Basic Overview of Ghana's Emerging Oil Industry

by Thomas Kastning for FES Ghana

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Abbreviations

bbl:	barrels of oil
bbo:	billion barrels of oil
bboe:	billion barrels of oil equivalent[1]
bpd:	barrels per day
mmbo:	million barrels of oil
mmboe:	million barrels of oil equivalent
pb:	per barrel
toe:	tonnes of oil equivalent

[1] "Oil equivalent" refers to crude oil and gas. The measurement of gas in the unit of barrel is based on the approximate energy, released by burning one barrel of crude oil. Gas is 100% recoverable.

1. Introduction

Ghana was the first sub-Sahara country to gain independence (1957). In the early 1990s, after a long period of military rule, Ghana became a democratic state. Since then, it has been regarded as one of the most stable African democracies. The level of corruption is quite low, there are no violent conflicts and the macroeconomic structure is relatively strong. GDP is around US$38,24 billion, while the total state revenues, including grants, are approximately 30% of GDP. The main export products are gold and cocoa *[CIA World Factbook, 2011]*.

In 2004 the country sold licences for offshore oil exploration and production (so called blocks) to different international companies. In July 2007, Tullow Oil and Kosmos Energy discovered oil in commercial quantities in the western region of Ghana. They named the area "Jubilee Field". Development of the production site started right away and in December 2010 oil production was officially launched. Since 2007 further discoveries have been made. The Tweneboa field seems to be a second major discovery.

In 2007 the former President Kuffour (2000-2008) announced enthusiastically, "With oil as a shot in the arm, we're going to fly" *[BBC News, 2007]*. Since then the country has witnessed a huge public discussion: How much money will accrue from the oil production? What will be done with the governmental revenues? How to avoid the so called 'Resource Curse'? But the participants in the discussion often lack basic information. This overview provides the basic facts on Ghana's emerging oil industry.

2. Technical Facts

2.1 Where is the Oil?

The Jubilee field is located in the Gulf of Guinea, 60 km off the Ghanaian coast, near the Côte d'Ivoire border (see Image 1). It is spread out in the Deepwater Tano and West Cape Three Points blocks. The wells are at a water depth between 1,100 and 1,300 meters and at a total depth between 3,400 and 4,200 meters. The field covers 110 km², which is about the size of 155 football pitches *[Offshore-Technology.com, 2011]*.

The Tweneboa field (6 km east of Jubilee) was discovered in March 2009. In July 2010 the Owo-1 drilling confirmed the reasonably big amounts of the field. A maximum depth of 4,000 meters has been drilled. There does not seem to be an underwater channel connection between the Tweneboa and the Jubilee field. Apart from these major findings, there are also several smaller wells close by. In total, the companies engaged in the discovery have discovered more than 15 wells in the western Ghanaian sea territory.

The exact positions of the wells have become of great interest, as in April 2010 the Government of Côte d'Ivoire enquired, if all drillings had taken place within the Ghanaian territory. Since then a Boundary Commission has been negotiating the exact maritime boundary. In particular the Owo-1 well in the Tweneboa field and the small Dana GH Western Tano field are located very close to the Côte d'Ivoire border. For these drillings precise locations have

not been made public, but all the exact coordinates of the Jubilee wells have been published and it seems clear that they are within Ghanaian territory *[Ghanaweb.com, 2010(I)]*.

