



UNIVERSITY OF GHANA
COLLEGE OF BASIC AND APPLIED SCIENCES

2016/2017 LECTURE SERIES

The background of the slide is a photograph of an offshore oil platform. The platform is a complex structure of steel beams and cranes, situated in the middle of the ocean. The sky is filled with dramatic, golden-yellow clouds, suggesting a sunset or sunrise. The water is dark and calm. The overall scene is industrial and atmospheric.

INTRODUCTION TO GHANA'S OIL & GAS INDUSTRY; HISTORY, CURRENT & FUTURE TRENDS

9th November 2016



GREETINGS FROM GNPC



IMPORTANCE OF OIL AND GAS

COUNTRIES



Modern Uses of Petroleum...

- Gasoline
- Motor Oil
- Waxes
- Dyes
- Plastics
- Synthetic Fibers – for example, polyester



<http://www.incpem.org/pages/data/Plastics.gi>

OIL COMPANIES

CONTENT

- **Introduction to Oil & Gas Exploration & Production**
 - Upstream
 - Exploration-Appraisal-Development & Production
- **Global Investment Trend**
 - Boom & Bust Cycle
 - Projections
- **Current Trends – Ghana**
 - Industry Structure; Roles of key players
 - History of Exploration
 - GNPC
 - Offshore Activities
 - Legislations
 - Key projects
- **Future Trends**
 - GNPC's Strategy
 - Projections
- **Conclusion**

HISTORY OF PETROLEUM



PHASES OF UPSTREAM OPERATIONS

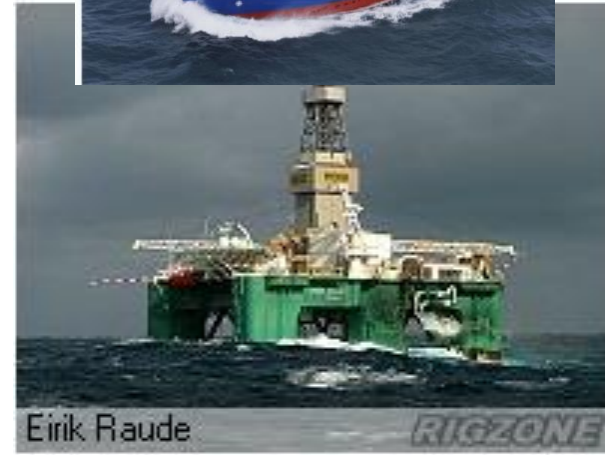
- The exploration and production operations are in phases
- The five interlinked phases are:
 1. Exploration;
 2. Appraisal
 3. Development
 4. Production
 5. Abandonment

EXPLORATION

- The exploration phase involves extensive geological and geophysical studies.
- It comprises of gathering, processing and interpretation of data.
- In some cases, the data may have to be reprocessed and re-evaluated, 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.

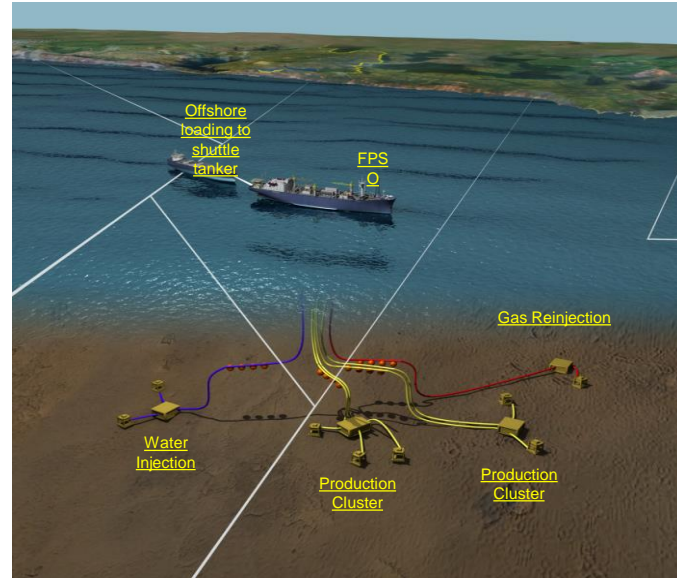
APPRAISAL

- More seismic data may be gathered
- It involves drilling of additional wells known as delineation wells to reduce the degree of uncertainty in the size and quality of the potential field
- One or more appraisal wells may be drilled
- Based on data gathered it may be possible to estimate the quantities and producibility of oil and gas in the field



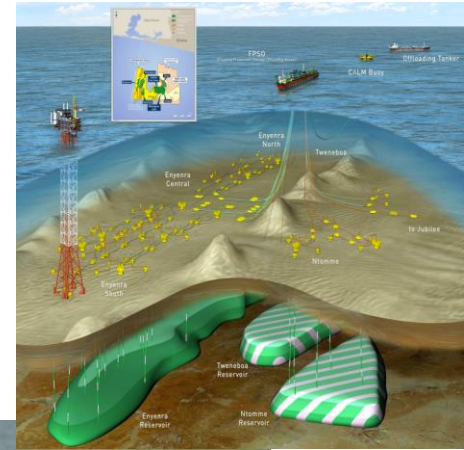
DEVELOPMENT

- If commercially profitable accumulations of oil and gas are found during appraisal drilling, development phase begins
- It involves Planning and deciding on how to develop discovery
- Value creation is critical
- Choosing the most cost-effective type of development
- Involves considerable investment



DEVELOPMENT PLAN

- 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; environmental impact assessment (EIA) which ensures that the development and production will be done in such a way as to have minimum adverse impact on the environment.



PRODUCTION

- It involves production of oil and gas and water
- Involves production well planning
- Maintaining the rate of production
- Maximising the life of the accumulation by injecting gas or water into injection wells to maintain pressure
- Reservoir management



ABANDONMENT

- It is the last Phase of a hydrocarbon project
- It involves decommissioning of any installations and subsea structures associated with the field





