



UNIVERSITY OF GHANA
COLLEGE OF BASIC AND APPLIED SCIENCES

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Topic: Introduction to Ghana's Oil & Gas Industry: History, Current and Future Trends

GNPC

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Salutations & Introduction

Mr. Chairman, Provost Chancellor Prof Daniel Asiedu, Faculty Heads, Heads of Departments, Senior members in Academia, colleagues from the Industry, Distinguished Invited Guests, Ladies and Gentlemen, it is a great honour to be here today, at the invitation of the College of Basic and Applied Sciences to speak at this lecture.

I bring you special greetings from the Chief Executive of GNPC, Mr. Alexander Mould, the Management and Staff, many of whom are represented here.

GNPC has been around for more than 3 decades. During this period, we have seen many changes in the global energy industry: the highs and lows which never seem to go away.

Mr. Chairman, 18 years ago when I left what was then the Geology Department (now the Department of Earth Sciences(?)), Ghana's upstream oil and gas industry was at best latent. It was confined to the limited activities of GNPC and a handful of its partners. With no production in commercial quantities, the industry was hardly noticed for majority of Ghanaians.

But the sweep and clock-speed of change have taken on a different pace in recent times have made our industry much more competitive to the extent that governments, companies, investors, technocrats, academia, students and the rest of us are faced with hard decisions and choices which will determine whether we all succeed or fail.

In June 2007, Ghana's President John Kufuor was reported to have said on BBC that the discovery of the country's first major oil deposit could turn the West African country into an "African tiger".

The President said that (I quote):"Even without oil, we are doing so well... With oil as a shot in the arm, we're going to fly," he told the BBC.

In July 2010, few months to Jubilee's First Oil, President Mills at a Government meeting with Top Executives of Tullow, was reported to have said that the government had learnt veritable lessons from countries where the discovery of oil had brought about agitation and civil unrest leading to the emasculation of local economies. President Mills said the government had instituted numerous interventions which would ensure that revenue from the sale of oil became a blessing to the people.

It was reported that when Mr. Barack Obama, President of the United States gave his State of the Union address in 2015, it took him less than two minutes to mention oil, and that if he hadn't been interrupted by applause, he would have gotten there even faster. This shows how important oil is to both advanced and developing countries and to the global economy.

We all know why. Petroleum is a finite resource- non-renewable. Oil is an essential part of the energy mix; and energy, in turn, is the lifeblood of human existence. It is very important to the modern economies – whether importing countries or exporting countries. Without energy, our lives would be almost unrecognizable. We at GNPC are proud to be part of an industry that truly powers economies.

In my lecture, today, I want to look at:

1. Introduction to Oil & Gas Exploration & Production

2. Global Investment Trend

3. Current Trends – Ghana

4. Future Trends

5. Conclusion

Introduction to Oil and Gas Exploration and Production

History has shown us that Petroleum in its unrefined state has been utilized by humans for over 5000 years. Oil in general has been used since early human history to keep fires ablaze and in warfare. Its importance to the world economy evolved slowly, with whale oil used for lighting in the 19th century and wood and coal used for heating and cooking well into the 20th century. The Industrial Revolution generated an increasing need for energy which was met mainly by coal, and with other sources including whale oil. However, when it was discovered that kerosene could be extracted from crude oil and used as lighting and heating fuel, the demand for petroleum greatly increased, and by the early twentieth century had become the most valuable commodity traded on world markets.

The global petroleum industry is usually divided into three major components: upstream, midstream and downstream. For simplicity, midstream operations are

usually included in the downstream category, and describe the activities from the transportation of the crude oil and gas (in tankers, pipelines) through refining and distribution of petroleum products

The upstream oil sector is also commonly known as the exploration and production (E&P) sector. It includes the exploration phase where extensive geological and geophysical studies are conducted. It comprises data gathering, processing and interpretation to generate drillable prospects that give a good understanding of the geological structures, with a view to reducing the risk attached before drilling of the prospect. The well drilled to establish the presence or otherwise of petroleum in any given prospect is called an exploration well. The global average success rate for exploration wells is 10%. In other words, one out of every ten (10) exploration wells is successful in finding commercial petroleum.

Having discovered oil during the exploration phase, new questions critical to further investment decisions come up: How much oil or gas has been encountered by the exploration wells? What is the areal extent of the accumulation? What are the characteristics of the rock formation in which the oil or gas is accumulated? What are the seabed conditions? What are the characteristics of the oil itself: is it light or heavy, at what temperatures will it freeze? What are the pressures in the reservoir? Answers to these questions will help establish the volumes of the oil in place, volumes that can be produced efficiently, the distribution of oil over the area and how the oil or gas should be produced.