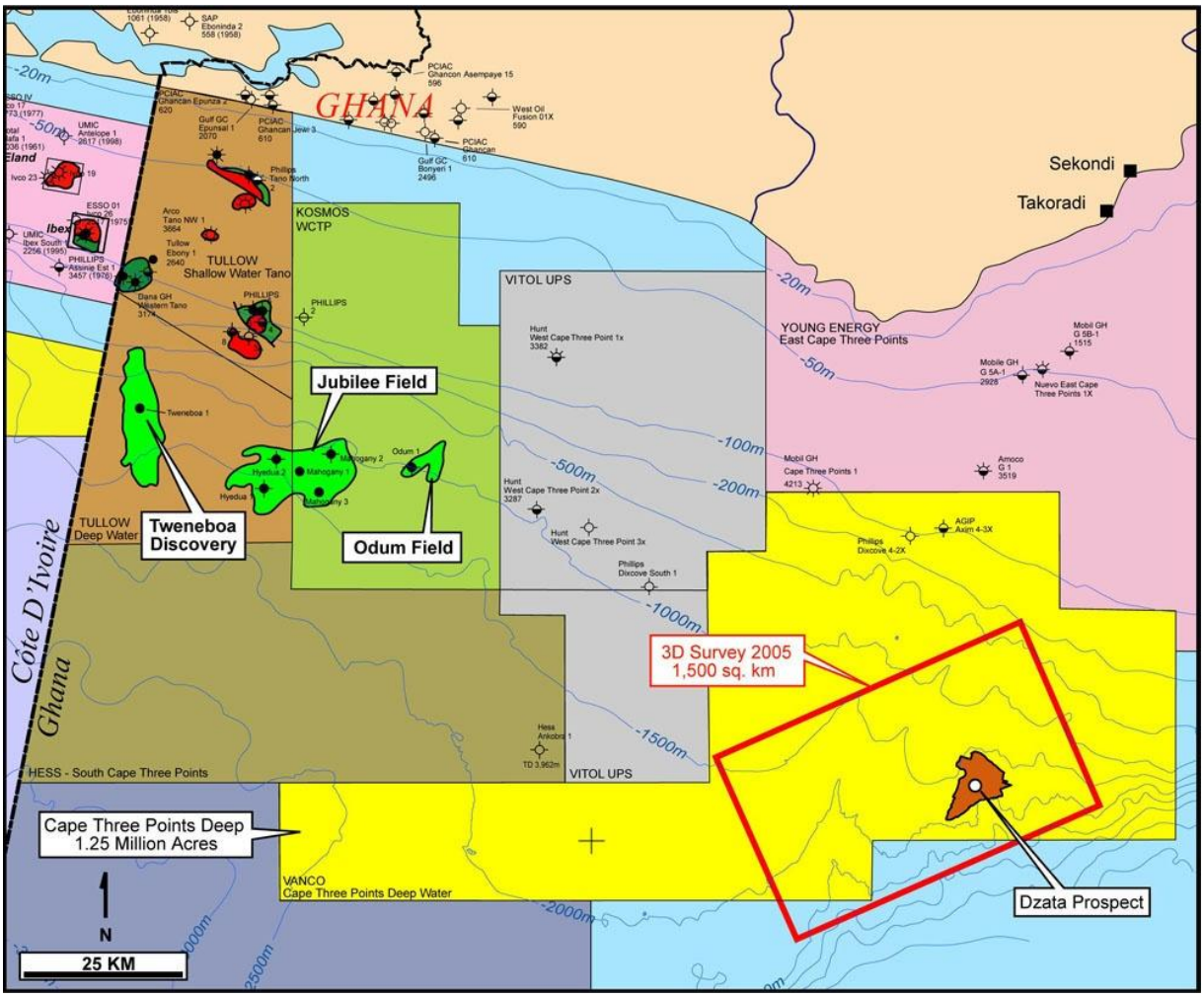

Image 1: Ghana's Oil Findings. [ghanaweb.com]

2.2 How much Oil is there?

The Jubilee Field

The figures of the amount of oil expected in the Jubilee field, published by Ghanaian newspapers, vary between 1 and 2 billion barrels of crude oil. One barrel is 158,987 litres. As it is quite often not stated, whether the authors are referring to the recoverable or the total amount, it can only be assumed, the total amount is meant. This makes a huge difference, as only 30-50% of a total field amount will be recovered. In their status report 2008, the state owned Ghana National Petroleum Company (GNPC) published figures stating that 800 million barrels of oil is the total field amount, with an upside potential of 3 billion barrels of oil *[GNPC, 2008]*. The International Monetary Fund (IMF) and the World Bank assumed in their base cases 2008/2009 a recoverable amount of 490/500 mmbo *[World Bank, 2009]*.

The field operator, Tullow Oil, reveals on the companies' website that there are at least 500 mmbo through a most likely 700 mmbo to an upside of 1.000 mmbo recoverable reserves.

As shown in the table below, the production amount depends on the number of drilled wells. The injection wells are especially important, as they maintain the field pressure.
It is estimated that the field contains an additional 1.2 trillion cubic feet of gas, which are approximately 162 million barrels of oil equivalent (mmboe). This measurement of gas in the unit of barrel is based on the approximate energy released by burning one barrel of crude oil. Gas is 100% recoverable *[Tullow Oil, 2010]*.
In geological terms, the Jubilee field is a continuous stratigraphic trap with combined hydrocarbon columns in excess of 600 meters.

Assumed Field Reserves	Phase 1 17 wells	Phase 1a with 5-8 additional wells	Phase 1b with 10-20 additional wells	Total Recoverable Field Reserves
Low estimates	250	60	160	470
Mid estimates	370	100	205	675
High estimates	590	215	260	1065
	Million Barrel Oil	Million Barrel Oil	Million Barrel Oil	Million Barrel Oil

Table1: Field output during different phases. [Tullow Oil, 2010]

Other Fields
In March 2009, the Tweneboa-1 exploration drilling discovered a field, containing up to 1.4 billion barrels of oil equivalent (bboe). The Owo-1 drilling tested the field structure and reported positively end of July 2010.The so called Tweneboa field seems to be of similar size to the Jubilee and is the second major finding in Ghana. The other findings were only minor amounts (e.g. the Odum field). But large parts of the Ghanaian sea have not been explored yet *[Tullow Oil, 2011]*.

2.3 What are the Facilities of the Jubilee Field?

Nine production wells bring the oil and gas from below ground to the surface. In addition there are eight drillings to *inject* gas and water. This is done to maintain the field pressure and to get rid of the gas, as long as there is no pipeline to the shore. There are plans to build one, but the financial questions have not yet been settled. Constant gas flaring is forbidden in Ghana.
All 17 wells will be connected to the Floating, Production, Storage and Offloading (*FPSO) Kwame Nkrumah vessel* (see Image 2).On the FPSO a daily maximum of 120,000 barrels of crude oil will be separated from gas and water. Most of these by-products will be pumped back through the injection wells. 15% of the gas will be used for power generation to run the FPSO.
Transport ships will collect the oil from the FPSO every 7 to 10 days and ship it to worldwide refineries. During the first phase, four drilling rigs are already under contract to finish the exploration and development of the remaining areas of the field, namely the southeast part.