GLOBAL INVESTMENT TREND



OIL PRICE AND INVESTMENTS

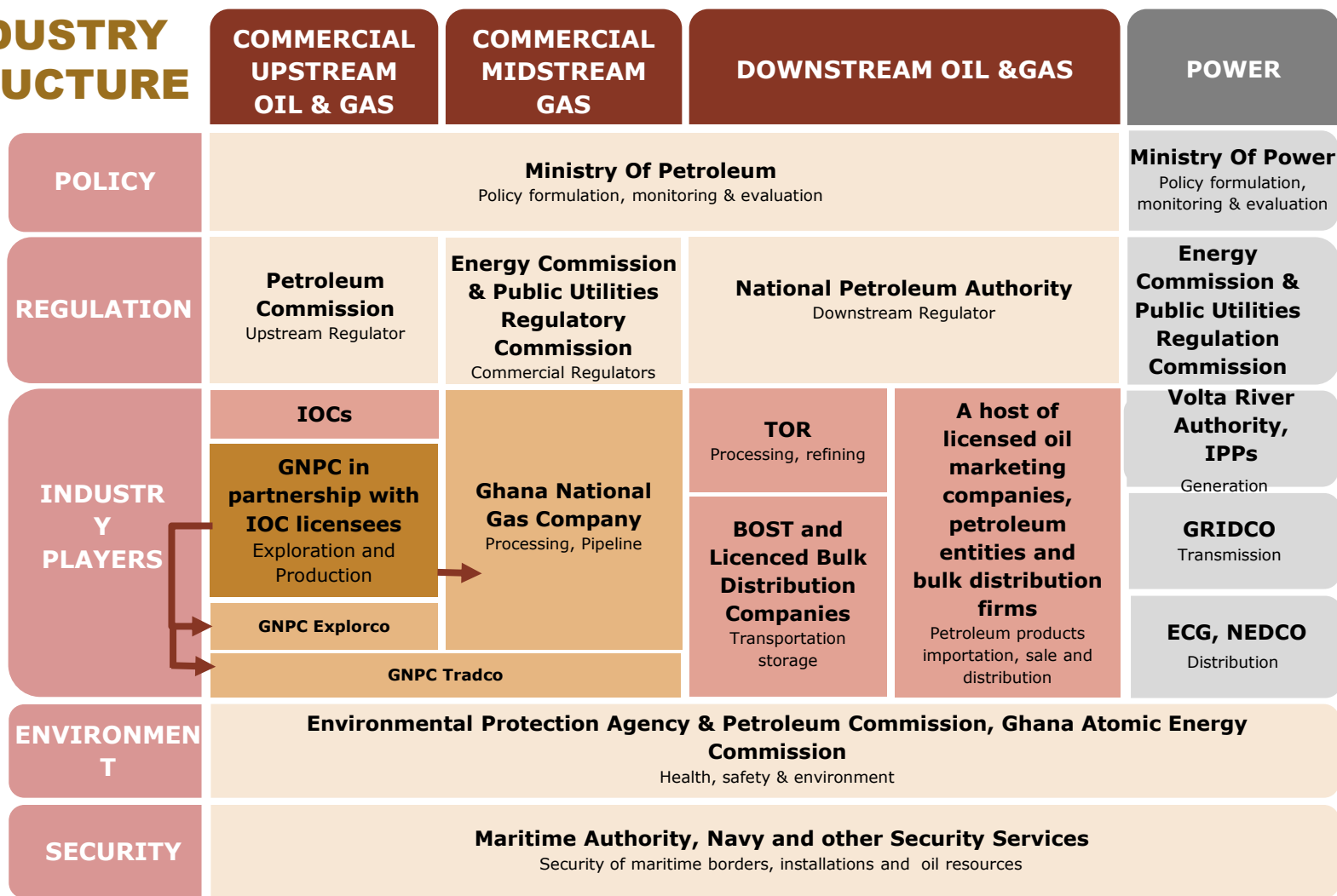
- Oil prices reflect supply and demand balances,
 - Increasing prices often encouraging producers to increase supply.
 - Increasing supply, in turn, typically requires increased investment in exploration and production (E&P) activities.
 - Lower prices reduce investment activity.
- Technology has continued to unlock new sources of supply – notably shale oil and gas in North America.
- Global demand growth has slowed from the extraordinary pace of the past 20 years, notably from China.
- Capital expenditures have been cut by 30 percent in 2016.
- 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.
- More than 200,000 employees have been laid off in the O&G industry



INDUSTRY STRUCTURE



INDUSTRY STRUCTURE



INDUSTRY IN PERSPECTIVE



- Ghana is an emerging oil and gas producer with enormous potential with over 5 years of commercial production
- Healthy investment climate and stable economy to encourage investment inflows
- Upstream industry made up of a mix of:
 - Majors (ENI)
 - Independents (Hess, Anadarko, Tullow, Kosmos etc.)
 - NOC (PetroSA),
 - Local Ghanaian companies: E&P and Service providers
- Established Legal, Regulatory and Institutional Framework for Oil & Gas sector

HISTORY (1)

Onshore & Early Offshore Exploration

- First well drilled in 1896 onshore
- First 2D seismic acquired in 1968
- First offshore well drilled in Saltpond Basin in 30m of water in 1970

First Deepwater Well Offshore Ghana

- South Dixcove -1 drilled by Phillips Petroleum offshore Cape Three Points in 900 meters of water in November 1978.
- It established an Albian Source rock and a Turonian reservoir

Extensive acquisition of 2D seismic by GNPC and IOCs in Deepwater from 1988-2000

- Increased 2D seismic coverage led to increased deepwater drilling
- In 1999, Hunt Oil Company drilled the WCTP-2X well in deepwater in 900m of water and discovered oil.
- Hunt Oil declared the find non-commercial.

HISTORY (2)

Government awards large acreages to IOCs in Deepwater

- Increase coverage of 2D and 3D seismic data
- Steep relinquishment provisions in PAs
- Increase activity led to increase in data gathering and to a greater understanding of the geology of the deepwater areas.

Deepwater Drilling in Keta Basin to the east

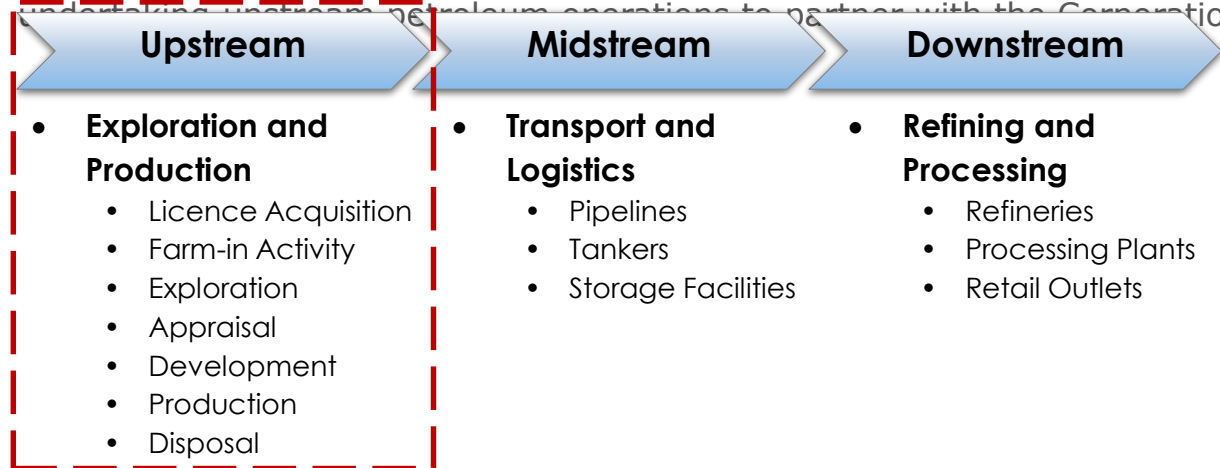
- Deepwater drilling in Keta Basins established thick reservoir presence
- No oil and gas discoveries made in the Keta Deepwater