The series of activities and steps taken to answer these questions are known as appraisal operations.

It includes drilling of additional wells known as delineation wells, acquisition of high resolution three-dimensional (3-D) seismic datasets, laboratory studies of oil samples and rock samples, well simulations, etc. These activities cost substantially more than the exploration and may take 2 – 3 years depending on the location (Deep Water, Shallow Water, etc.).

It is very important to note that GNPC does not take exploration risk. Such risk during exploration and appraisal are solely carried by the Investor/Operator even though GNPC's interest remains intact.

Having determined field size, oil or gas reserves, field characteristics and distribution of oil and gas over the field, reservoir pressures, we then proceed to determine how to produce the resources (oil and gas) and get them to the market. In the process, we have to conduct series of engineering studies to determine subsea conditions, pressure management, facility types and size. These facilities are not sold on the shelf: they have to be designed, constructed or fabricated from scratch to suit the water depth and seabed conditions of the discovery area. Designing, construction and execution of such facilities could take up to two (2) years or more depending on the nature of the facilities and availability of slots/space in shipyards around the globe. Critical decisions will also have to be made about how the oil and gas would be evacuated from the location to refineries/marketing centers, especially gas.

The number of production wells and water/gas injection wells and their spacing and location will have to be accurately determined to optimize recovery of oil or gas from the subsurface. This is usually done through simulation.

The cost of development could range from US \$1 billion to US \$10 billion depending on location, water depth, size of field, the geology, distance to market and available existing infrastructure.

Development and production is a long-term activity, spanning 15 – 25 years and therefore has a more permanent potential impact on the environment. This calls for a Development Plan which details out a strict engineering design and construction of all facilities, and an environmental impact assessment (EIA) to ensure that development and production activities by law (international and local), will be done in such a way as to have minimum adverse impact on the environment. The plan also calls for how the operator will mitigate any potential environmental disaster during the process of production should they occur. The development plan also clearly spells out how the facilities used in the production of oil and gas will be decommissioned at the end of the field life.

Global Investment Trend

The oil industry is indeed a global one. As we are all very aware right now, the industry is going through a time where supply has outstripped demand.

Technology has continued to unlock new sources of supply – notably shale oil and gas in North America.

At the same time, global demand growth has slowed from the extraordinary pace of the past 20 years, notably from China. The glut has driven prices down, and the pressure is now on every stakeholder to become more competitive at lower prices.

The impact of this situation on oil and gas producers has been rapid and dramatic. In the third quarter of 2014, when oil prices were still above \$100 per barrel, the supermajors posted aggregate net income of \$23 billion, according to Bloomberg. Twelve months later, upstream profits had been wiped out. In response, companies are slashing outlays. Capital expenditures have been cut by 30 percent in 2016. Already, petroleum exporting countries and Governments around the world have suffered revenue shortfalls. Both international and national oil companies are negotiating aggressively for 10 to 30 percent discounts from oil-field service providers. Head counts are affected as well. More than 200,000 employees have been laid off in the O&G industry due to the current oil price falls, according to recent company announcements.

These are profound changes, which require that we all become competitive in a way that's different from the past.

Oil prices as you may be aware, reflect supply and demand balances, with increasing prices often encouraging producers to increase supply. Increasing supply, in turn, typically requires increased investment in exploration and production (E&P) activities. Lower prices reduce investment activity. This has been the story of many projects in both matured and immature (high risk) areas/basins around the world.

This state of affairs is not good for countries, investors and the local populace.

We are part of an industry driven by big monies, in millions and billions of US Dollars; an industry that requires management of existing production assets and evaluation of prospective projects often requiring years of upfront investment

spending on exploration, appraisal, and development before reserves are developed and produced.

Over the years, we have used previous investment cycles to gain insights into how investment responds to crude oil price changes. According to information from the US Energy Information Administration, in 1981 and 1982, after crude oil prices significantly increased, investment topped out at more than \$100 billion (in 2014 dollars) and then averaged \$30 billion to \$40 billion per year into the early 2000s as crude oil prices fell and remained in the \$20-\$30 per barrel range. From 2003 to 2014, investment spending increased from \$56 billion to a high of \$158 billion as crude oil prices increased from \$34.53/b to \$87.39/b, including several months of prices reaching more than \$100/b. EIA's 2015 Annual Energy Outlook Reference case, projects real domestic first purchase prices to average about \$70/b in 2020. This price level could result in substantially lower annual oil and natural gas investment over the 2015-20 period than the annual average of \$122 billion spent during the 2005-14 investment cycle crest period.