Phase 1b may involve up to 20 additional wells and is likely to require the expansion of the subsea infrastructure. The timing of these additional development phases depends on the performance of the Phase 1 wells and the FPSO vessel. As long as natural pressure brings the oil to the surface, it is called Phase 1.
During Phase 2 pumps would have to be installed to gain the remaining oil. Production becomes less- or even non-profitable. It is estimated that up to 670 people are needed during the installation and start of the Jubilee project reducing to approximately 300 during the operational phase *[Offshore-Technology.com, 2011]*.

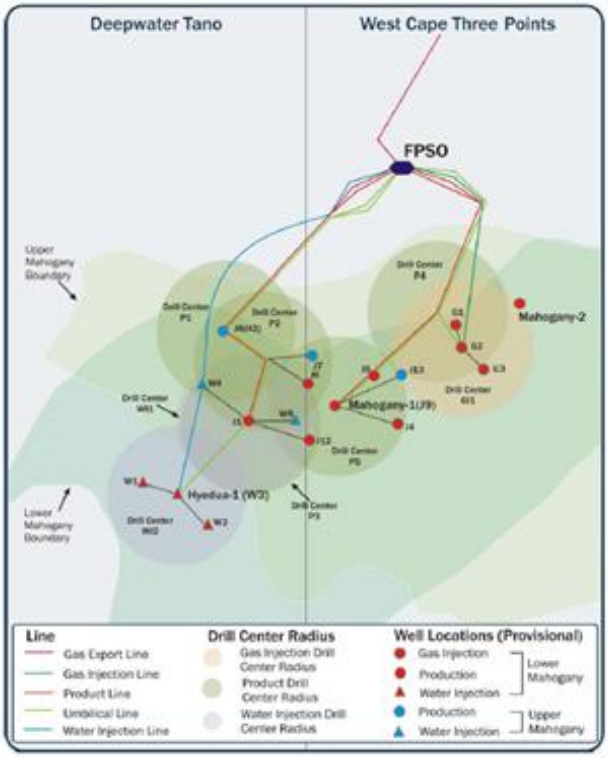

Image 2: Drill Centre Locations and Associated Flowlines, Injection Lines and Umbilicals. [Tullow Oil, 2009]

2.4 The Quality of the Oil

Jubilee crude oil is light and sweet. For oil refiners lightness and sweetness indicates high quality. Independent laboratory analysis says that the crude oil has an API Gravity of 37.6 degrees and a sulphur content of 0.25 % (weight), with no unusual characteristics. Crude oils of this type are attractive for worldwide refineries and can compete with the international price reference oils. Therefore Jubilee oil will be sold for the official oil price.

Refineries

Currently Ghana has only one refinery: the state owned Tema Oil Refinery (TOR), with a capacity of around 45.000 barrel per day. Due to some financial and technical problems the refinery seldom worked at upside production rate in the past. In March 2010, Ghana's Gov-

ernment made 445 million GH¢ (US$316 million) available to amortize the refinery's debt to the Ghana Commercial Bank.

To achieve international economic viability, it has to increase its capacity utilization. In future years the government intends to invest US$300 million in TOR to increase its capacity to 100.000 bpd. But this plan was already on the table in the late 1990s and nothing happened since *[Ghana Business News, 2010]*.

Even if TOR had run at its maximum of 45.000 bpd, in 2009 this would have met only 50-60% of the domestic fuel demand. The country is highly depending on fuel imports which exceeded one million tonnes per annum in 2009.

Products	2009 Consumption (in tonnes)	Net/Shortfall (in tonnes of oil equivalent - toe)
Gasoline	756,956	45,196 – 66,196
Diesel	1,362,470	242,281 - 344,281
Kerosene/ATK	214,549	118,914 - 222,015
LPG (Low Pressure Gas)	220,603	65,451 – 76,251

1 tonne of oil ≈ *7,3 barrel of oil (bbl)*

Table 2: Ghana's Petroleum product consumption in 2009. [Essandoh-Yeddu, 2010]

As there is only a very limited number of jobs in the highly technical upstream production of oil (approximately 300 at Jubilee), it is of enormous importance to create a strong mid- and downstream oil industry. Mid- and downstream means every sector of the oil and gas industry in addition to the actual exploration and production. By supporting these sectors, not only jobs are being created, but moreover value is added to the resources and dependence on the traded barrel price is being decreased. The final products (i.e. fuel) are not subject to such drastic global oil price fluctuations. Finally, refineries in the home country decrease the local fuel price, as the production and importation costs of oil are reduced.

Two new refineries are planned by foreign companies. Barclays Gedi Group's 100.000 bpd refinery next to Takoradi was originally scheduled to begin construction in early 2011. Apparently the building of the refinery has been delayed because of the lack of a contractual agreement with the Government of Ghana *[Modernghana.com, 2005]*.