First Significant or Commercial Deepwater Discovery

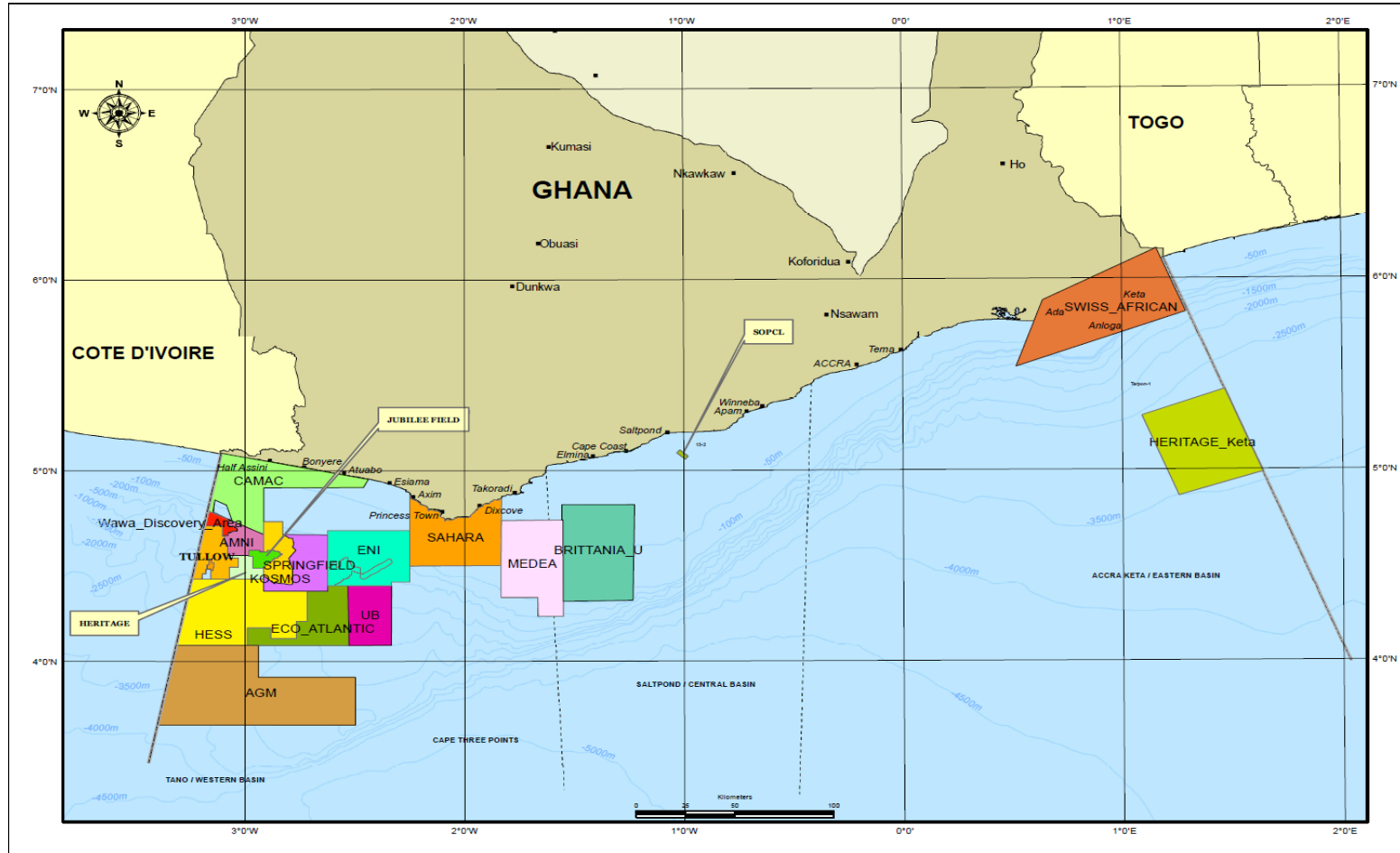
- In 2007 Mahogany-1 well drilled by KOSMOS in the West Cape Three Points License discovered over 100m (about 312ft net) column of high grade oil
- 23 deepwater oil and gas discoveries made between 2008-2014
- Over 80% exploration success rate

GNPC'S MANDATE AND OBJECTS

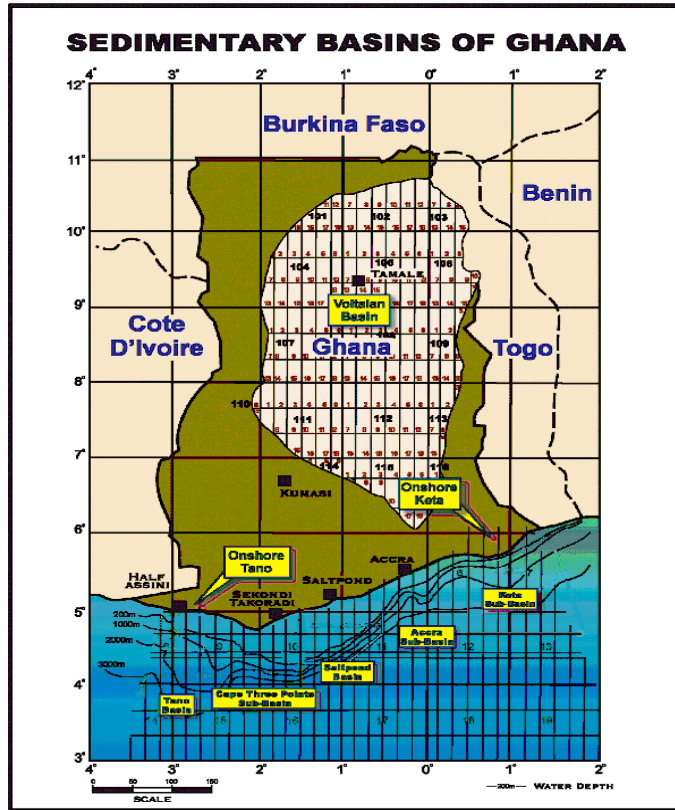
- Ghana National Petroleum Corporation was established in 1983 by GNPC Law 1983 (PNDC Law 64) as a **commercial strategic vehicle** for state participation in the oil and gas industry.
- The **Objects of GNPC** as enshrined in section 2 (1) of PNDC Law 64 are:
 “to undertake the exploration, development, production and disposal of petroleum.”
- The newly passed E&P Law continue to complement PNDC Law 64 by giving GNPC rights to undertake its mandate in all open blocks... and requiring all persons desirous of undertaking upstream petroleum operations to partner with the Corporation