This will be a challenge when you consider that oil and gas is of critical importance to the African economy. In fact, it is estimated that 57% of Africa's export earnings are derived from hydrocarbons. Within the continent, North and West Africa are host to the most renowned producers; some of the countries in these regions are also among the most dependent on oil and gas revenues in the world. In regions like East Africa, where significant gas discoveries have been made, billions of dollars' worth of investment will be needed over the next decade to commercialize the region's hydrocarbon resources. The same can be said of significant discoveries made offshore Ghana.

How do we commercialize our many stranded resources in the face of low investment appetite by IOCs?

Sheikh Ahmed Zaki Yamani, a former Saudi Arabian oil minister once said in the year 2000 during an interview that (I quote): “The Stone Age did not end for lack of stone, and the Oil Age will end long before the world runs out of oil”.

Oil is still here with us, and it does not look like it’s going away very soon. However, it’s clear that the industry is going through one of the most transformative periods in its history, which will ultimately redefine the energy business as we know it. To navigate change of this scale, it is important that decision makers in governments and businesses make smart, strategic judgments that will attract investments, drive capital and cost efficiencies for both the medium and long terms.

The good news is that demand for petroleum continues to grow, particularly from the developing world. BP’s Energy Outlook projects that this demand will be up 33% by 2035 on the most likely path.

Current Trends – Ghana

Until recent times, Ghana’s petroleum industry was defined by intermittent acquisition of data and drilling of wells offshore (upstream sector), the importation of crude oil and petroleum products, a relatively small amount of crude refining, and the distribution of refined products, all at the downstream sector of the industry. There was virtually no upstream service industry.

Within the last eight years, positive changes, especially in the upstream sector, are taking place. Before I discuss further down in my presentation some of the positive

changes that have engulfed our nascent industry, please permit me to first discuss the structure of the industry.

The structure of the industry is as follows:

The Ministry of Petroleum (formerly Ministry of Energy), led by the Hon. Minister is in charge of developing and formulation, implementation, monitoring and evaluation of energy sector policies. Any activity in the upstream sector starts from the Ministry of Petroleum. There are sector Agencies that report to the Ministry of Petroleum. The Upstream petroleum regulator, the Petroleum Commission, is one of such Agencies.

The Petroleum Commission is the upstream regulator that is mandated to regulate, manage and co-ordinate all activities in the Upstream Petroleum Industry for the overall benefit and welfare of Ghanaians. In doing this, the Commission promote local content and local participation programmes with the aim of creating the best possible values through prudent and sustainable management of oil & gas resources. In addition, it is a requirement under the Petroleum Commission Act 2011, (Act 821) for all upstream petroleum companies who intend to operate in Ghana to register with the Petroleum Commission and be issued with a permit before commencement of operations.

Beyond the policy development and formulation and the regulatory roles that I mentioned earlier, there are industry players in the upstream sector in Ghana. They are the National Oil Company and the International Oil companies.

The Ghana National Petroleum Corporation (GNPC), the National Oil Company, is a state organization that reports to the Ministry of Petroleum. It is a national organization charged with significant responsibilities in respect of petroleum

exploration and production. The objectives of the Corporation include efficient exploitation of oil and gas resources within our territories, jobs creation, general economic development, economic and energy security, vertical integration and the maximization of shareholder value. Over the last 30 years we have worked with the Government and other sister Agencies in restructuring and positioning the nascent industry for the big take off.

The IOCs that characterize the current exploration and production (E & P) business environment are the following:

- “Major” companies such as Eni;
- Large and Medium Size “Independents” such as Anadarko, Hess, Tullow; Kosmos;
- Small “Independents” such as Heritage Oil, Medea Development AS, AGM Petroleum, Erin Energy; and
- Start Ups and Promoters e.g. Sahara, Amni Development, Eco Atlantic, Brittania-U, Springfield, UB Resources, etc.;

Service Companies such as Schlumberger, CGG, PGS, Baker Hughes, Technip, Halliburton, FMC Technologies, MI-SWACO, MODEC, Stellar Group and others have all played very important roles in the advancement of the industry together with Ghanaian companies such as Menergy, Seaweld Engineering, Rigworld, etc. to mention but a few.

