

CVR: 27171877  
VestJysk Bank: 7606 1064127



Niels Bohrs Vej 6  
DK-6700 Esbjerg, Denmark

**A STUDY OF OPPORTUNITIES FOR DANISH OFFSHORE COMPANIES  
WITHIN THE ANGOLAN OIL&GAS SECTOR**

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## 1 Executive Summary

Crude oil has been commercially exploited in Angola since its discovery onshore in 1955, which makes the Angolan oil industry a decade older than the Danish oil industry. The sector has grown rapidly since then, and especially after 1980, facilitated by the successful attraction of large foreign investments and technological expertise from the major international oil companies. Production is expected to come increasingly from deep-water offshore fields, with higher production costs and more challenging technological requirements, as shallower, more mature fields closer to shore gradually decline.

Angola's oil industry appears to be an attractive investment opportunity, offering foreign companies favourable geology, low operating costs, and constructive business approach from the Angolan government.

Proven oil reserves in Angola have tripled in the last seven years and approximately 90% of Angola's government revenues come from the sale of oil. Angola had proven oil reserves of 5.4 billion barrels as of January 2006. The majority of the reserves are located in Angola's offshore blocks. Angola's crude oil production has more than quadrupled over the past two decades. Oil production is predicted to reach two million bbl/d by 2008. Angola represents over 16% of the projected growth in global volumes from 2005 to 2010. In terms of non-OPEC nations Angola accounts for 26% of production growth. Angola is therefore a very attractive market destination for the Danish service providers.

Angola's national oil company, Sociedade Nacional de Combustiveis de Angola (Sonangol), was established in 1976 and made the sole concessionaire for exploration and production in 1978. Sonangol works with foreign companies through both joint ventures and Production Sharing Agreements, funding its share of production through oil-backed borrowing.

The top foreign oil companies operating in Angola are US-based ChevronTexaco and ExxonMobil, France's Total, UK's BP, UK/Dutch Shell, and Italy's Agip/Eni Oil Company. The most active in Angola is ChevronTexaco (60% of current output) and Total (36%). Maersk Oil Angola and partners have in 2006 entered Production Sharing Agreements with SONANGOL where Maersk Oil is designated operator and holds a 50% working interest.

The Fina Petroleos de Angola refinery in Luanda, a Joint Venture between Sonangol, Total and private investors, has a crude oil processing capacity of 39,000 bbl/d. The refinery produces almost all of Angola's domestic requirements of gasoline, kerosene and jet fuel, as well as a small amount of products for export. Angola is developing plans for a new 200,000-bbl/d refinery in the coastal city of Lobito.

Angola has proven natural gas reserves of 1.6 trillion cubic feet as of January 2006. The majority of natural gas produced in Angola is flared; the remainder is re-injected to aid in oil recovery or processed in the production of liquefied petroleum gas.

The Angolan oil sector is a major driver for the country's economical growth and related political stability. The oil sector, operating offshore, did not experience many disruptions throughout the period of civil war and was able to attract substantial foreign investments. The entire Angolan oil industry is with a very few exceptions operated by foreign companies. Absence of a local service

industry creates some specific challenges to the oil industry. These challenges manifest themselves as gaps in the industrial service available in Angola, which on the other hand can be seen as the opportunities for the foreign players to enter the market. In this relation five key opportunities have been selected as the ones with the biggest potential:

- HSSE regulations in Angola are strict and supposedly similar to the North Sea. The Angolan Environmental Services (Essa) is the main institution, which focuses on professional training specifically related to work safety in the oil industry. Essa is one of the Sonangol subsidiaries and provides most of the basic training. The main opportunities for intervention are the practical part of training and training of trainers.
- Fabrication and construction is the largest area of demand by the oil industry operating in Angola. It is a sector where foreign investments are highly feasible. Most aspects of fabrication require highly specialized and technical skills that are currently not present in Angola, thus creating an opportunity.
- There is a substantial demand for preventive maintenance within the Angolan oil industry, but the current supply suffers from limited capacity and competition and related high prices. As a consequence, many companies within the oil industry frequently send equipment and machines out of the country to have them adequately repaired.
- The area of electrical equipment and electronics offers opportunities for companies – experts in process control systems, instrumentation, industrial telecommunications networks and electrical installations; those working with unit shutdowns, modernisation of information and process control systems, control room ergonomics and industrial architecture, industrial analysers or automation of oil and gas transport networks, etc.
- In relation to hydraulics, pneumatics, pumps and accessories the situation is similar to the one described above in relation to electrical equipment and electronics with no domestic fabrication and all the products being imported to Angola.

Additionally there are some ongoing and upcoming projects in Angola providing concrete opportunities within all the above listed fields.

Foreign investment is considered crucial to Angola's reconstruction process and the promotion of foreign investment is a major priority of the Angolan government. The regulatory framework for the private sector has been improving over the past couple of years, so does the promotion and support of local business sectors.

A number of recently established independent Angolan companies are looking for joint venture partners with expertise. Additionally, Sonangol invites foreign companies to participate in the rapidly growing oil related activities, provided they fulfill the related requirements of involving Angolans in these activities. These requirements are presented in more detail in the publication "Doing Business in Angola".