GHANA'S OFFSHORE ACTIVITY MAP

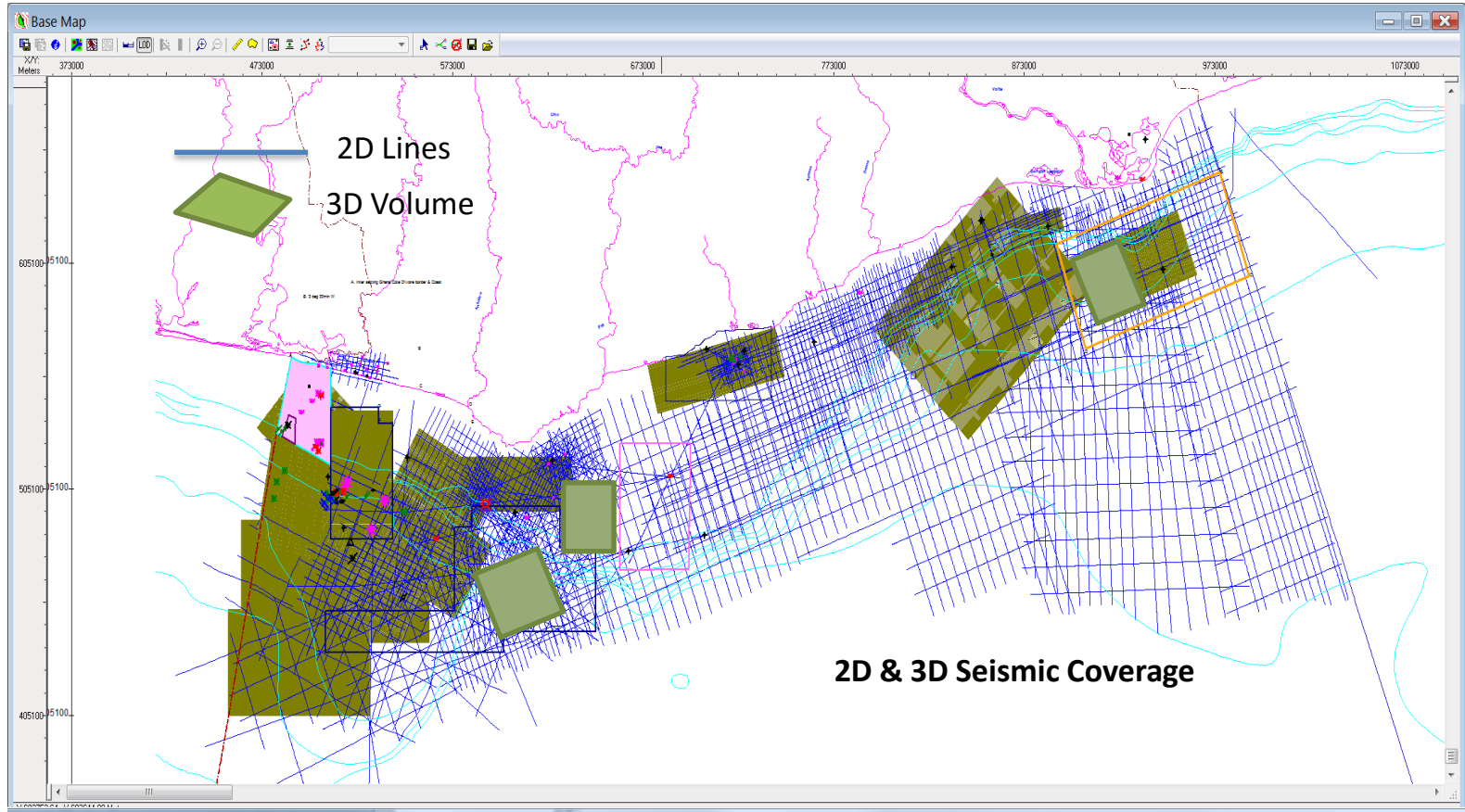


Sedimentary Basins in Ghana

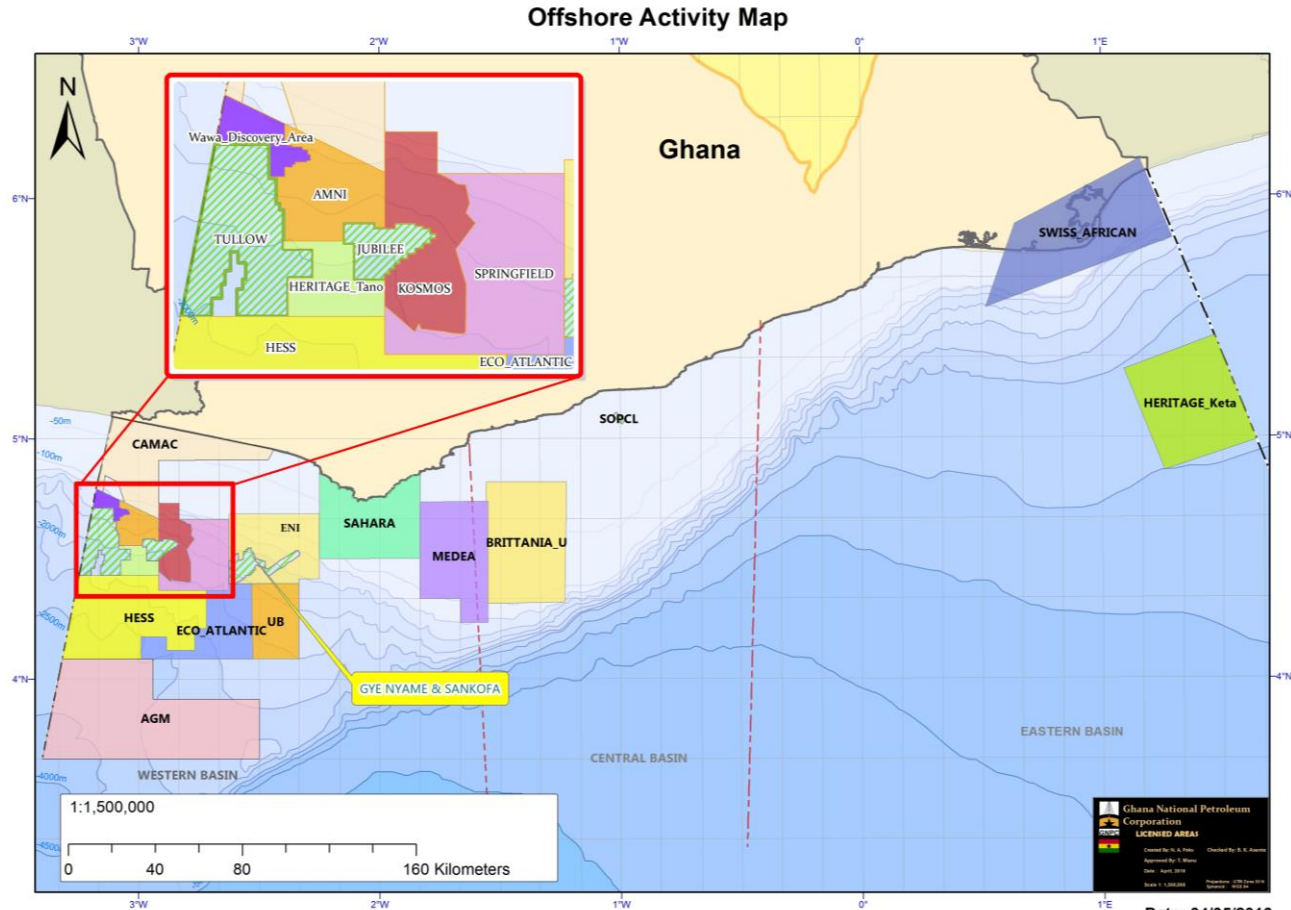


Basin	Status
Tano-Cape Three Points	Shallow/Deepwater well explored; Ultra deepwater unexplored
Saltpond	Shallow water moderately explored
Accra-Keta	Shallow water moderately Explored; Deepwater poorly explored
Voltaian	Huge Potential Untested; Barely Explored

Comprehensive Seismic & Well Database



Ghana Offshore Activity Map





REGULATORY ENVIRONMENT



LEGAL AND POLICY FRAMEWORK

Acts/Laws

- The 1992 Constitution of the Republic of Ghana
- GNPC Law (PNDCL 64)
- Petroleum Exploration & Production Act (2016)
- The Income Tax Act, 2015 (ACT 896)
- The Petroleum Revenue Management Act, 2011 (Act 815) – Amended in 2015
- Petroleum Commission Act, 2011 (ACT 821)
- Local Content and local participation Regulation

Policies

- Ghana Shared Growth and Development Agenda
- Energy Sector Strategy and Development Plan
- The Gas Master Plan
- The Gas Pricing Policy
- Local Content and Local Participation
- Model Petroleum Agreement (MPA)

Guidelines

- Guidelines For The Formation Of Joint Venture Companies In The Upstream Petroleum Industry Of Ghana (March 2016)

KEY HIGHLIGHTS OF THE NEW E&P LAW

New E&P Law passed by Parliament on 4th August, 2016 to replace PNDC Law 84 as the primary legislation to regulate Ghana's upstream petroleum sector.

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.