In July 2009 South Africa's New Alpha Refinery Ghana Ltd. and the Ghanaian government wrote a Memorandum of Understanding to construct a new US$6 billion oil refinery in Accra. Production rates would be 200.000 bpd, but with a possible expansion to 400.000 bpd. This would be Africa's biggest refinery. The aim is to start production in 2015. At the moment New Alpha is trying to raise funds *[Africa Business Source, 2009]*.

New refineries would aim for export, especially to the other West African Countries. Potential destinations are not only the non-refinery countries, but even Nigeria, where due to operational inefficiencies of the existing refineries, a high fuel demand exists.

3. Economical Facts

3.1 Who Owns the Oil?

Article 257(6) of the Ghanaian Constitution of 1992 states: "Every mineral in its natural state in, under or upon any land in Ghana, rivers, streams, water courses throughout Ghana, the exclusive economic zone and any area covered by the territorial sea or continental shelf is the property of the Republic of Ghana and shall be vested in the President on behalf of, and in trust for the people of Ghana."

However, the right for exploration, development and production of different offshore blocks was sold in 2004. In the following you will find the ownership shares of each oil field (also see Image 3).

Deepwater Tano Block

Tullow Oil & Gas (Operator) 49.95%, Kosmos Energy 18%, Anadarko Petroleum Corporation 18%, Ghana National Petroleum Corporation 10%, Sabre Oil & Gas 4.05%.

West Cape Three Points

Kosmos Energy (Operator) 30.875%, Anadarko Petroleum Corporation 30.875%, Tullow Oil&Gas 22.896%, Ghana National Petroleum Corporation 10%, EO Group 3.5%, Sabre Oil & Gas 1.854%.

Jubilee Field (located in both blocks)

Tullow Oil & Gas (Operator) 34.705%, Kosmos Energy (technical operator for development) 23.491 %, Anadarko Petroleum Corp. 23.491 %, Ghana National Petroleum Corporation 13.75 (10% carried interest, potential 3.75% working interest, if they decide to apply for their back-in right within 60 days after production started), Sabre Oil & Gas 2.813 %, EO Group 1.75%. *[Offshore-Technology.com, 2011]*

Image 3: Ghana's Oil Blocks. [GNPC, 2011]

Excurse: Traditional Ghanaian Land Ownership

Most the Ghanaian land is either owned by stools, skins, families or clans, usually held in trust by the chief or the head of family/clan. But as stated in the constitution, "minerals under or upon any land" belong to the Government of Ghana.

Professor Kenneth Attafuah (Executive Director of the Justice and Human Rights Institute Ghana) recognizes a "sense of ownership" by the local communities for the oil. Especially directly after the findings, there should have been better communication between the Government and the local communities. Apparently the chiefs and people of Ahanta and Nzema, the local ethnic groups next to the oil exploration sites, were very disappointed that they were not officially informed about the discovery of oil on their ancestral land. Though by law the oil clearly belongs to the state, demands for royalties arose [Osabutey, 2010].

3.2 Which Major Companies Are Involved?

3.2.1 Tullow Oil & Gas

Tullow Oil & Gas is an independent Irish exploration and production company, quoted on the London and Irish Stock Exchanges. In 2004 it acquired Energy Africa. It employs ca. 900 people (2011). Its headquarters are in London and it runs two offices in Accra.

The company has 23 licenses around the world, with the focus on Africa. Tullow has production sites in Gabon, Côte d'Ivoire, Mauritania, Congo-Brazzaville and Equatorial Guinea and two development programs in Ghana and Uganda. The Jubilee field was their largest discovery so far. In Europe the company concentrates on gas production.

In 2010, the company had an operating cash flow of US$762 million and a profit after tax of US$73 million. The profit was more than doubled compared to the results of 2009. In total, 58,100 barrels of barrel oil equivalent per day (boepd) were produced.

The management reports regularly on their projects to their shareholders. The reports are published. On www.tullowoil.com detailed information on the Jubilee field and other exploration sites can be found. Tullow gives an insight into the company's structures, regularly updates news, and provides various reports online. In some countries Tullow has been willing to publish their oil contracts *[Tullow Oil, 2011]*.

3.2.2 Kosmos Energy

Kosmos Energy is an independent American Oil and Gas Exploration and Production Company. It was founded in 2003 by five partners. All of them had previously worked for Triton Energy, which was acquired by Amerada Hess Corporation in 2001. Kosmos Energy has its headquarters in Dallas, TX and they operate an office in Accra.

According to their own website "Kosmos' strategy is to aggressively pursue growth organically through drill-bit success rather than acquisition." Their main operation venue is West Africa, with on-going drilling in Ghana, Cameroon and Morocco. The Jubilee field was their first major discovery success.