## 2 An introduction to the structure and workings of the Angolan oil & gas industry

Angola's economy has grown rapidly over the last few years, which can be attributed to the ongoing oil boom in the sub-Saharan African country. Approximately 90% of Angola's government revenues come from the sale of oil.

Proven oil reserves in Angola have tripled in the last seven years. According to the Oil and Gas Journal (OGJ), Angola had proven oil reserves of 5.4 billion barrels as of January 2006. The majority of the reserves are located in Angola's offshore blocks. The most prolific offshore blocks have been Blocks 15 and Zero. Proven reserves are also located onshore near the city of Soyo. The majority of Angolan oil is medium to light crude (30 degrees – 40 degrees API) with a low sulphur content (0.12% - 0.14%).

Angola is sub-Saharan Africa's second largest oil producer behind Nigeria. Angola's crude oil production has more than quadrupled over the past two decades. In 1986, crude oil production averaged 280,000 barrels per day (bbl/d), while production in 2005 averaged 1.25 million bbl/d. Oil production is predicted to reach two million bbl/d by 2008, when new deep-water production sites are expected to come online. Angola's oil consumption is relatively small. In 2005, Angolan oil consumption averaged 60,000 bbl/d. However, oil consumption is expected to increase as Angola's infrastructure is refurbished and expanded.

### 2.1 Exports

Angola's largest export partners in 2004 were the United States and China, which comprised 40% and 35% of total exports, respectively. In January 2004, the United States made Angola eligible for tariff preference under the African Growth and Opportunity Act (AGOA), which means that Angola can export petroleum products to the USA duty free and quota free. Angola also exports crude oil to Europe and Latin America.

### 2.2 Sector Organization

Angola's national oil company, Sociedade Nacional de Combustiveis de Angola (**Sonangol**), was established in 1976 and made the sole concessionaire for exploration and production in 1978. Sonangol works with foreign companies through both joint ventures (JVs) and production sharing agreements (PSAs), funding its share of production through oil-backed borrowing. It is a central player in Angola's oil sector with roles that include issuing exploration and production permits, participating as a partner in concessions with other companies, and conducting its own exploration and production activities.

Sonangol has a number of roles, including commercial and regulatory.

Its regulatory tasks include overseeing petroleum operations of foreign companies and managing the development of services to support petroleum operations and the export of crude oil. It recommends areas that should be opened for exploration and conducts the bidding process and negotiations for concessions.

The new Petroleum law transfers certain monitoring roles from Sonangol to the Ministry of Petroleum and helps clarify the division of responsibility between the two entities. However,

according to this law it leaves Sonangol E.P. as the sole concessionaire with large effective powers in determining which companies are awarded contracts. This maintains a potential conflict of interest, since Sonangol could find itself in situations where its own commercial interests conflict with the best interests of the government on whose behalf it is taking decisions.

In addition, Sonangol has well over 30 subsidiary companies in areas as diverse as manufacturing, transport, telecommunications, and banking.

### 2.3 International oil companies

The top foreign oil companies operating in Angola are US-based ChevronTexaco and ExxonMobil, France's Total, UK's BP, UK/Dutch Shell, and Italy's Agip/Eni Oil Company. The most active in Angola is ChevronTexaco (60% of current output) and Total (36%).

Since drilling its first well in 1968 on the Malongo prospect, **ChevronTexaco** dominated production both onshore and in the shallow waters of the Cabinda concession for over 30 years. However, in the early 1990s, when the first round of deepwater blocks were licensed (14, 15, 16 and 17), ChevronTexaco failed to capitalise on its position of prominence. Total and Exxon acquired the top two blocks (16 and 17), and ChevronTexaco failed to secure either operatorship or minority interest in any deepwater block other than Block 14.

ExxonMobil, Total and BP are the new leaders in the region with similar reserve bases, production levels and a host of projects in the pipelines. Newcomer Marathon has managed to gain interests in Blocks 31 and 32. Statoil has a high leverage.

**ExxonMobil's** quick rise in Block 15 has helped it replace ChevronTexaco's domination – especially in the deepwater. The company started three major projects in only 20 months with a combined production of nearly 600,000 barrels per day gross (240,000 bpd net), becoming leader in production. As operator of the “golden” Block 17, Total started up the giant Girassol project in 2003, and has a host of projects in line on Block 17. Like Exxon and BP Total has operatorship of one of the ultra-deep blocks (32), but unlike newcomers Exxon and BP, Total has a history in Angola and enjoys key production from Cabinda and onshore acreage as well.

**BP's** strength is in its breadth of exposure. It has an interest in nearly every prominent deepwater block (15, 17, 18, 31, 32, 33), and operates two: 18 and 31. BP is seeing the greatest success in the ultra-deep on Block 31, with nine discoveries to date compared with modest progress in Blocks 32 and 33.

**Marathon** has worked to establish a position of strength in the Gulf of Mexico deepwater. The company holds interests in the two most successful of the ultra-deep blocks up to date – Blocks 31 and 32. With no production up to date it should enjoy tremendous future growth starting 2010 when Block 31 projects begin to come on-stream.

**Eni, Statoil and Norsk Hydro** have material positions relative to their size. These mid-size European companies each have positions in one or both of the fruitful Blocks 15 and 17, but none operates a block in the area. Their positions tend to be small, ranging from 10-20%.