Some highlights of the new Law are:

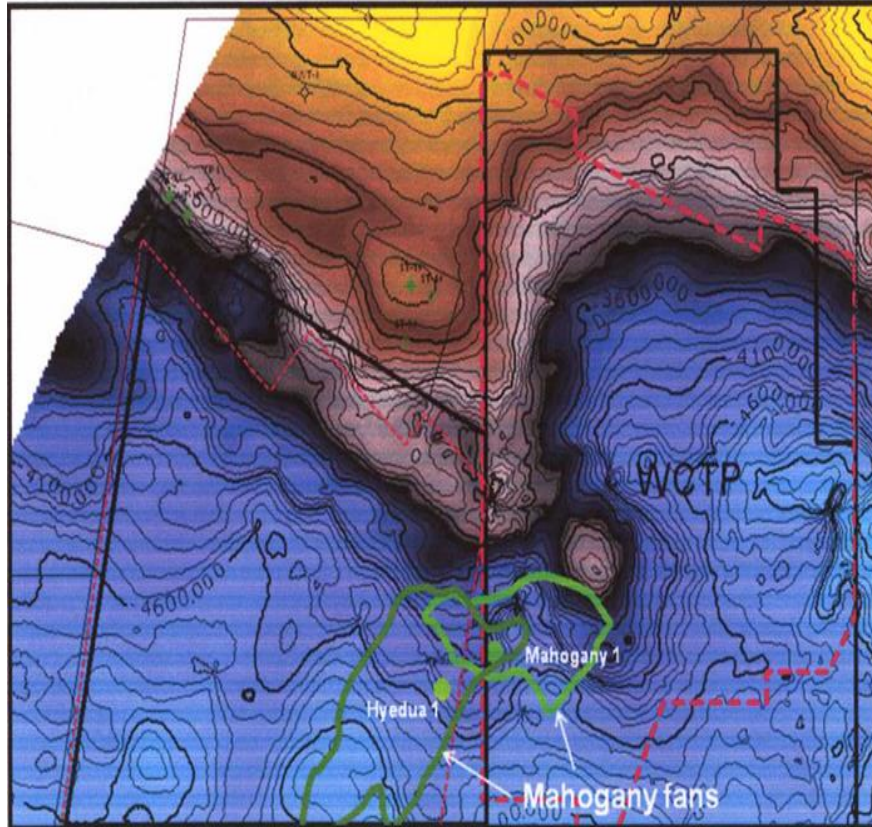
- GNPC remains a partner in all Petroleum Agreements with a minimum of 15% initial carried interest in plus Additional interest.
- The Corporation remains permitted to undertake petroleum activities in an open area which is not covered by a petroleum agreement.
- Any borrowings in excess of US\$30million for purposes of Exploration and Development will have to go to Parliament
- GNPC will have preemption rights if contractor is selling any stake;
- The new law clarifies the application of finance lease in respect of assets used in petroleum operations. The asset will be treated as a purchased asset if the finance lease charges exceed 75% of the cost of the asset.



UPDATE ON KEY PROJECTS

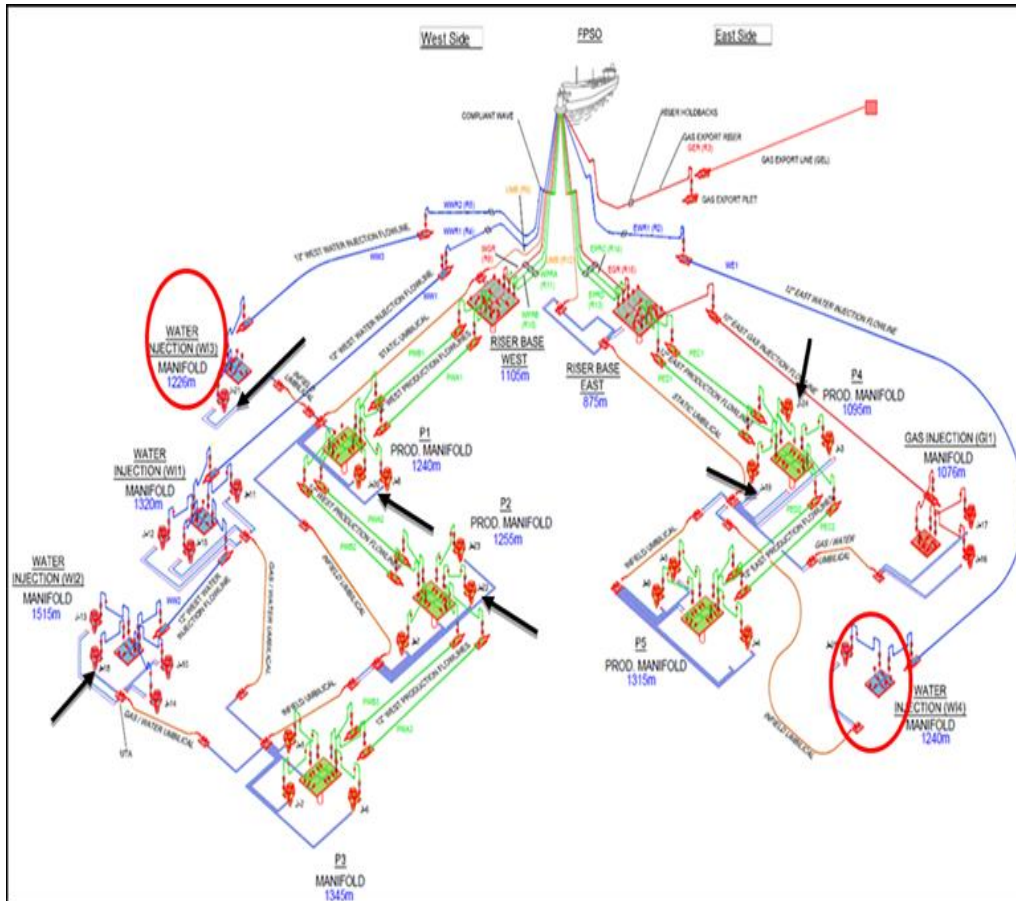


JUBILEE FIELD



- Mahogany-1 well discovered oil in June 2007
- Hyedua-1 well also discovered oil August 2007
- The two discoveries were found to be in the same oil pool
- Decision was taken to unitize the field at initial 50% WCTP:50%DWT
- 1st Redetermination completed in December 2011 at a split 54.37% WCTP and 45.63% DWT
- GNPC holds 10% initial interest and 3.64% additional paying interest (13.64%)
- Government of Ghana have 5% Royalty on gross production

Jubilee Field – Development Concept (cont'd)



Phase 1

- Plan of Development approved in July 2009
- Drilling and completion campaign completed
- All subsea infrastructure installed, commissioned and hooked up to FPSO
- First oil achieved on 28th November, 2010

Phase 1A

- Completed Phase 1A subsea infrastructure expansion
- Drilling campaign completed

Jubilee Field – Development Concept -



Greater Jubilee Full Field Development

– Greater Jubilee is the integration of Current Jubilee Field and Mahogany and Teak discoveries in the West Cape Three Points Block

– Preparation of Plan of development suspended as a result of Turret Bearing issue