The Law that established GNPC (PNDC Law 6) and the E&P Law (PNDC Law 84 as well as its successor Act 919) both enjoined the Corporation and its Contractors and subcontractors to ensure that petroleum operations are conducted in such a manner as to prevent adverse effects on the environment, resources and people of

Ghana. The Environmental Protection Agency is the body empowered and mandated to ensure compliance with any laid down environmental impact assessment procedures in the planning and execution of development projects, including compliance in the respect of existing projects. The EPA acts in liaison and co-operation with other government agencies such as the Petroleum Commission and GNPC, and institutions to control pollution and generally protect the environment.

Ghana-History of Hydrocarbon Exploration and Production

Ghana has four sedimentary basins. These are:

The Tano Basin (including Cape Three Points Sub-basin), Central (Saltpond) Basin Accra/Keta Basin and the Inland Voltaian Basin .

According to records from the Ghana Geological Survey, exploration for oil and gas in Ghana started in 1896 in Onshore Tano basin in today's administrative Western Region. It was an era where early explorers chased onshore oil and gas seepages in that area. Early shallow wells were drilled without geological understanding nor the benefit of seismic data back then. Records also show that oil was produced from these shallow wells.

During the First Republic, exploration activities continued onshore in basins other than Tano. Under the auspices of a Ghana – Soviet Union friendship pact, Soviet and Romanian Geoscientists explored for oil and gas in the Accra/Keta and Voltaian basins.

During the period also, the Soviet team drilling for water in the onshore Voltaian basin encountered traces of oil and gas in some of the boreholes in some areas in

the Northern and Upper East regions. Also, calcic waters associated with hydrocarbons were encountered in some of the boreholes. Furthermore, renowned Ghanaian geologist and past Director of the Geological Survey of Ghana, Mr. G. O. Kesse (of blessed memory), reports that salt used to be mined at Daboya along the White Volta northwest of Tamale in the Northern region. The association of salt deposits with hydrocarbons in sedimentary basins worldwide is well documented. These are all indicative pointers to the possibility of commercial accumulation of hydrocarbons in the Voltaian basin.

Unknown to many of you here, the first offshore well was drilled in the Saltpond basin in 1970. It was the discovery well for the Saltpond field which started production in 1978. Following this discovery, several marginal oil and gas discoveries were made in the Tano basin.

In 1978, the first deepwater well was drilled by Phillips Petroleum Offshore Cape Three Points in 900m of water.

Most of these exploration activities took place without the active involvement of the government and people of Ghana.

In 1983, the Government established the Ghana National Petroleum Corporation as **a strategic commercial vehicle** for active, rather than passive, state participation in the exploration and production of hydrocarbon. It was envisaged that GNPC would be the strategic vehicle through which:

- Ghana would develop comprehensive national capacity in all areas of the oil and gas industry

- Ghanaian institutions and communities could optimize their engagement with this industry
- Ghana would steadily increase her control over the resources for the maximum benefit of our people.

GNPC was therefore established to be developed into a highly competitive and successful company that can take on the responsibilities of exploring, developing and producing complex oil and gas fields and infrastructure.

In the early days, the Corporation focused on data re-organisation and consolidation, aggressive capacity development across all the different functional areas including development of in-house processing and interpretation capacity; thorough evaluation of petroleum resource potential, aggressive promotion of the hydrocarbon potential and effective partnering, leading to establishment of Western Basin petroleum system and several significant discoveries (e.g. North and South Tano oil and gas fields, West Tano 1 and WCTP-2 discovery oil discoveries) between 1989 and 1999.

By 2000, GNPC was a strong institution with an international reputation for professionalism. This was supported by strong networks and evidently effective cooperation with relevant national institutions and the media. GNPC we can confidently say was a valuable and well-known brand presence. The string of discoveries made since 2001 emanated from this era and is a direct result of the work done in this period.

The oil and gas exploration market is a very competitive one. The success of attracting investors depends on the attractiveness of the potential (the geology), the fiscal arrangements, social and political factors.

Even though oil prices fell to record lows in the early 2000s, GNPC's commercially driven and ambitious corporate culture and quest for operational autonomy/independence in the 1980s and 1990s, ensured that the momentum for exploration that had been generated and supported by the data and knowledge dividends (in the past) enabled more drilling activity by IOCs. This directly led to the string of discoveries from 2007 to 2014.