Though the company itself has very limited capital of its own, they have access to a rather big budget: the private equity companies, Warburg Pincus and Blackstone Capital Partners,

provide Kosmos with monetary resources. These companies manage worldwide investments, worth more than US$100 billion.
Looking at the company's structure, in comparison to other international corporations, Kosmos Energy is a rather small player in the oil and gas industry.
In Ghana, Kosmos Energy was the first company to start extensive exploration of the Tano Basin. At the beginning Kosmos had an 86.5% interest in West Cape Three Points Block (GNPC 10%, EO Group 3.5%). *[Kosmos Energy, 2011]*
Initially the company was introduced in Ghana by the managers of the EO Group. EO Group was suspected by Ghanaian officials and Anadarko to have used its political connections to bribe officials in the Kuffour government (2000-2008) to gain a hold on the offshore oil block and win more favourable contract terms for Kosmos Energy and themselves *[Owusu, 2010].*
Anadarko wrote a report on the EO Group - Kosmos connections and submitted it to the U.S. Department of Justice, under the Foreign Corrupt Practices Act (FCPA). After further investigations by the Ghanaian CID and the U.S. Department of Justice, the latter declared on 2nd June 2010, that they "do not intend to take any enforcement action against EO Group or its principals [...] and have closed our inquiry into the matter" *[quoted according to Modernghana.com, 2010]*
Since May 2009 Kosmos has expressed the wish to sell its share of the Jubilee field. They nearly closed a deal worth US$400 billion with the American company Exxon, but the Ghanaian Government stepped in. They accused Kosmos firstly of overseeing a GNPCs exclusive pre-emptive right and secondly of sharing secret data with other oil companies.
In August 2010 it was announced that the deal with Exxon had been terminated. Kosmos will continue to participate in field operation for an indefinite period.

3.2.3 Anadarko Petroleum Corporation

Anadarko Petroleum Corporation is one of the world's largest independent oil and gas exploration and production companies, quoted on the U.S. Top 500 Stock Exchange. It employs 4300 people (2011). Anadarko has its headquarters in The Woodlands, Texas, U.S. They do not have an office in Ghana.
Anadarko mainly operates in the U.S. and Algeria. It does onshore and offshore drilling as well as midstream processing of minerals.
The company calculated 2.3 billion bboe of proved reserves and an annual production rate of 220 million bboe at the end of 2009. In 2008 it made a US$3.3 billion profit after tax.
Anadarko has a 25 % working interest in the Gulf of Mexico field where the Deep Water Horizon spilled 4 million barrels crude oil in April 2010. If the field operator (BP) cannot be proved to have been grossly negligent, it might mean the insolvency for Anadarko.
Of all stakeholders in the Jubilee field, Anadarko has the most technical experience. *[Anadarko Petroleum Corporation, 2011]*

3.2.4 Ghana National Petroleum Corporation

The Ghana National Petroleum Corporation (GNPC) was formed in 1985. It belongs to the Ghanaian state. Current Managing Director is Nana Boakye Asafu-Adjaye. GNPC main office is based in Tema, Ghana.

GNPCs working field has been outsourced by the Ministry of Energy "to accelerate the promotion of petroleum exploration activities to ensure early commercial discovery and production, to undertake the appraisal of existing petroleum discoveries to ensure production to meet national requirements and to ensure that Ghana obtains the greatest possible benefits from the development of its petroleum resources."

Currently, GNPC concentrates on data management of geological and geophysical information, the promotion of further exploitation sites, and the control of oil companies which are operating in Ghana.

It owns a 10% interest in the various Ghanaian offshore blocks. Therefore a 10% carried interest in the Jubilee field belongs to them. The GNPC runs the Tema Oil Refinery. *[GNPC, 2011]*

The company's revenues flow into state funds and budget. For upcoming revenues from the Jubilee field see chapter "Revenues".

Interestingly, Tsatsu Tsikata, former head of the GNPC, was put in prison and tried for "causing financial loss to the state" when Kuffour came to power in 2000. He was pardoned in 2009 after Mills had won the election. Apparently he is one of the major Energy Advisors of President Mills *[Eshun, 2010]*.

3.2.5 EO Group

The EO (Edusei - Owusu) Group was formed in 2002, by the Ghanaians Dr. Kwame Barwuah Edusei and George Owusu. For a long time Dr. Kwame Barwuah Edusei worked as a physician in Washington D.C. After the Petroleum Agreement between the EO Group, Kosmos Energy and GNPC was signed in July 2004, Dr. Kwame Bawuah-Edusei became Ambassador to the UN in Switzerland and in September 2006 he became the Ghanaian Ambassador to the United States. His diplomatic career ended February 15, 2009. George Owusu is an environmental scientist, who has been working in the energy industry (i.e. Shell Oil, Houston. U.S.) for about twenty years. During the exploration time of the Tano Basin he worked as a representative of Kosmos Energy in Ghana.

The EO Group does not maintain an official office, but currently they are registered as KG (Kwame - George) Group in the tax haven Cayman Islands.

In Ghana, the company owns a 3.5 % share in the West Cape Three Points Block and along with that a 1.75 % interest in the Jubilee field. It is a *carried* interest, as Kosmos pays the development and exploration costs for the EO Group. There is no other sector than this, that the company is known for to be is engaged in. It was the EO Group that brought Kosmos Energy to Ghana and introduced them to the GNPC and the Ministry of Energy. However, in March 2011, Tullow Oil released a statement saying that the Company is willing to acquire

the EO Group's percentage of the Jubilee Field. This development would minimize the significance of the EO Group in Ghana's oil business.