**Shell** held an interest in a number of blocks, including operatorship of block 16. However, after a failure to drill a commercial well in eight attempts, Shell relinquished the block in 1999. Shell now has shares in blocks 21 (10%) and 34 (15%), but no significant oil reserves have been located in these blocks to the date.

In June 2005 Block **Maersk Oil** has purchased from Canadian Natural Resources Limited the 50% interest of CNR Ranger (Angola) Limited in the Production Sharing Agreement for Block 16. After the year of exploration it appears that Block may be promising, especially with the current oil prices.

Maersk Oil Angola and partners have on 2<sup>nd</sup> November 2006 entered Production Sharing Agreements with SONANGOL covering Blocks 8 and 23 offshore Angola. Maersk Oil is designated operator and holds a 50% working interest. Other partners in Blocks 8 and 23 are Occidental Petroleum (30%) and SONANGOL (20%).

Blocks 8 and 23 cover areas of some 5,000 square kilometers each. Water depth in Block 8 is up to 500 meters while Block 23 has water depths up to 1,500 meters. The initial exploration phase is for 4 years during which the work program comprises seismic acquisition and, later, exploration drilling.

**Table 1 Ownership rights of offshore producing oil blocks**

<b>Offshore operating/producing</b>							
<b>Block 0</b>		<b>Block 1</b>		<b>Block 2</b>		<b>Block 3</b>	
<i>Production 2004: 393 kb/d</i>		<i>Production 2004: 0 kb/d</i>		<i>Production 2004: 41 kb/d</i>		<i>Production 2004: 120 kb/d</i>	
ChevronTexaco	39.2	Agip	50.0	ChevronTexaco	20.0	Total E&P	50.0
Sonangol EP	41.0	Elf	25.0	Total E&P	27.5	Ajoco-Ajex	25.0
Total E&P	10.0	Petrogal	10.0	Braspetro	27.5	Agip	15.0
Agip	9.8	Ina-nafta plin	9.8	Sonangol P&P	25.0	Naftagas	5.0
		Naftagas	9.8			Ina-nafta plin	5.0
<b>Block 4</b>		<b>Block 14</b>		<b>Block 15</b>		<b>Block 17</b>	
<i>Production 2004: 0 kb/d</i>		<i>Production 2004: 61 kb/d</i>		<i>Production 2004: 134 kb/d</i>		<i>Production 2004: 235 kb/d</i>	
Sonangol P&P	80.0	ChevronTexaco	31.0	Esso	40.0	Total E&P	40.0
Elf	10.0	Agip	20.0	BP	30.0	Esso	20.0
Agip	9.8	Total E&P	20.0	Agip	20.0	BP	16.7
		Sonangol	20.0	Statoil	10.0	Statoil	13.3
		Galp Energy	9.0			Norsk Hydro	10.0

Source: Angolan Ministry of Petroleum

**Table 2 Production forecast 2005-2010, kb/d**

<b>Block</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Baseload Deepwater	250	226	181	145	116	93
0	21	48	80	64	51	41
14		62	80	115	200	250
15	357	568	689	751	741	693
17	32	77	200	315	357	391
18			50	150	200	250
31				25	75	100
<b>Total deepwater</b>	<b>664</b>	<b>981</b>	<b>1280</b>	<b>1590</b>	<b>1840</b>	<b>2017</b>
Other production	530	492	394	315	252	202
<b>Total oil production</b>	<b>1195</b>	<b>1473</b>	<b>1674</b>	<b>1905</b>	<b>2092</b>	<b>2219</b>

Source: IEA Oil Markets

## 2.4 Refining and Downstream

The Fina Petroleos de Angola refinery in Luanda, a JV between Sonangol, Total and private investors, has a crude oil processing capacity of 39,000 bbl/d. The refinery produces almost all of Angola's domestic requirements of gasoline, kerosene and jet fuel, as well as a small amount of products for export.

Angola is developing plans for a new 200,000-bbl/d refinery in the coastal city of Lobito. A total of 50% of the products produced at the new refinery would be consumed domestically; the remaining 50% would be for export. Various firms have expressed interest in partnering with Sonangol in building the refinery, especially after Sonangol linked building the refinery to having upstream ownership in Blocks 15, 17 and 18. The refinery is expected to be operational by as early as 2009.

Since the cessation of armed hostilities in Angola, the domestic demand for oil products is rising. Sonangol estimates that Angolan demand for oil products will grow by 500% within 10-20 years. In early 2004, Sonangol imported oil from abroad to ease domestic shortages when the Luanda refinery was unable to meet increasing demand due to ongoing problems. In March 2004, Angola committed itself to ending fuel subsidies by the end of the year to encourage downstream investment.

Angola's retail sector, which once boasted over 450 filling stations, has shrunk to 100 outlets. Construction of 120 additional stations is planned over the next several years. Potential stumbling blocks to new construction include the more than \$300 million expected cost and the lack of foreign investment from both Sonangol and foreign firms. In July 2004, Portugal's Galp Energia announced intentions to build several stations in Angola. Sonangol and Galp Energia currently provide product distribution and marketing in Angola.