The strategy in the past was to assist the authorities in the award of large acreages with competitive terms to successful applicants and encourage the acquisition of seismic and other data over the whole acreage. With relinquishment provisions inserted into the various Petroleum Agreements, the Petroleum Minister is able to award relinquished blocks to other companies with better fiscal terms after a few years. This strategy led to an aggressive exploration activities offshore Ghana. Through this strategy, Ghana increase the amount of data coverage offshore and also the drilling density in our basins.

We progressed from acquiring under 2,000 sq. km of 3D seismic from 1990-2000, to acquiring over 10,000 sq. km of 3D seismic from 2000 to 2010. Currently 2D seismic coverage offshore Ghana is over 70,000-line km while 3D seismic coverage is over 25,000 sq. km. About 180 wells have been drilled across our sedimentary basins with about 70% of the wells located in the Tano-CTP basin.

It is said in the industry that "oil is first discovered in the mind". This saying is just emphasizing the role of human beings in the discovery of oil and gas. GNPC over the years has developed an experienced and very skilled workforce through training and development, working with various companies with different technologies and strategies to launch itself into heightened activity both as a key

participant and operator in the O&G industry. All this is geared towards positioning the organization to reclaim the leadership role in the commercialization and development of Ghana's hydrocarbon potential.

In line with the GNPC Law and the E&P Law of 2016, GNPC acquires interest and partners all companies that are awarded the exploration and production rights to a license/Block in Ghana. Nobody understands our sedimentary basins better than we do. We can therefore lay claim to the successes that have been chalked over the years in the industry. In all cases, what these companies have done and continue to do is to build on work that has been done by GNPC prior to their coming, and continue to work in close partnership with the Corporation. There are currently 17 active licenses offshore Ghana. GNPC's participating interest ranges from 13% to about 27%.

GNPC has contributed immensely not only to the current discoveries and production of oil and gas, but also played a lead role in the development of the whole upstream petroleum sector.

Current Trends

Finding new oil and gas reserves is not just about gaining rights to licenses and having access to capital and technology, but also about laws, regulations and permits established by authorities and by governments. It is also about forming and managing partnerships, negotiating complex deals and working with the complex geopolitics of the industry.

The discovery of commercial quantities of oil and gas in deepwater offshore Ghana made it evident that the existing legal and regulatory framework governing the industry was not robust enough to counter the challenges.

The Government and other stakeholders therefore set out to tightened up framework to adequately protect the interest of Ghana and to ensure maximum benefits from the natural resource for the people of Ghana .

, Ghana has therefore improved on its legal framework with the passing into law of the new E&P Law, 2016. Prior to this, several Acts have been passed to augment the legal regime in place prior to the development of commercial quantities of oil in Ghana. Among these laws are the Petroleum Revenue Management Act, 2011 (Act 815), the Petroleum Commission Act, 2011, (Act 821) and the Local Content and Participation regulation, 2013 LI 2204.

There is no doubt that the implementation of these Laws has brought checks and balances to the activities in our emerging industry and significant benefits to the country and the people of Ghana.

The new E&P Law was passed by Parliament on 4th August, 2016 to replace PNDC Law 84 as the primary legislation to regulate Ghana's upstream petroleum sector. The Law has gained Presidential Assent and been gazette as Act 919. Building on PNDC Law 84, the new law is expected to improve the business environment for petroleum exploration and production in Ghana, as well as enhance the State's fiscal benefits.

For example, the overarching principle which forms the bedrock of the New E&P Law, Act 919 is to ensure that petroleum resources are managed and exploited for the optimal benefit and welfare of the Ghanaian people, in a safe, secure and

sustainable manner, and conducted in accordance with international best practice within the petroleum industry.

In addition to this theme, the law seeks to provide transparency and certainty, in order to attract private investment into the sector.

Some highlights of the new Act 919 are:

- GNPC remains a partner in all Petroleum Agreements with a minimum of 15% initial carried interest in plus Additional interest.
- The Corporation remains permitted to undertake petroleum activities in an open area which is not covered by a petroleum agreement.
- Any borrowings in excess of US\$30million for purposes of Exploration and Development will have to go to Parliament
- GNPC will have preemption rights if contractor is selling any stake;
- A minimum GNPC's Carried Interest of 15%, etc.
- Bidding rounds preferred to Direct negotiations in the award of blocks

It has been nine (9) years since commercial quantities of oil was found in the Tano basin, at what is known now as the world class Jubilee Field. It was the field that put Ghana on the map of oil producing countries. Jubilee recoverable reserves is about 630 million barrels of oil. At the end of 2015, we celebrated five years of production from the Field.