There is little information available about the company's finances. The only revenue it must have earned so far is an initial fee that was paid by Kosmos.[2](Non-official sources say US$250.000.) Their stake in the Jubilee field has an estimated value of US$300 million. As stated before, the EO Group was suspected by Ghanaian officials and Anadarko to have used its political connections to bribe officials in the Kuffour government (2000-2008). The allegation said this was to gain a hold on the offshore oil block and achieve more favourable contract terms for Kosmos Energy and themselves. The funding members are said to have very close connections to former president John Agyekum Kuffour (2000-2008). *[ghanaweb.com, 2010 (II)]*

Ennex, an Irish company withdrew from a possible deal on the same oil block in 2003, because it felt "uncomfortable with EO's demands".

Anadarko submitted a report on the EO Group-Kosmos connections to the U.S. Department of Justice, under the Foreign Corrupt Practices Act (FCPA). After further investigations by the Ghanaian CID and the U.S. Department of Justice the latter one declared on 2nd June 2010, that they "do not intend to take any enforcement action against EO Group or its principals, including Mr. Owusu and Dr Edusei, and have closed our inquiry into the matter" *[Modernghana.com, 2010]*

3.3 Possible Rewards from the Jubilee Field

The possible rewards from the Jubilee field are of great interest to various institutions. Therefore predictions and base cases have been made, although some calculation parameters are very uncertain.

The oil companies themselves definitely have the greatest knowledge of the important parameters, but none of them have announced a revenue forecast.

As the oil company Exxon bid US$4 billion (and they had insight into non-public data) for Kosmos' 23.5% stake in the Jubilee field, they must have assumed an absolute minimum revenue from the total field of US$17 billion *[Ghanaweb.com, 2009]*.

The most detailed public base case has been published by the World Bank staff in December 2009. Interpreting the World Bank data, the bank's staff calculated total companies' (excluding GNPC) revenues of US$ 8,29 billion. Assuming the World Bank was right, the Exxon bid for 23.5% of the field was far too high – if they do not expect production in other fields. The German development agency GTZ estimates the annual Government revenue between US$200 million and US$1 billion, while the World Bank predicts the highest Government revenue (in year 2016) to be US$1.8 billion. These variation shows, how different institutions interpret different data.

[2] Statement by EO Group Limited 27/01/2010

Year of Production	Field Output (barrel per day)	Capital & Operating Costs (In Million US Dollar)	Gross Revenue, with an average barrel price of 75 $US (In Million US Dollar)	Government revenues (In Million US Dollar)
2008	0	397.8	0	0
2009	0	1094.5	0	0
2010	0	1094.5	0	0
2011	106.900	1108.9	2925.0	900 (30,77%*)
2012	120.500	1268.3	3300.0	1.011 (30,64%*)
2013	120.500	350.3	3300.0	1.083 (32,82%*)
2014	120.500	350.3	3300.0	1.484 (44,97%*)
2015	120.500	350.3	3300.0	1.796 (54,42%*)
2016	101.400	327.0	2775.0	1.804 (65,00%*)
2017	89.000	312.1	2437.5	1.587 (65,11%*)
2018	79.500	300.4	2174.9	1.400 (64,37%*)
2019	69.900	288.8	1912.4	1.213 (63,43%*)
2020	61.600	278.8	1687.4	1.053 (62,40%*)
2021	56.100	272.1	1536.8	946 (61,56%*)
2022	50.700	265.5	1387.6	839 (60,46%*)
2023	46.600	260.5	1275.1	759 (59,52%*)
2024	43.800	257.2	1200.1	706 (58,83%*)
2025	41.100	253.9	1125.1	652 (57,95%*)
2026	38.400	250.6	1050.1	599 (57,04%*)
2027	35.600	247.2	975.1	546 (55,99%*)
2028	34.300	245.6	937.6	519 (55,35%*)
2029	32.900	243.9	900.1	492 (54,66%*)
	499.977.000	9.819	37.500	19.389 (51.7%*)
				* Effective Government percentage share. (Edited by the author.)

Table 3: [World Bank, 2009].

3.3.1 The Used Parameters

The Recoverable Amount

It is important to note that the figure used refers to the recoverable and not the total field amount. As indicated above, Tullow Oil estimates that there are at least 500 mmbo, most likely 700 mmbo to and an upside potential of 1,000 mmbo recoverable reserves. The recoverable amount depends on the field structure, but also on the facilities used. To recover a high amount further injection wells (to maintain the field pressure) are needed (see table 3.). World Bank base case of 2009 calculates with a recoverable amount of 500 mmbo.

Daily Production Rate

After the first weeks, a production rate of 120.000 bpd is expected. There was talk of increasing the production rate after some time, but this would mean using another Floating Production Storage and Offtake (FPSO) vessel. The World Bank estimates the rate to reach a maximum of 120.500 bpd.

The Facilities

The FPSO is capable of processing 120.000 barrels of oil and injecting more than 230.000 barrels of water and 160 million cubic feet of gas per day.

In Phase 1 nine production wells bring the oil and gas from below ground to the surface. Additional eight drillings will inject gas and water.