Jubilee Field – Production Status

JUBILEE ANNUAL PRODUCTION



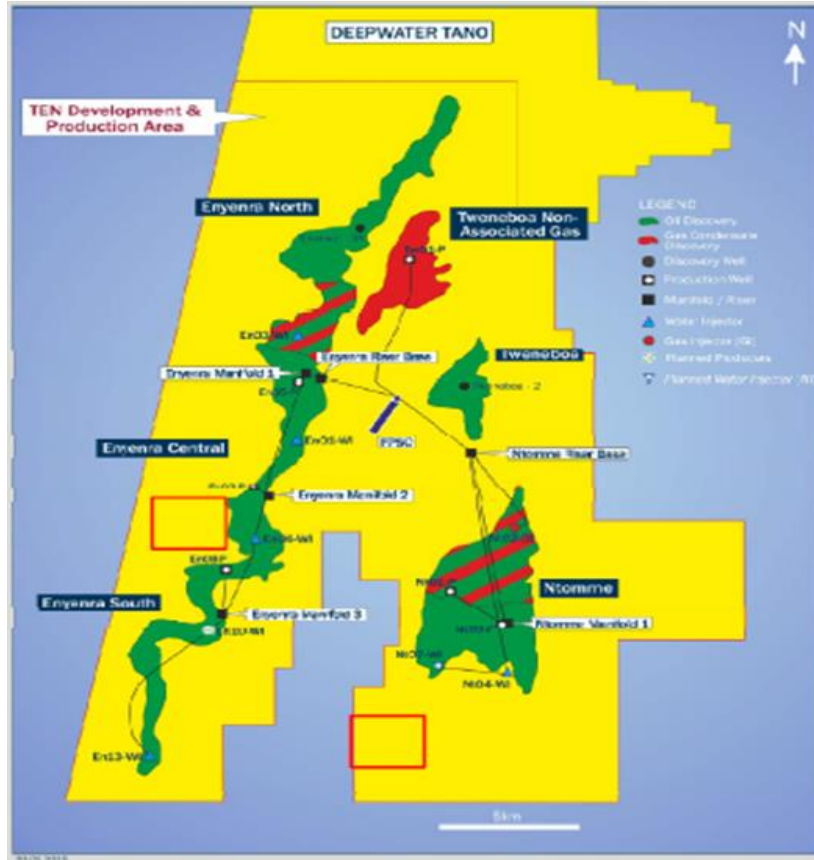
Production Status

- Total of 178.84 MMbbls produced over 5 years with average daily production above 100,000 bopd since 2013
- A total of 16.912 MMbbls produced as at August 2016 with an average daily production of 69,314.21 bopd
- Ghana group has lifted 31.99 MMbbls sold at an average price of US\$88.59/bbl
- Three (3) cargoes totalling (2,93 MMbbls) lifted on behalf on 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

Challenges

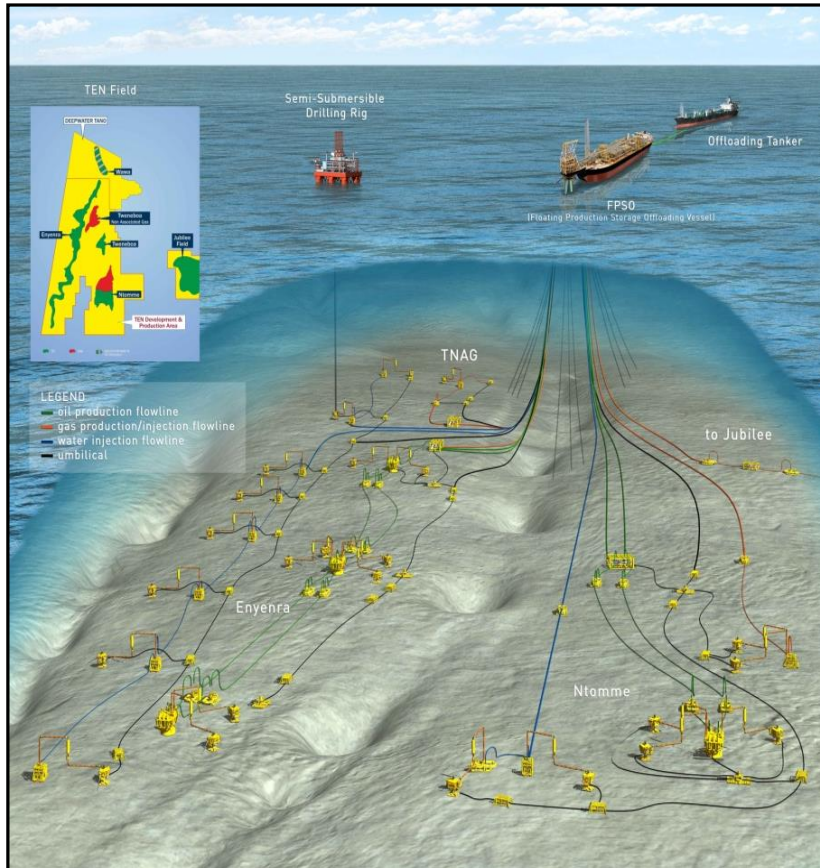
- Production impairment due to fines
- Damage of High pressure compressors
- Failure of Deck boiler
- Damage on the turret bearing of the FPSO Kwame Nkrumah

Tweneboa-Enyenra-Ntomme (TEN) Field



- Made up of Three fields:
Tweneboa, Enyenra, Ntomme
- FPSO capacity: 80,000 bopd
- Project spend: \$4bn to First Oil
- Wells: 24 in total / 10 for First Oil
- Total Reserves: 300 MMboe (239MMbo and 360 bcf of gas)
- Plan of development (POD) approved by the Minister for Petroleum on 29th May, 2012

Tweneboa-Enyenra-Ntomme (TEN) Field (cont'd)

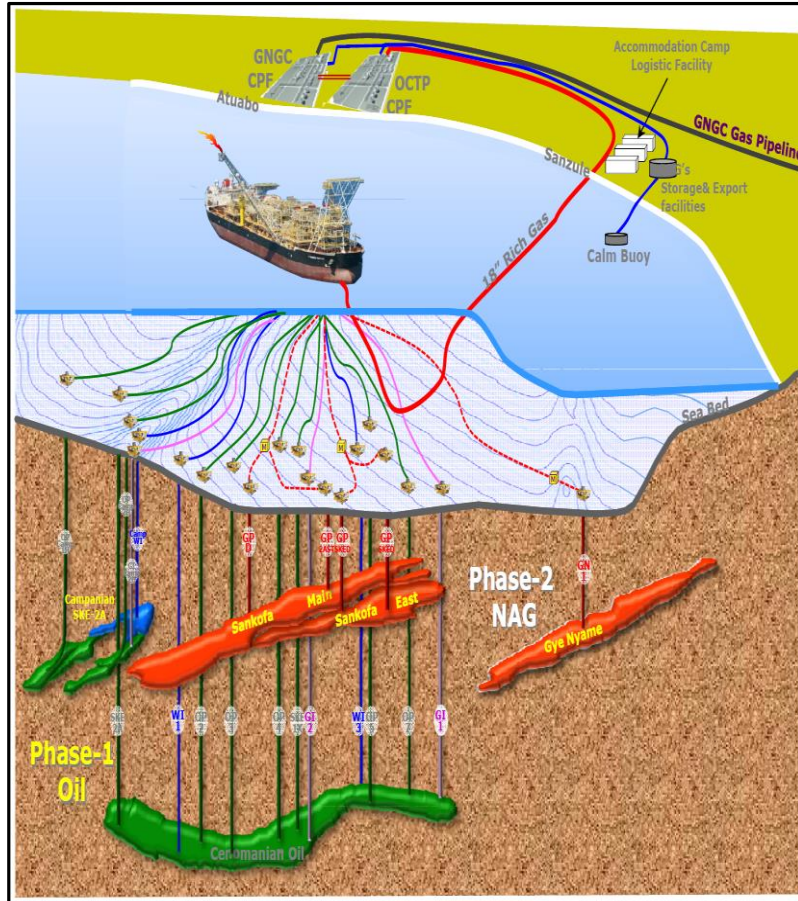


- The FPSO Prof. Mills which holds the world's largest turret of 3,055 tones arrived in Ghana on 2nd March, 2016
- First oil achieved on 17th August 2016
- Current production is at 31,600 bbls per day
- Expected peak oil production: 76,000bopd

TWENEBOA-ENYENRA-NTOMME (TEN) FIELDS (cont'd)

