilled professionals in the coming years and decades. This makes it essential to strongly embed the NICHE activities in existing structures - or to create new structures - that will remain intact in the foreseeable future to guarantee the continuation of the building of capacity also after the NICHE programme has ended. It is therefore recommended to:
    a. Develop new - or strengthen existing - education/training programmes that can contribute to meeting the (future) demand for gas/energy -related expertise and are adaptable to changing needs and circumstances.
    b. Incorporate these programmes in the structures of existing knowledge institutes.
3. According to the survey conducted under this quick scan, most service companies in the upstream and midstream oil & gas industry will focus their business development on large projects of the National & International Oil Companies (NOCs and IOCs). The service companies will first start investing in local partners on a project-by-project basis. When several projects with long-term perspective are being implemented in the region at the same time the companies may consider to open an office in Mozambique. Once this decision has been made, companies will invest in human resources in Mozambique. Of course, they will also look at alternative options such as Tanzania.
4. Attracting more companies to the downstream business and government services offers the opportunity of creating a longer-term cooperation on gas between the Netherlands and Mozambique.
5. NICHE should cooperate with a group of oil & gas knowledge oriented organisations in combination with training institutes for business skills & competences.

References

European Union Energy Initiative, 2012, Mozambique Biomass Energy Strategy, Germany.

International Institute for Sustainable Development, 2010, Energy Security in Mozambique, Canada.

SPTEC Advisory, 2013, Mozambique: The emergence of a Giant in Natural Gas.

US Energy Information Administration, accessed online at http://www.eia.gov/countries/country-data.cfm?fips=mz.

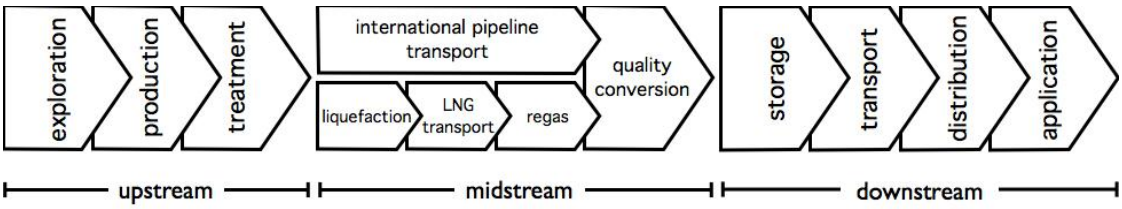
MIREM & IFC – Natural Gas Master Plan for Mozambique 2012.

Appendix A. Natural gas product chain and asset life cycle

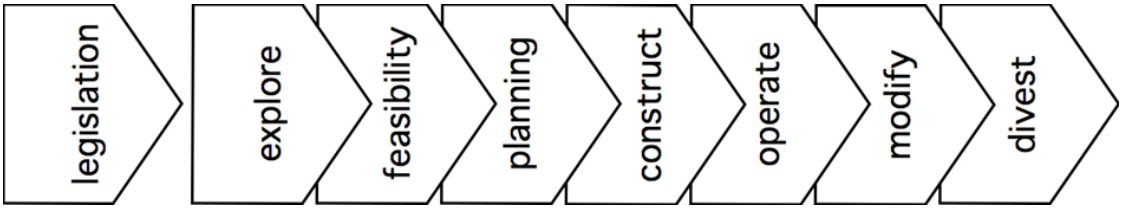
The interviewees were chosen on the basis of their contribution to the hydrocarbon (natural gas) product chain, their contribution to the asset life cycle and their contribution to the hydrocarbon value chain.

The hydrocarbon product chain

The picture below shows schematically the natural gas product chain.

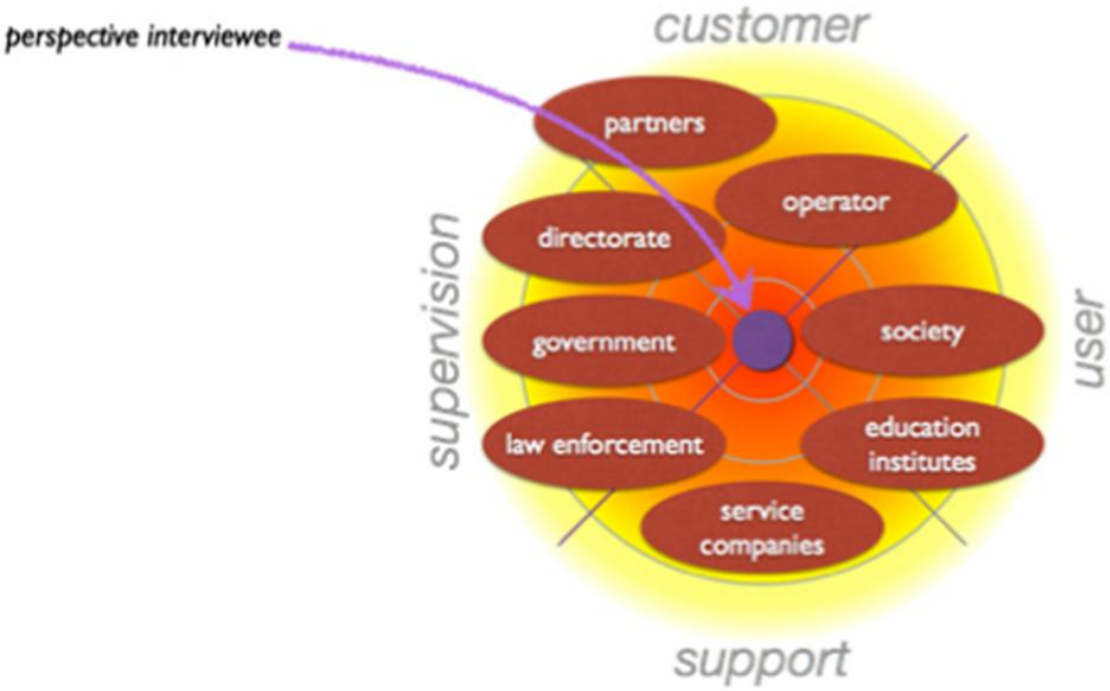


The picture below shows the asset life cycle.



The picture below shows the natural gas value chain.

The interviewees were asked to picture their environment on the bases of the picture below, their stakeholder map.



Local oil & gas population

Traditionally the oil companies, e.g. Shell, Exxon, Statoil, ENI oversee the whole product chain from their position as a partner in a joint venture or as a shareholder of a company controlling part of the product chain. They are supervised by their board of directors and have to abide by the existing rules and legislation. Oil companies are supported by service companies.

Gradually this picture has changes and the oil company now focuses more on the high-risk activities and services companies become fully responsible for managing complete asset life cycle elements and hence are directly exposed to governmental supervision and law enforcement. Turn-key projects for well engineering and construction, traditionally called 'drilling', and Engineering, Construction and Procurement (EPC) contracts have become more popular. To enforce warranty, today contracts go as far as that the EPC contractor (consortium) is responsible for commissioning, start-up and operate and maintaining the facilities. So-called Floating Production, Storage and Offloading facilities (FPSO's) are leased including crew by the oil company.

This makes the representation of the various companies during the asset life cycle more fluid, less massive and relying on expatriates. For direct services, offshore supply and maintenance campaigns on relies on local partners with local staff.

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