## 2.5 Natural Gas

According to the Oil and Gas Journal (OGJ), Angola has proven natural gas reserves of 1.6 trillion cubic feet (Tcf) as of January 2006. The majority (approximately 85%) of natural gas produced in Angola is flared; the remainder is re-injected to aid in oil recovery or processed in the production of liquefied petroleum gas (LPG). The Angolan government has plans to reduce natural gas flaring by ending flaring at fields north of the Congo River mouth in Cabinda. Cabinda Gulf Oil Company (CABGOC) has initiated two zero-flare fields, Nemba and Lomba, and plans to make Kuito the third. Future plans include converting flared gas to liquefied natural gas (LNG), natural gas liquids (NGLs), and LPG.

In October 2004, ChevronTexaco awarded a contract to Paragon Engineering Services to lessen natural gas flaring at its Tukula, Wamba, Numbi, and Malongo fields. Paragon plans to build several new gas processing platforms and modify existing platforms to recover gas that is currently flared.

## 2.6 LNG

In the absence of a sufficiently large domestic market for gas, Angola is seeking a large-scale opportunity to commercialize associated gas from current and future developments and to commercialize non-associated gas from fields that have already been discovered in Angola.

The Government of Angola and its national oil company Sonangol consider the opportunity to produce Liquefied Natural Gas (LNG) to be of national importance and the cornerstone of its plans to commercialize and develop the country's natural resources and reduce gas flaring.

To turn this opportunity into reality, Angola LNG Project was formed - a joint project involving: Sonangol (22.8%), Chevron (36.4%), BP (13.6%), ExxonMobil (13.6%), and Total (13.6%).

Sonangol and Chevron serve as co-project leaders. Angola has ample proven gas resources to supply a nominal 5 million tonnes/year (6.8 billion cubic meters/year) Liquefied Natural Gas (LNG) plant for over 20 years. Most-likely natural gas resources of 10.5 trillion cubic feet (297 billion cubic meters) have been identified.

Much of Angola's deep and ultra-deep water areas are considered to be highly prospective and remain to be explored. The primary source of supply for the LNG plant during the early years of operation will be associated gas. As oil fields mature and associated gas production declines, non-associated gas from previously discovered gas fields will feed the plant. The Angola LNG Project will gather associated gas (AG), in water depths of up to 1500 meters from the following producing blocks:

- Block 15 (ExxonMobil)
- Block 17 (Total)
- Block 18 (BP)
- Blocks 0 and 14 (ChevronTexaco)
- Future Blocks (TBD - Ultra deep water blocks)
- The Angola LNG Project will also develop previously discovered non-associated gas fields in Blocks 1 and 2 to supplement the gas (AG) produced with oil.

Gas production from these Blocks will be transported by (3) high-pressure pipelines to the LNG plant onshore for conditioning and extraction of Natural Gas Liquids (NGLs) before liquefaction to LNG.

## 3 Market Analysis

### 3.1 Market overview

Crude oil has been commercially exploited in Angola since its discovery onshore in 1955, which makes the Angolan oil industry a decade older than the Danish oil industry. Commencement of production offshore the coastal enclave of Cabinda followed shortly afterwards. The sector has grown rapidly since then, and especially after 1980, facilitated by the successful attraction of large foreign investments and technological expertise from the major international oil companies. Angola is now sub-Saharan Africa's second largest oil producer after Nigeria, producing approximately 1.46 million barrels per day in 2006. Production is expected to come increasingly from deep-water offshore fields, with higher production costs and more challenging technological requirements, as shallower, more mature fields closer to shore gradually decline.

Angola boasts major hydrocarbon basins spanning the country's entire coastline: the Congo, the Kwanza, and the Namibe. The range of probable recoverable barrels is estimated at 30 – 40 billion barrels.

The Angolan coastline is divided into 35 offshore exploration blocks. The Congo basin is the only basin from which oil and gas is currently being produced. Producing blocks offshore are: 0, 1-4, 14, 15 and 17. Production is expected to start in Block 18 in 2007. Intense exploration activity is occurring in a number of other blocks, notably 31 and 32. As older, more established onshore and shallow water fields start to decline, future growth is expected to come primarily from the new deep and ultra-deep water blocks.

Angola's oil industry appears to be an attractive investment opportunity, offering foreign companies favourable geology, low operating costs, and constructive business approach from the Angolan government. According to a Centre for Strategic and International Studies (CSIS) report (Goldwyn and Marrison, 2004), Angola has offered fiscal terms that enable international oil companies to earn upwards of 15% rate of return on their investments. Such favourable terms should attract an estimated foreign investment of USD 20 billion over the next few years.

Deutsche Bank 2005 estimates (Stankey, 2005) show that Sub-Saharan Africa accounts for 5.7% of global crude production, with Angola and Nigeria accounting 1.4% and 2.9% respectively. In terms of growth, Angola's numbers are much more substantial. Of the projected growth in global volumes between 2005 and 2010, Angola represents over 16%. In terms of non-OPEC nations Angola accounts for 26% of production growth. Angola is therefore a very attractive market destination for the Danish service providers who may, in the future, experience a declining home market, caused by the falling production due to the declining reserves.

There is little indigenous oil service industry in Angola, including oil related construction activities. Most oil industry equipment is imported. Many of the large international names are present in Angola, including Schlumberger, Halliburton, Baker Hughes, ABB, Cameron, FMC, Aker

Kvaerner, Waterford, Daewoo Corporation etc. Sonangol also owns a number of oilfield service companies.