- Total of 178.84 MMbbls produced over 5 years with average daily production above 100,000 bopd since 2013

- As at October 2016, Ghana group has lifted 31.99 MMbbls
- Three (3) cargoes totalling (2,93 MMbbls) lifted on behalf of Ghana Group in 2016 representing 18% of the total lifted by partners
- Recoverable reserves of 455 million barrels and 456 billion cubic feet (bcf) of gas as at June 2016
- Total volume of Gas delivered to GNGC of 39,837 MMscf

In August 2016, Ghana was privileged to bring on stream, her second major oil producing field, the TEN Fields. The TEN fields hold recoverable **Oil Reserves of about 240** Million barrels and **Gas Reserves** (Associated and Non-Associated Gas) of about **360 Billion** Cubic Feet (BCF).

At peak production, TEN will produce about 80,000 barrels of oil per day. Significant gas production is expected to commenced in 2017.

- The FPSO Prof. Mills which holds the world's largest turret of 3,055 tons arrived in Ghana on 2nd March, 2016
- First oil achieved on 18th August 2016
- First NAG production from Tweneboa field expected in 1st Quarter 2017
- Gas export will be achieved through a subsea pipeline and manifold structure interconnection to the existing Jubilee pipeline
- Drilling operations on the field expected to resume after ITLOS ruling in late 2017

TEN brings to the economy new revenue streams, additional gas, primarily to boost domestic supply to mitigate challenges in the power sector.

Ghana's third major oil and gas development known as the Sankofa Gye Nyame Field is currently ongoing and on schedule. The SGN Field holds reserves of 204 MMbbls of oil and 1,071 bcf of gas as at June 2016.

- Sixteen (16) out the total nineteen (19) wells approved for the OCTP oil and gas development have already been drilled – 7 oil producers, 3 gas producers, 3 gas injectors and 3 water injectors
- Construction of all 17 topside modules have been completed and lifted onto FPSO in Singapore for integration
- Overall progress of work was 54.3% against a target of 54.8% as at end of August 2016

The Sankofa-Gye Nyame field is on track to deliver first oil in August 2017 and first gas in the second quarter of 2018 to augment thermal power generation that will ensure sustainable electricity production.

The Sankofa project is expected to deliver an additional 45,000 barrels per day of oil and 180 million cubic feet of gas per day to Ghana.

Mr. Chairman, GNPC is leading exploration activities in the inland Voltaian basin under its 5-year initial exploration programme from 2015 – 2019

The main project objective is to establish the prospectivity and enhance the knowledge base of the Voltaian Basin.

The project is GNPC's flagship project through which the Corporation will exert significant impact on the Ghanaian petroleum industry

The 5-year reconnaissance program will cover 2D seismic data acquisition and processing, environmental impact assessment, community relations management and drilling of 2 conventional wells.

Preparations are currently underway to select a seismic contractor to commence acquisition of the data.

Secondly, Mr. Chairman, let me tell you about the benefits that the Local Content LI has brought to the Ghanaian Economy. In its quest to avoid the 'resource curse' phenomenon and to spread the benefits of petroleum resources among a wider spectrum of Ghanaians, the government of Ghana developed the Local Content and Local Participation in Petroleum Activities Policy Framework in 2011, and the parliament of Ghana passed the Petroleum (Local Content and Local Participation) Regulations 2013, (L.I. 2204). It came into force in February 2014 and the Petroleum Commission and the Local Content Committee started implementation thereof. The industry has generated both direct and indirect employment since inception. Records available to the PC indicates that the upstream petroleum sector has created about 7,000 jobs, out of which 5,590 or 80% are Ghanaians. The International Oil Companies have employed about 3,616 people out of which 2,315 are Ghanaians. Between 2010 – Q3 2015, contracts worth about USD6.3 billion were awarded to companies operating in Ghana's upstream sector, out of which over \$1billion worth of contracts were awarded to 3,532 indigenous Ghanaian

companies. It can be deduced from the analysis that, over the years, the level of local participation in upstream activities continue to grow with the expansion of the oil and gas industry.