- First oil and gas project with important FPSO and Subsea production components fabricated in-country (FPSO spools, suction piles, mud mat, jumpers, sleepers and gas export manifold)
- 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
- The TEN Gas Sales Agreement expected to be negotiated between GNPC and its partners in the coming months
- Drilling operations on the field expected to resume after ITLOS ruling in late 2017

OCTP – SANKOFA GYE-NYAME



Integrated oil & gas development in 2 phases

Phase-1 Oil

- 8 oil producers
- 3 water injectors
- 3 Gas injectors
- Spread-moored FPSO
- Subsea tie-back in a daisy chain

Phase-2 development of NAG with oil

- 5 gas producers (4 Sankofa Main + 1 Gye-Nyame)
- Onshore Receiving Facility (ORF) at Sanzule
- 63km – 22" OD Gas export pipeline

Reserves

- 204 MMbbls of oil and 1,071 bcf of gas as at June 2016

OCTP – SANKOFA GYE-NYAME (cont'd)

Current project status

- The integrated POD was approved by the Minister of Petroleum on 30th December, 2014
- Awarded major contracts (FPSO – Yinson; Drilling and completion – A.P. Moller Maersk and SPS – General Electric - GE) in 1st Quarter 2015
- Gas Sales Agreement (GSA) and Heads of Agreement (HoA) were signed in June, 2015
- World Bank backed security package agreement signed - PRG (Partial Risk Guarantee)
- First oil and gas expected by August 2017 and February 2018 respectively.

OCTP – SANKOFA GYE-NYAME (cont'd)

Current project status

- 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 fro integration
- Overall progress of work was 54.3% against a target of 54.8% as at end of August 2016
 - Drilling operations – 38.0% against a planned of 31.7%
 - FPSO contract – 88.1% vs. 89.0% target); pre-commissioning activities commenced
 - SPS contract – (progress is 76.2% vs. 79.1% target)
 - Risers & Flowlines (R&F) – 37.1% versus a target of 36.0%



FUTURE TREND

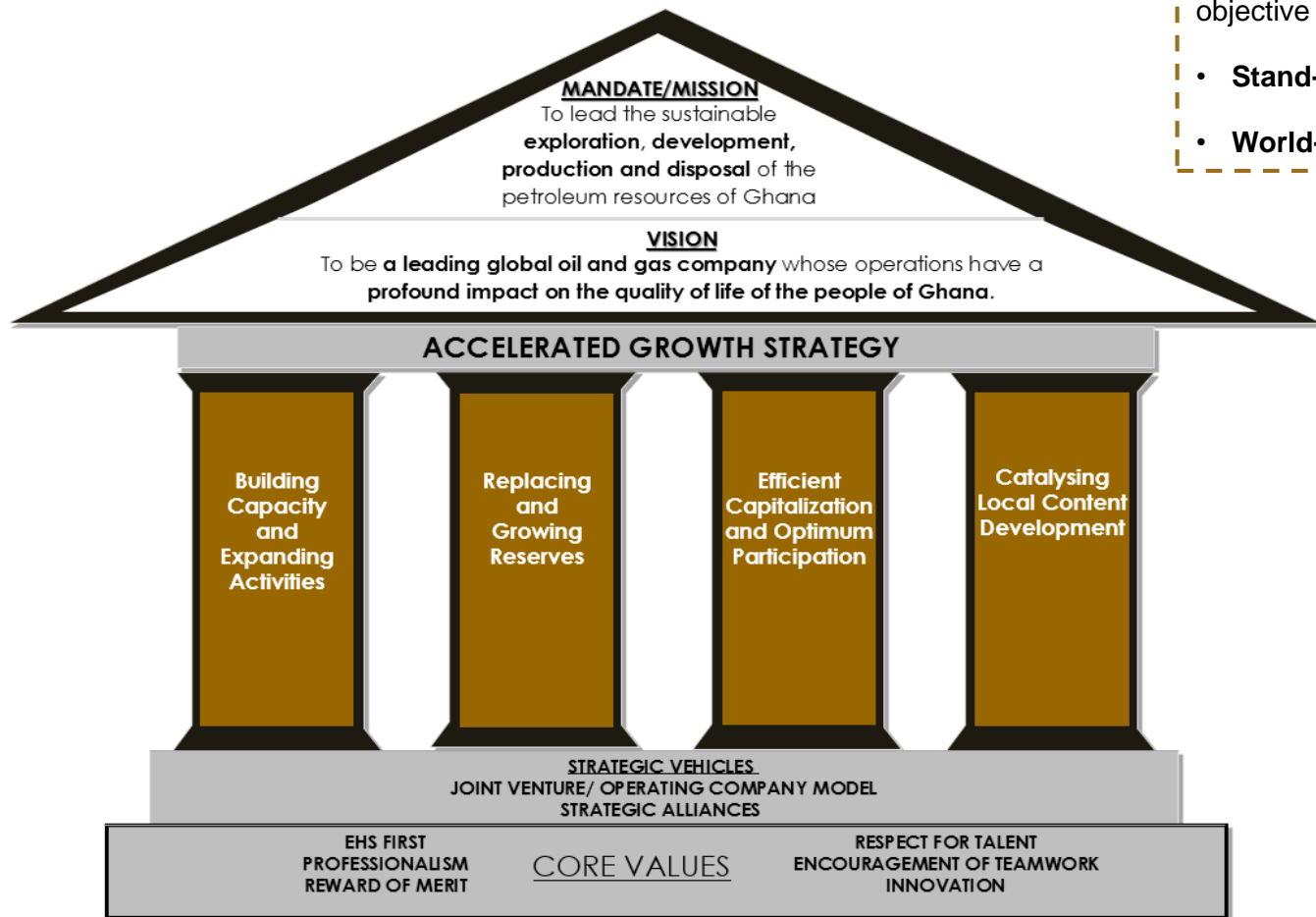
GNPC MANDATE



GNPC's Strategy

GNPC's overarching strategic objective is to be a;

- **Stand-alone operator by 2019)**
- **World-class operator by 2027**



Pillars of the Strategy

- ***Building capacity and expanding activities***
 - Investing systematically and prudently in building operating capability to manage a wider portfolio of producing assets.
- ***Replacing and growing reserves***
 - Investing in high impact initiatives for the replacement and growth of reserves.
- ***Efficient capitalization and optimum participation***
 - Securing capital at the lowest possible cost to maintain an optimum level of participation in petroleum operations.
- ***Catalysing local content development***
 - Expediting the creation of an appropriate environment for Ghanaian participation in the upstream sector of the petroleum industry.