The same companies that produce Angola's oil also export it to international markets. All oil exports are by the sea. Most pass through Angola's major oil exporting terminals situated in Luanda, Palanca, Kuito and Malango (Cabinda).

There appears to be sufficient oil storage capacity in Angola to meet future oil production and export growth. However, storage capacity in oil product distribution may present a serious bottleneck for the domestic market.

### **3.2 Business environment**

Foreign investment is considered crucial to Angola's reconstruction process and the promotion of foreign investment is a major priority of the Angolan government.

The regulatory framework for the private sector has been improving over the past couple of years, so does the promotion and support of local business sectors. The government has recently introduced some changes aimed at eliminating duplications and ambiguities with the approval of several laws, such as the company and private investment laws. The new Foreign Investment Law was passed in 1995. In 2004, a new Petroleum Activities Law came into force. It seeks to standardise future production sharing agreements, streamline the licensing process for granting rights to engage in exploration and production activities, and clarify the roles of the Ministry of Petroleum, Sonangol and operating companies.

Taking the next step and enforcing these laws would result in more effective supporting and promoting of the private sector.

In Angola, most international oil companies are currently involved in social responsibility programs including health, education and development activities. Under some contracts the partners in a particular block are obliged to devote a percentage of the block's revenues to fund such corporate social responsibility (CSR) activities.

Most companies note that they plan their CSR activities in consultation with the Angolan authorities. Some also sub-contract at least a portion of such activities.

Related to the companies' corporate social responsibility programs is the drive towards local content. Despite positive contribution to GDP and exports, oil projects in developing countries typically have very high import intensity and very few linkages with local business. The Angolan authorities have expressed a wish to see more local personnel in international oil company activities. Direct references to local content in the new petroleum law include the following:

- Support the professional education of Angolans
- The companies operating in Angola must include Angolan citizens at every level of staff providing they possess the required expertise: payment and other conditions shall be the same.

Although the linkages have started to grow, the integration between domestic and foreign business remains limited to very low skilled activities, such as catering and cleaning. The lack of domestic skilled labour is today too big to and this is understood by both - international companies as the Angolan government.

### 3.3 SWOT of the Angolan oil industry

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Extreme growth in proven oil reserves in last seven years</li> <li>• Projected large production growth with the production start in the new offshore blocks</li> <li>• An emerging market, favourable for the new entrees</li> <li>• Tax regime is relatively attractive compared with other African oil producing countries</li> <li>• Big investments from Danish operator Maersk Oil</li> </ul>	<ul style="list-style-type: none"> <li>• Higher costs of filed development</li> <li>• Technical difficulties working in deep and ultra-deep waters</li> <li>• Lack of infrastructure</li> <li>• Expensive business start-up and high living costs</li> <li>• Logistical challenges</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• Good project opportunities within the key Danish competences in oil industry</li> <li>• Export of know-how to the fast developing country</li> <li>• Operational platform for access to the neighbouring African markets</li> </ul>	<ul style="list-style-type: none"> <li>• Political institutions are untested and unstable</li> <li>• Bureaucracy and corruption remain a challenge</li> <li>• Domination of Sonangol and its subsidiaries</li> </ul>

### 3.4 Market strategy

A proposed market strategy for Danish company (to be considered as an advice only) is to go to Angola as a consortium consisting of a group of a few companies. This solution should help minimizing the start-up costs and related risks and offer more comprehensive technological solutions. As establishing good local contacts are crucial for the future success, setting up a local representative office is longer term a must.

Business contracts may in many cases be made abroad, contacting the head offices of the international companies - 1<sup>st</sup> tier service providers in Angola. Here all the existing contacts or business relationships with these international companies become handy.

Knowledge of Spanish/Portuguese helps to mingle in the local business circles and to come in contact with potential business partners and particularly representatives of the governmental institutions - although communication within the oil industry and related authorities happens in English.

## 4 Concrete Project Opportunities

### 4.1 Key opportunities

The Angolan oil sector is a major driver for the country's economical growth and related political stability. The oil sector, operating offshore, did not experience many disruptions throughout the period of civil war and was able to attract substantial foreign investments. The entire Angolan oil industry is with a very few exceptions operated by foreign companies.

Absence of a local service industry creates some specific challenges to the oil industry. These challenges manifest themselves as gaps in the industrial service available in Angola, which on the other hand can be seen as the opportunities for the foreign players to enter the market.

The state-owned national oil company Sonangol invites foreign companies to participate in the rapidly growing oil related activities provided they fulfil the related requirements of involving Angolans in these activities. These requirements are presented in more detail in the publication "Doing Business in Angola". A number of independent recently established Angolan companies are also looking for joint venture partners with expertise.

A main objective of this report is to investigate the current market gaps within the Angolan oil industry and present attractive opportunities to the Danish offshore sector. Five key opportunities have been selected as the ones with the biggest potential. Selection was made evaluating the concrete profile of Danish offshore industry and its key competence areas in alliance with the Angolan oil sector demand. These opportunities are described in more detail below.