Assumed Field Reserves	Phase 1 17 wells	Phase 1a 5-8 additional wells	Phase 1b 10-20 additional wells	Total Field Reserves
Low	250	60	160	470
Mid	370	100	205	675
High	590	215	260	1065
	Million Barrel Oil	Million Barrel Oil	Million Barrel Oil	Million Barrel Oil

Table 4: The field production, depending on the number of drilled wells. [Tullow Oil, 2009]

The Development Costs

Tullow publishes on their current website that the Phase 1 development costs are approximately US$3.3-3.4 billion. Newspapers, however, sometimes refer to figures between US$4 and US$5 billion. World Bank estimates US$4.264 billion of development costs.

The Operation Costs

The operating costs (incl. general and administrative costs) are also uncertain. Tullow predicted US$7 per barrel for year 1-2 (incl. the leasing of the vessel) and US$7.5 per barrel for years 3-7. Compared to other deep water production sites these are relatively low assumptions. The Tullow prediction was made in 2008.

Following the World Bank base case 2009, the calculated per barrel capital and operation costs will increase during the 19 years production time:

2013-2015: US$7.96 per barrel (pb)
2020: US$12.40 pb
2025: US$16.80 pb;
2029: US$20.31 pb.

The Barrel Price

The oil price experienced a record peak of US$145 per barrel in July 2008 while in December of the same year it fell to US$30. This shows how the oil price fluctuates. Reasonable predictions for the next five years vary between US$60 and US$120 per barrel. Goldman Sachs expects an average of US$92 in 2011.

The oil from the Jubilee field seems to be of similar quality as the price-reference crude oils, traded on the international markets. Therefore Ghanaian oil will be sold for approximately the official barrel price. As shown in table 4, the revenue is highly barrel price dependent. The World Bank calculates with an average long term oil price of US$75, which stays stable over 19 years of production.

Year of Production *(All revenues in Million US Dollar)*	Gross Revenue, with the World Bank assumptions, and their predicted barrel price US$75	Gross Revenue, with the World Bank assumptions and a barrel price of US$60	Gross Revenue, with the World Bank assumptions and a barrel price of US$80	Gross Revenue, with the World Bank assumptions and a barrel price of US$90	Gross Revenue, with the World Bank assumptions and a barrel price of US$100	Gross Revenue, with the World Bank assumptions and a barrel price of US$120
2011	2925.0	2341.1	3121.4	3511.7	3901.9	4682.2
2012	3300.0	2638.9	3518.6	3958.4	4398.3	5277.9
2013	3300.0	2638.9	3518.6	3958.4	4398.3	5277.9
2014	3300.0	2638.9	3518.6	3958.4	4398.3	5277.9
2015	3300.0	2638.9	3518.6	3958.4	4398.3	5277.9
2016	2775.0	2220.6	2960.9	3331.0	3701.1	4441.3
2017	2437.5	1949.1	2598.8	2923.7	3248.5	3898.2
2018	2174.9	1741.0	2321.4	2611.6	2901.8	3482.1
2019	1912.4	1530.8	2041.1	2296.2	2551.4	3061.6
2020	1687.4	1349.0	1798.7	2023.6	2248.4	2698.1
2021	1536.8	1228.5	1638.1	1842.9	2047.7	2457.2
2022	1387.6	1110.3	1480.4	1665.5	1850.6	2220.7
2023	1275.1	1020.5	1360.7	1530.8	1700.9	2041.1
2024	1200.1	959.2	1279.0	1438.8	1598.7	1918.4
2025	1125.1	900.0	1200.1	1350.1	1500.2	1800.2
2026	1050.1	840.9	1121.3	1261.4	1401.6	1681.9
2027	975.1	779.6	1.039.5	1169.5	1299.4	1559.3
2028	937.6	751.1	1001.6	1126.8	1252.0	1502.3
2029	900.1	720.5	960.6	1080.8	1200.9	1441.0
	37000.5	29997.8	38958.5	44989	49998.3	59997.2

Table 5: Gross Revenue, with the World Bank assumptions, but varying barrel price assumptions.

The Revenue for the Government

The exact governmental revenue percentages are defined in the Petroleum Agreements which have been signed between the Government of Ghana and the various petroleum companies. Despite a number of promises, these contracts have not yet been made public. A Model Petroleum Agreement from the year 2000 can be downloaded from GNPCs homepage. The parameters, which are usually referred to in public, are taken from this model agreement: Petroleum Income Tax 35 %[3]; Carried Interest 10 % (through GNPC)[4]; Royalty 5 %[5]; Additional Interest 3.75 %[6]; Addition Oil Entitlement 3.75 %[7]. According to the Ghana Oil news portal www.ghanaoilonline.org, "the production rate is expected to supply more than $400 million to the government's 2011 budget and around $1 billion per year into the country in the early years".

The advisor to the Minister of Finance announced 42.20% as the effective percentage share of total revenue that would accrue to Ghana. The effective share is not a simple addition of

[3] *Petroleum Income Tax* is profit-related revenue accruing to the State.

[4] *Carried Interest* is a share of the oil or the sales revenues without paying for exploration and development costs.

[5] *Royalty* is levied on gross production of oil and gas irrespective of the profitability of the operation.

[6] *Additional Interest*, which is a paying interest, is an option that requires the state to pay the proportionate share of the development and production cost. It is normally applicable within 60 days after production start.