Conversely, it is clear that indigenous Ghanaian companies have grown significantly in the non-technical aspects of the industry like freight forwarding, catering, manpower supply, but not very active in the highly technical aspects of oilfield operations. This gap can be plugged with the strict adherence to Regulation 4(6) of the local content L.I. 2204 which creates opportunities for Ghanaian companies to form joint ventures with foreign companies.

Producing these fields leads to depletion of resources that took millions of years to form. As a country, how do we ensure that we replace this non-renewable resource? In addition, how do we ensure aggressive and sustainable exploration activities to increase the country's chances of finding new oil and gas resources in our vast sedimentary basins?

One way of doing this is by encouraging the acquisition of either proprietary or speculative new data over licenses awarded, conducting detailed G&G data study of the data, and promoting the sedimentary basins or blocks to IOCs and leading NOCs. Interested companies should then be invited to participate in open and competitive bidding and offered attractive but competitive fiscal packages.

With the oil price continuous slump and the uncertainty around it, companies, from large IOCs to small independents are cutting down exploration budgets, slowing down activities or delaying investments. It is estimated that projects worth over USD300bn are being delayed globally. Therefore attracting investment into

exploration has become more difficult than ever. This is why going into the future; we must think outside the box.

Future Trends

GNPC is looking to the future of Ghana's petroleum industry with a lot of hope. The Corporation's vision to become a key player in the shortest possible time, in the context of the corporation's evolving external environment and internal circumstances, requires a shift in focus. Coming from an era of pioneering innovation, a contractionary phase with emphasis on investments promotion and facilitation, through the current stage of renewal and consolidation, GNPC has now embark on an "Accelerated Growth strategy" anchored on four key pillars.

Through this strategy, we are building our human and organizational capacity; determined to work towards replacing and growing our reserves; taking steps to efficiently capitalize GNPC; and catalyzing local content development in the industry. The strategy is being implemented using a number of vehicles including subsidiaries, effective partnerships, and joint operating companies.

GNPC's priority is to develop the capacity to conduct petroleum operations independently in order to fully appropriate the benefits accruing along the value chain. Even where GNPC is a non-operating financial investor, such operating capability will enable us to, as any other commercial partner would, monitor these investments more effectively and optimize our return on investment. It will also provide us the requisite standby capability to conduct sole risk operations.

GNPC will continue to work with and support all stakeholders in the industry. The Corporation's attitude to community relations will hinge on a proactive positive strategy of engaging the communities and improving the livelihood of the local communities in tandem with the growth of operations there and not simply the mitigation or management of the potential impacts of our operations.

We regard our corporate social responsibility as a strategic business function aligned with our core business. We believe that it will promote sustainability and seek to optimize and not just mitigate the long-term social and environmental impacts of our activities.

We will continue to priorities investments in education, health, community development, sports and alternative livelihoods.

With respect to building national capacity, the Corporation will thus implement strategies that make local capacity competitive in the industry by developing a pool of professionals from which the Corporation and other players can readily satisfy its human resource needs, and creating support services that are domesticated to secure the corporation's competitiveness as an operator deriving from lower cost and proximity.

We will proactively engage Academia and help close the loop between industry, training and research and development institutions that have a focus on resolving peculiar challenges of our environment.

Mr. Chairman, in 2012 when oil was selling above \$100 a barrel, the focus was on barrels rather than margins. This has changed since the slump started in late 2014,

and now with oil below \$50 per barrel, the focus is now on the barrels with the best margins - and being able to produce those barrels as competitively as possible. The race to be competitive is redefining the industry as we speak.

Since 2007 when the Mahogany discovery was made, more than 23 oil and gas discoveries have been made offshore Ghana. Most of these discoveries are clustered within the Western Basin.

The majority of these discoveries are in water depths of more than 800 meters where development cost is high and also technically challenging. The discoveries are fraught with varied subsurface risks and there is no existing development infrastructure close by to tie them to. This is compounded by the relatively small sizes of the fields making stand-alone development economically unattractive for many upstream operators in these water depths.

To date, the Jubilee field with reserves of over 600MMBO is the only discovery which has been developed as stand-alone projects in the Tano basin. The individual fields in the TEN-development area as well as Gye Nyame/Sankofa development areas would be difficult to be developed as standalone. Both fields have been developed as semi hubs. On the other hand, smaller sized fields such as Akasa, Mahogany East, Odum, Banda, Teak, Beech, Hickory, Paradise, Cob, Almond and Ebony will require innovation in order to create transformation.