#### 4.1.1 Safety equipment and related training

HSSE regulations in Angola are strict and supposedly similar to the North Sea. The Angolan Environmental Services (Essa) is the main institution, which focuses on professional training specifically related to work safety in the oil industry. Essa is one of the Sonangol subsidiaries and provides most of the basic training. The main opportunities for intervention are the practical part of training and training of trainers.

Any technical and even non-technical training (computer literacy, language, business ethics, etc.) are in high demand in Angola. Decades of tough civil war has destroyed the local skills base. The government seeks to use the large oil reserves and related substantial presence of foreign companies as a vehicle for rapid development of local skills. Technical and non-technical training is, therefore, a rapidly growing industry. English is widely spoken within the oil industry and related training activities – but not outside the oil industry; Angola being a Portuguese speaking country.

Environmental issues in relation to the oil industry are highly prioritised by the Angolan government, although environmental certification procedures are lengthy and may take up to 6 months. Two main environmental issues in Angola's upstream sector are the flaring of associated natural gas and discharges by oil tankers. Essa is currently the only training institution having capabilities to work in this area. Environmental technical expertise is in demand and so are experts for oil spill contingency planning.

Safety and related training is one of the strongest expertises of the Danish offshore sector. Opportunities within this sector could be relevant to: *Esbjerg Safety Consult, Falck Nutec, Fire-Protect, Ocean Team Scandinavia, Orbicon A/S, Procurator Safety Denmark, ResQ, Roxtec ApS, STMS – Survival Training Maritime Safety, Viking Life – Saving Equipment A/S*, etc.

#### **4.1.2 Fabrication and construction**

Fabrication is the largest area of demand by the oil industry operating in Angola. It is a sector where foreign investments are highly feasible. Most aspects of fabrication require highly specialized and technical skills that are currently not present in Angola.

It will probably take 10-20 years before a substantial group of Angolan companies has established a capacity to compete within the technical side of the oil industry.

Some Asian (Chinese and Korean) companies have started fabrication activities in Angola including fabrication of wellheads and pipelines. The Chinese presence is expected to increase during the years to come as a consequence of the Chinese interest in the Angolan oil reserves (China currently being the second-biggest consumer of Angolan oil) combined with a very comprehensive collaboration agreement between Angola and China.

The oil industry is very sensitive to the high-technology production and would prefer quality over the price, what looks like a good opportunity for Danish fabricators.

There are many construction activities in relation to the offshore sector as well as in other sectors currently happening in Angola and many more are expected to come. Within the oil industry an onshore liquefaction plant for LNG exports is about to be built in Soyo in the Northern part of Angola. Several of the oil majors are currently constructing new head offices in Luanda. A new international airport outside Luanda, new hotels and office buildings plus many other buildings are to be constructed in the next 5 years.

Comprehensive project management solutions including after-product services are crucial for success. More expensive solutions, which include on-site support services, will often be preferred over lower quality solutions with fewer services. Logistical bottlenecks in Luanda harbour cause delays and related operational costs to the operators but provide a favorable advantage to fabrication taking place in Angola. The availability of raw materials is poor in Angola, so it requires substantial investments and related robust cash flow to establish fabrication activities in Angola. The foreign companies, which have overcome these challenges and established fabrication activities in Angola, run very successful businesses. Among these companies could be mentioned Bocard Angola (construction of subsystems in new sites for oil & gas production, refinery and transformation), Friedlander Angola (coding and welding), Portumo Angola (Ponticelli Freres) (construction and maintenance of full installations for petroleum industry), Stapem Offshore (support services for oil operators and companies in the oil & gas industry), etc.

Opportunities within this sector could be relevant to: *Alslev Rustfri Montage A/S, Carl Bro A/S, Dansk Svejse Teknik A/S, Jørgen Kynde Isoleringsfirma, MacArtney A/S, Madsens Maskinfabrik ApS, MT Højgaard International, Persolit, Pon Power A/S, Promecon, Rambøll, Semco Maritime, Vestjysk Hydraulik A/S, VSB Industri- og Stålmontage A/S, Welcon*, etc.

### **4.1.3 Preventive maintenance**

Preventive maintenance requires an actual presence in Angola. It would be difficult to provide maintenance, inspection and repair operating from abroad because of the logistic challenges.

There is a substantial demand for preventive maintenance within the Angolan oil industry, but the current supply suffers from limited capacity and competition and related high prices. As a consequence, many companies within the oil industry frequently send equipment and machines out of the country to have them adequately repaired. In addition, the cost of purchasing spare parts in the local market can be extremely high, inflated far above normal market prices.

There are several joint ventures (JVs) between foreign and local companies in the market currently providing these types of services. Sonadiets is a good example of the JV operating in this field in Angola. Established in 1999 and owned by Dutch company Dietsmann (70%) and Sonangol (30%), Sonadiets successfully performs technical assistance, maintenance and professional training. Nevertheless, demand still far outpaces supply, and there is substantial room for new players who wants to market their quality services to the oil industry.

The actual maintenance performed is not much different from that in Denmark. Inspection, maintenance and repair that are done in Esbjerg are needed in Luanda as well. The difference is that there is a shortage of qualified providers of these services in Angola. Operational costs are extremely high in Angola and operators are, therefore, looking for fast and high quality maintenance services.

Establishing a business in Angola is quite expensive due to a high cost level. But the considerable demand for preventive maintenance services promises good market opportunities. Starting up in Angola could in time also provide an operational platform for access to the neighbouring African markets in Gabon, Equatorial Guinea etc.