[7] *Additional Oil Entitlement* is additional profit tax, which is only taken, if the investor's actual internal rate of return exceeds the targeted rate of return.

the above listed percentages (that would be 57.5%); because for example the taxes are calculated after the carried interest has been taken away.
The World Bank base case 2009 uses the same parameters, but no Additional Interest and, more importantly, different Addition Oil Entitlements:
"A share of petroleum revenue net of royalty and initial interest that is linked to the project rate of return (ROR) on a sliding scale; the terms of each contract are understood to differ so, for this analysis, a four-point sliding scale has been assumed as follows: *@ ROR >18% AOE = 10%; @ ROR >23% AOE = 15%; @ ROR >28% AOE = 20%; @ ROR >33% AOE = 25% (World Bank assumptions)".*
According to the World Bank assumptions, the effective governmental share over 19 years of production would be 51.7%. This leads to a total government revenue of US$19,39 billion. Using the same World Bank parameters, but an effective percentage share of 42.20%, the governmental stake would only be US$15.825 billion. (If the average barrel price is below US$75, the governmental stake becomes even less – see Table 4.)
The Addition Oil Entitlement is absolutely central for a revenue prediction. As long as contract details are not officially published, any government or companies' revenue prediction is highly speculative. Besides the governmental share, the assumed barrel price is the most critical parameter. The World Bank assumption of a constant 75 US$ seems unrealistic. In the next years it might be even dangerous to rely on predictions that assume an average of 75 US$, because a lower barrel price is not unlikely. On the other hand it is very likely that the average oil price in the next 20 years exceeds 75 US$. The upcoming production peak and the worldwide rising demand will probably push the oil market. *[World Bank, 2009]*

4. The Oil Policy of the Government of Ghana

4.1 Transparency Measures

Ghana is member of the Extractive Industries Transparency Initiative (EITI). The organisation was launched in 2002 and "encourages government, extractive companies, International agencies and NGO's to work together to develop a framework to promote transparency of payments in the extractive industries" *[EITI Ghana, 2011]*. The aim of the initiative is to create an environment of transparency and accountability between companies, governments and citizens in resource rent-seeking states. After publishing data and independent reports on the country's mining sector, Ghana achieved compliance with the EITI in October 2010.
Even though the membership of Ghana in the EITI is a major step towards a transparent resource management policy, it has to be noted that it is first and foremost focussing on Ghana's mining sector. Yet, the initiative has been extended to the oil sector in April 2010.
The main criticism towards the EITI is the lack of efficiency due to non-compulsory guidelines of the organisation. This deficit means that Ghana can voluntary fulfil the transparency standards of the organisation as it happened in the mining sector. However, in the oil sector, no action has been taken to improve the overall transparency because there are no legal measures that are backing up the fulfilment of EITI standards *[ibid]*.

The current lack of transparency in Ghana's oil policy envisages in the refusal of the Government to publish the contracts that were signed with the companies involved in the oil production (see Chapter 3.3.1).

4.2 The 'Petroleum Revenue Management Bill'

In early 2010, the Government of Ghana proposed a 'Petroleum Revenue Management Bill'. The purpose of this legislation is to regulate the use and management of the rents that will be generated through the oil industry. According to a publication by Dr. Amoako-Tuffour from the Ministry of Finance and Economic Planning, a central feature of the bill is to split the revenue into the Annual Budget Funding Amount (ABFA) and into two long-term funds. These funds were established to back up the country's economy in case of oil price variability and "to generate an alternative stream of income for the future" *[Amoako-Tuffour, 2010]*. The bill suggests using at least 30 % of the oil revenue for the long-term funds. The other 70 % of the revenue will stream into the annual budget of the Government. The "Petroleum Revenue Management Bill" suggests various limitations for the spending of the ABFA and also rules for reporting on oil findings and investments, along with the creation of an independent regulatory body. However, it does not provide a detailed plan that shows which sectors/ministries will profit most from the revenue. For instance, it is not possible to directly derive investments in the infrastructure of the country from the bill. Even though it is widely appreciated that the government tries to introduce legal measure to regulate oil revenue management, the lack of details is the target of many critics *[ibid]*.

Even more important is the fact that the bill was pending in front of the parliament for almost a year and has still not become a law. The main conflictive issues in the parliament debate were the percentages of the revenue that will stream into the budget and respectively into funds and the question if a Public Interest and Accountability Committee (PIAC) should be established to enhance public accountability and transparency in the management of the petroleum revenue *[Ghana News Link, 2011]*.

5. Concluding Remarks

The future of oil in Ghana is extremely hard to forecast. On the one hand the government tries to show good will in implementing useful measures to control the oil industry. On the other hand, there is much insecurity about the reliability of the involved companies and especially about the amount of the revenue. These facts are confronted with high expectations in the Ghanaian society which can be seen in the rising number of people who are moving to the Western Regions major city of Takoradi in the hope of getting employment in the emerging oil industry. Taking the numbers of the estimated revenue and the amount of available resources in account, it seems impossible to match the expectations of the people. However, it is the Government of Ghana's responsibility to ensure that the oil revenue is spend in the best possible way and under the most transparent and democratic conditions to make petroleum a blessing for the Ghanaian people.

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