The solution that has been successfully employed in other oil producing jurisdictions particularly in the US Gulf of Mexico for multiple “small sized fields” has been a production HUB development approach.

GNPC has evaluated the challenges facing most of the undeveloped deep-water discoveries and will be working with operators and the Petroleum Commission to find solutions that will allow the development of fields across different contract areas efficiently. With this concept, one Facility will not only service fields within the same licensed area but will be optimally positioned to service fields from different contract areas. This provides improved field development economics by allowing different contractors to share infrastructure costs and would enable the production of the Country's hard to develop hydrocarbon resources as well as facilitate the continuous inflow of investment into the upstream industry in Ghana.

GNPC has established a subsidiary known as the GNPC Exploration and Production Company (or Explorco), which has entered into joint ventures and joint operating company arrangements with strategic partners to jointly operate in some selected license areas. Explorco has acquired commercial interests in selected upstream assets exclusive of the 'initial' and 'additional' interests of GNPC, which have carried components.. This commercial interest constitutes a full equity position, and therefore contribution by Explorco for costs begins from exploration, through development to production. It involves measured risk, but this effectively increases the overall State take in the venture in the case of success. Our goal is to achieve a high Return On Investment (ROI) while minimizing risk through a process which includes taking stakes in high-impact projects that have high probabilities of success.

It is our expectation that Explorco would build technical and managerial capacity through direct access to the management systems that International Oil Companies

(IOCs) partnering Explorco will bring to the JOCs. This will guarantee the building of Explorco's capacity.

In the near future, Ghanaians who want to participate or invest in petroleum activities by direct acquisition of shares in Explorco would be given the chance to acquire a portion of the company, to give meaning to local content and local participation.

It is no secret that some of the international oil companies that have secured exploration rights to offshore blocks in Ghana have not performed as expected in view of the prevailing industry conditions and other factors.

Our nascent industry has suffered as a result of the reduction in the hitherto aggressive exploration activities. In order to ensure that we return to the previous state of affairs, GNPC and Explorco are working to attract credible, technically and financially endowed companies to partner with us and or farm-in into some of these 'distressed' blocks.

Such partnerships if successful will lead to continuous acquisition of data and exploration drilling, which will in effect lead to a higher probability of success.

Conclusion

Mr. Chairman, distinguished ladies and gentlemen, it is expected that Ghana's daily oil production will reach 240,000 barrels by 2020 when the three fields will all be at peak production. This is good news for all stakeholders including the people of Ghana. However, this trend will not last if (1) investment into the industry stalls, (2) pace of exploration reduces, (3) we do not find more oil and gas, and (4) we do not commercialize our finds.

Currently about 50% of our sedimentary basin offshore is open with very little activity. The Voltaian basin with a size of about 103,000 sq. km, and currently undergoing some level of exploration, led by GNPC. The basin would also be available for licensing to investors in the next 2 years or so.

Offshore Ghana still host a number of stranded or captured resources which cannot be commercialized on their own. It is important that going forward, all stakeholders come together and find ways through which these resources can be commercialized either together or in clusters (hub system).

Ghana's oil reserves currently stand at 1.27 billion oil equivalent. This is relatively small compared to Nigeria's 40 billion barrels of oil equivalent. With almost 200 million barrels already produced, we must all work together to improve our replacement ratio by finding and developing more resources.

Disputes in the oil industry can be costly and deadly. There is no doubt that the maritime boarder dispute with La Cote D'Ivoire has also effected exploration and production activities offshore Ghana due to the fact that six of our most prospective blocks have all been affected by the dispute with the 'no drilling' order by the ITLOS Court.

It is our expectation that even though oil prices generally continue their downward pressure in response to higher supply against lower demand, when the dispute is resolved in our favor, Ghana will continue to attract serious and well established oil companies who will work with GNPC and Explorco to ensure that we sustain aggressive exploration and development activities in our basins.

This is key for us because increased exploration, development and production activities will lead to increased work load and demand for local participation and use of local goods and services.

Increased industry activities in Ghana also present opportunities for improving infrastructure and facilitate continuous operations thereby ensuring that our government revenues are sustained and citizens remain in jobs to promote economic growth.

Let me once again express my profound appreciation to the organizers, and all those who contributed in putting this lecture together. This lecture no doubt will contribute to the sustenance of interest of all stakeholders in the oil and gas industry in Ghana.

Mr. Chairman, distinguished participants, Ladies and Gentlemen thank you for listening.