Opportunities within this sector could be relevant to: *AN Group A/S, A/S Oil Power, Brüel & Kjær Vibro, FORCE Technology, Ocean Team Scandinavia, Promecon, Rovsing Dynamics, Semco Maritime, Valtor Offshore A/S, Ødegaard & Danneskiold-Samsøe A/S*, etc.

### **4.1.4 Electrical equipment and electronics**

This industrial gap offers opportunities for companies – experts in process control systems, instrumentation, industrial telecommunications networks and electrical installations; those working with unit shutdowns, modernisation of information and process control systems, control room ergonomics and industrial architecture, industrial analysers or automation of oil and gas transport networks, etc.

There is currently no electronics industry in Angola; all products are imported from abroad. Some local companies are involved in this import business. A huge informal market for basic electronic products booms throughout the country with cheap electronics from Asia. This informal market represents a huge percentage of this sector and has a very significant impact on the formal market. The oil sector does not and cannot purchase from the informal sector – it is forced to pay

a premium for many of these goods. Local fabrication of electrical equipment and provision of related services therefore offers itself as an opportunity.

ABB Ltda, Siemens, Cegelec are some of the names of electronics providers currently represented in Angola.

Opportunities within this sector could be relevant to: *AN Group A/S, ABB Danmark, Carl Bro A/S, DAN-EX Electric A/S, Endress+Hauser A/S, ep tools a/s, Furuno Danmark A/S, Hytor A/S, Laybourn Trading & Technology, L.T. & T, Nordsø Elektronik A/S, Olesen & Jensen, Pon Power A/S, Selco A/S, Semco Maritime, Solar Offshore, YIT A/S.*

#### **4.1.5 Hydraulics, pneumatics, pumps and accessories**

The situation in relation to hydraulics, pneumatics, pumps and accessories is similar to the one described above in relation to electrical equipment and electronics with no domestic fabrication and all the products being imported to Angola.

Provision of related after-sales services is extremely important. Provision of these types of products (pumps, accumulators, motors, valves etc.) and related services could lead to an attractive market position in Angola, where operational costs are extremely high (e.g. drilling costs comprise approximately USD 7000 per day).

Opportunities within this sector could be relevant to: *A/S Oil Power, COWI, Danfoss A/S, eo tools a/s, Fyns Kran Udstyr, Hydropower A/S, Hytor A/S, Olesen & Jensen, Sanistål A/S, Score Danmark A/S, Sturnus Engineering, Valtor Offshore A/S, Vestjysk Hydraulik a/s.*

#### **4.2 Concrete opportunities – ongoing and upcoming projects**

Below are listed some ongoing and upcoming projects in Angola giving concrete opportunities within all the above listed fields:

Total – Dalia project  
Total – Rosa project  
Total – Lirio project  
BP – Greater Plutonia project  
ExxonMobil – Kizomba  
Sonangol – Lobito refinery

##### **4.2.1 Dalia project**

The project was launched in May 2003. Work continues on the Dalia project to develop a deepwater oil field 230 kilometres offshore Angola in water depths of 1,200 to 1,400 meters. Producing at such depths requires the installation of separator units for the mixture of oil, water and gas produced, on a floating production, storage and offloading (FPSO) vessel tied into the wellheads by flexible risers. The FPSO will be capable of processing 240,000 b/d and a storage capacity of 2 million barrels of oil.

In total, the development of Dalia project represents an estimated investment of USD 3.4 billion.

#### **4.2.2 Rosa and Lirio project**

The Rosa development will require 25 sub-sea wells – 14 producers and 11 injectors – tied back to the Girassol FPSO vessel, anchored around 15 kilometers away. Modifications of the FPSO will increase the yearly average production rate to 250,000 b/d.

Rosa is the second field to be tied back to the Girassol FPSO, after the Jasmim field in the late 2003. It is scheduled to come on stream in the first half of 2007, raising and prolonging the peak production of the Girassol FPSO.

#### **4.2.3 Greater Plutonio project**

The project to develop six fields is the first BP-operated project in Angola.

The fields Galio, Cromio, Paladio, Plutonio, Cobalto and Platina, collectively known as Greater Plutonio, are located in water depths of 1,200 to 1,500 meters.

The development will consist of a single spread-moored floating, production, storage and offloading (FPSO) vessel linked by risers to a network of subsea flow lines, manifolds and wells.

The field is scheduled for a production start up in 2007 and is expected to produce over 200,000 b/d.

#### **4.2.4 Kizomba project**

Esso has started production of the Xikomba deepwater development offshore Angola block 15. Xicomba is the company's first production facilities offshore Angola.

Located in the northwest corner of Angola Block 15, about 230 miles (370 kilometers) northwest of Luanda in water depths of up to 1,480 meters, Xicomba employs an Early Production System, consisting of nine subsea wells tied back to a FPSO vessel. Xicomba is the third deployment of ExxonMobil's Early Production System (EPS) Technology offshore West Africa and the first EPS offshore Angola.

Kizomba A and Kizomba B, both USD 3.4 billion developments, together have estimated recoverable resources of approximately two billion barrels of oil and combined target production of 500,000 barrels of oil per day.

#### **4.2.5 Lobito refinery project**

Angola has one existing refinery in Luanda with a capacity of 39,000 b/d although it is working at about 90% capacity. The refinery is operated by Fina Petroleos de Angola.

After government approval in 1997, Sonangol announced in January 1998 that it would build a new 200,000 b/d refinery in Lobito, a coastal city in central Angola. Lobito is about 300 kilometers south of the Angolan capital, Luanda. Sonangol's cost estimates for the new refinery are around USD 3.6 billion.

Sonangol is now trying to interest a major foreign company to join the project as a strategic financial and marketing partner. The goal is for Sonangol to take a 40% stake in the venture. The government reportedly will not be a direct investor, but may guarantee the loans financing the project.

The proposed refinery is designed to process the increasingly acidic crude that the country increasingly will be producing from its deep and ultra-deep offshore blocks. The goal for the new refinery would be to help capture more of the value of Angola's rising sour crude production for the country.

Sonangol has also hired an international investment bank to advice on the project and help raise the needed capital.

### **4.3 Additional opportunities**

There are, in addition to the five key opportunities presented above, many other areas where Danish companies could do attractive business in relation to the Angolan oil and gas sector. Selected additional opportunities are described in a table below.

<b>4.3.1 Design &amp; Engineering</b>	<p>Design and engineering sectors in particular present tremendous opportunities for the Danish investors. The engineering education is only starting up in Angola and it will take the whole generation, before there this gap will disappear.</p> <p>The engineering sector is currently dominated by international companies that provide services to industry from afar and even more so by those companies that set up operations in Angola, like Aker Kvaerner, Schlumberger, Halliburton, etc. There are also several Sonangol JVs such as Petromar, Sonaid, Technip and Sonadiets. However, there is a big demand for the educated and experienced personnel in Angola.</p>
<b>4.3.2 Consultancy</b>	<p>Another big gap in the Angolan offshore sector. Similar potential as design and engineering. There is no local technical expertise to provide high quality consultancy for oil sector. Good opportunity for Danish companies, who have particularly strong positions in consultancy. Consultancy services may be provided to the industry operating from the office abroad.</p>
<b>4.3.3 LNG</b>	<p>The Angola Liquefied Natural Gas project is on its way (earliest possible completion date in 2008). A Participation Agreement signed in early 2002 designated Sonangol and Chevron as project leaders. Currently, shares in the project are divided as follows: Chevron 32%, Sonangol 20%, with 12% each for BP, ExxonMobil, Norsk Hydro and Total.</p> <p>The project will consist of pipelines to gather gas from associated fields in production blocks 2, 15, 17 and 18, as well as non-associated gas fields 1 and 2 (currently undeveloped), a pipeline to land the gas in Soyo; and a new liquefaction plant. The overall investment requirements are expected to be about USD 3-5 billion. Foreign investments are expected to take place and are welcome by Angolan state.</p>
<b>4.3.4 Sub-sea technology</b>	<p>Innovative technologies in upstream and production play an important part in successfully producing oil at great depths in Angola. As exploration moves into deepwater areas, technological progress will be vital ensuring successful development of these new discoveries. Angola's exploration has not yet reached the current world record water depths of 3000 m seen offshore Brazil, but as exploration continues to drift towards more costly ultra-deep water blocks oil findings will bring with them even tougher technological challenges to make these deep-water projects economical. Currently subsea technology is provided by Sonangol and it's JV Sonamet and a range of foreign companies, like Aker Kvaerner, Vetco Gray, Roxar, Norsk Hydro, etc.</p>
<b>4.3.5 Oil spill equipment</b>	<p>Discharges by oil tankers are one of the biggest environmental challenges in Angola. A National Oil Spill Contingency Plan for Angola does not exist at present; however the local authorities have initiated its drafting.</p> <p>The Angolan government has no specialised equipment. The operating oil companies, primarily Texaco, Chevron and Total</p>

	have developed a cooperative agreement to allow the maximum use of their recourses. This comprises vessel mounted dispersant spraying equipment, helicopter spray buckets and limited stocks of containment and recovery and temporary storage equipment. Shoreline cleaning equipment and vacuum truck are also held. The oil spill handling equipment could be provided by Danish producers directly contacting the major operating companies.
<b>4.3.6 Mechanical repair</b>	Mechanical repair sector is one where there is both a large supply and capability gap and can likely be addressed through relatively simple interventions, e.g. establishing JVs with existing local repair companies.
<b>4.3.7 Other machinery</b>	In addition to the above mentioned, other types of machinery are lacking in Angola as well. Starting with the basic power tools to the high technology drill floor machinery – a market is quite large and promising.
<b>4.3.8 Logging and directional drilling</b>	As this sector is extremely technical and requires huge capital investments and highly-skilled technicians, there is a complete gap between supply and demand. No Angolan-owned companies exist that can provide such services. The international service providers are: Baker Hughes, Halliburton, and Schlumberger. There are also two Sonangol's JVs that provide services in this sector – Sonamer and Angola Drilling Company.
<b>4.3.9 Lifting equipment/appliances</b>	Include cranes, loose gear, winch, launching appliances for life saving, personnel lifts, etc.
<b>4.3.10 Welding</b>	This is largely a services sector – another big supply gap in Angola.