Expected Outcomes of the Strategy

GNPC emerges a strong NOC-

- Becomes active independent operator
 - GNPC capabilities comparable to best in industry
 - Ensures better Ghanaian control over contracting process
-

Ghana Makes More discoveries

- Through expanded activities and investments
 - Both within Ghana and beyond at the right time
 - To replace and increase reserves
-

Ghana increases its share of daily production

- Boosting revenue to public funds
 - More fuel for power generation and industrial growth, thus improving energy security
-

Increased local content and local participation

- Supporting the development of a globally competitive local industry
 - Well integrated with the rest of the economy
 - Creating employment
 - Retaining maximum value for Ghanaians
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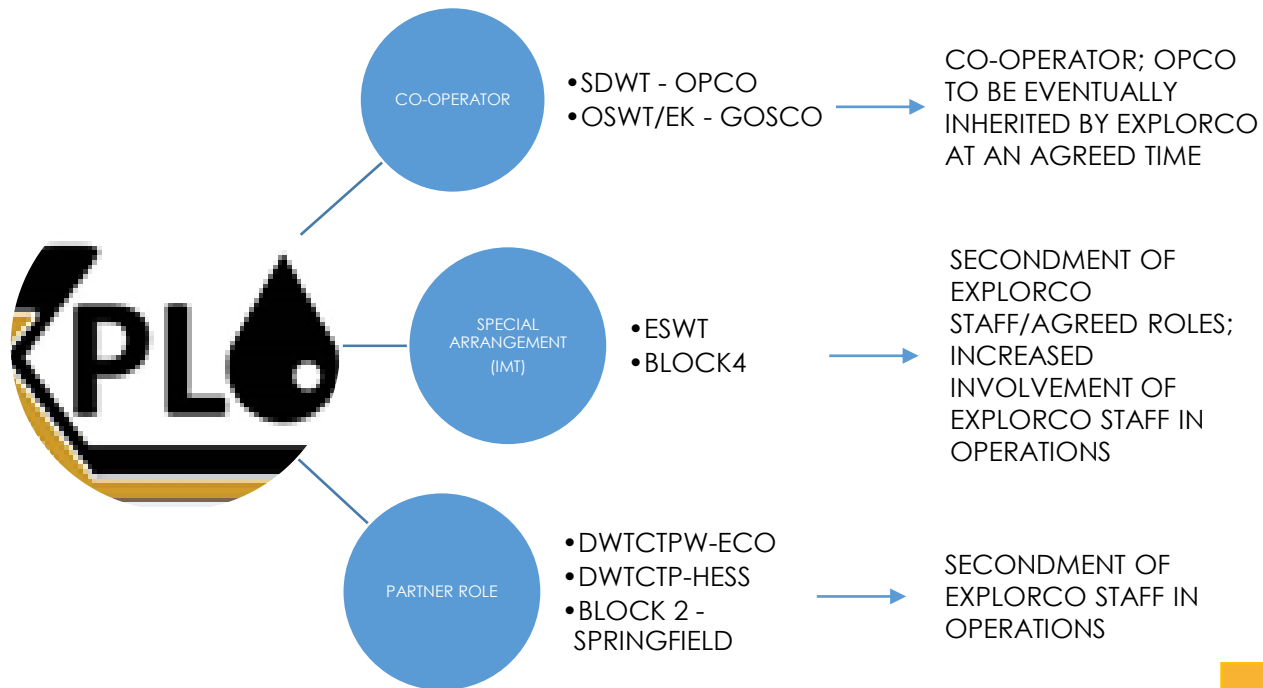
FUTURE TREND

HARNESSING RESOURCES
EXPLORCO
INCREASING PRODUCTION

EXPLORCO

- The Law that established GNPC, allows it to establish subsidiaries to perform operations on its behalf
- Explorco established in November 2012, is a wholly-owned subsidiary of GNPC. It became operational in December 2013.
- The GNPC Exploration and Production Company Limited (Explorco) was established:
 - **So GNPC can grow its interests and participation** in exploration and production activities in Ghana and beyond
 - As a GNPC strategic tool to achieve **rapid capacity building and technology transfer** to GNPC staff
 - As a separate entity to participate in E&P activities by taking on measured commercial risk in selected blocks, and building operating capability through the Joint Operating Company (“JOCs”) concept/model in partnership with world-class operators.

OPERATING STRUCTURES – ENHANCED PARTNERSHIP MODEL



ESWT

Operator: Erin Energy
Blk Size: 1506sq.km
Location: Shallow
Water Tano
Water Depth: 10 -200m
Explorco%: 22.5

OSWT

Operator: Heritage
Blk Size: 175sq.km
Location: Deepwater
Tano
Water Depth: 1000 –
 1500m
Explorco%: 8.8

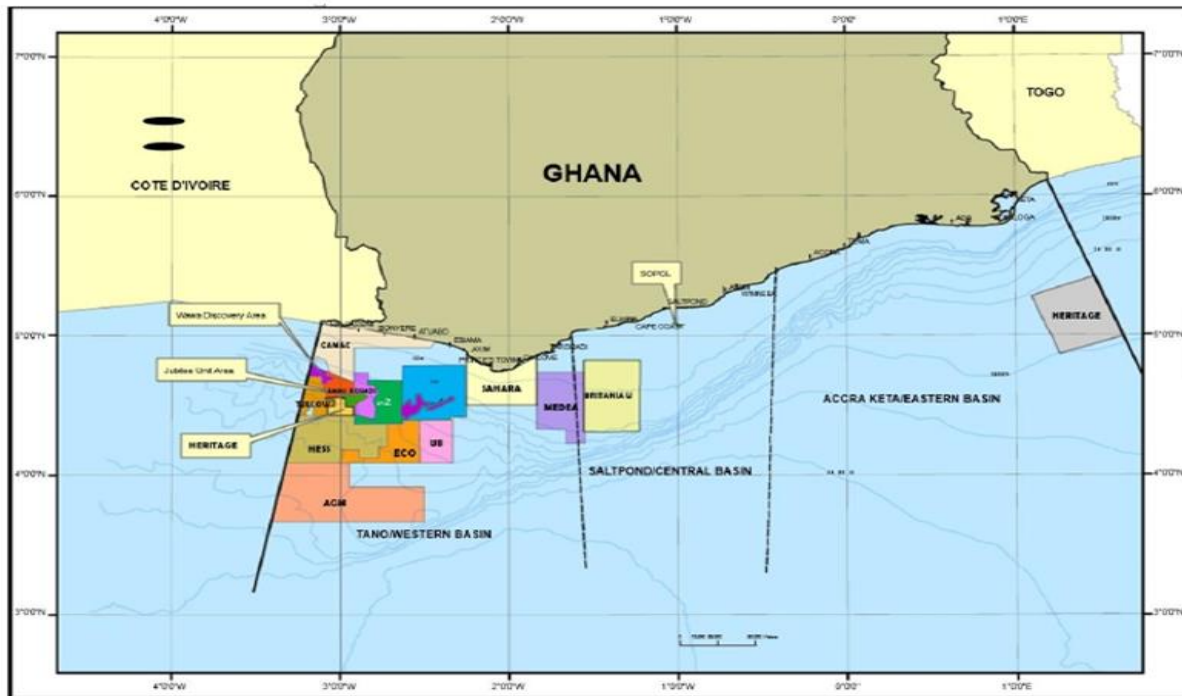
CTP BLK 4

Operator: Eni Ghana
Blk Size: 1127sq.km
Location: Deepwater
Tano
Water Depth: 300 –
 1800m
Explorco%: 4

WCTP BLK 2

Operator: Springfield
Blk Size: 673sq.km
Location: Deepwater
Tano
Water Depth: 800 –
 1700m
Explorco%: 10

EXPLORCO COMMERCIAL INTERESTS



- ESWT: Expanded Shallow Water Tano
- OSWT: Offshore South West Tano
- WCTP BLK 2: West Cape Three Points Block 2
- CTP BLK 4: Cape Three Points Block 4
- DWCTPW: Deep Water Cape Three Points West
- DWCTCTP: Deep Water Tano Cape Three Points
- SDWT: South Deep Water Tano
- EK: East Keta

DWCTPW

Operator: Eco Atlantic
Blk Size: 944sq.km
Location: Deepwater
Tano
Water Depth: 1500 –
 2500m
Explorco%: 4.35

DWCTCTP

Operator: Hess Ghana
Blk Size: 2009sq.km
Location: Deepwater
Tano
Water Depth: 2000 –
 3000m
Explorco%: 10

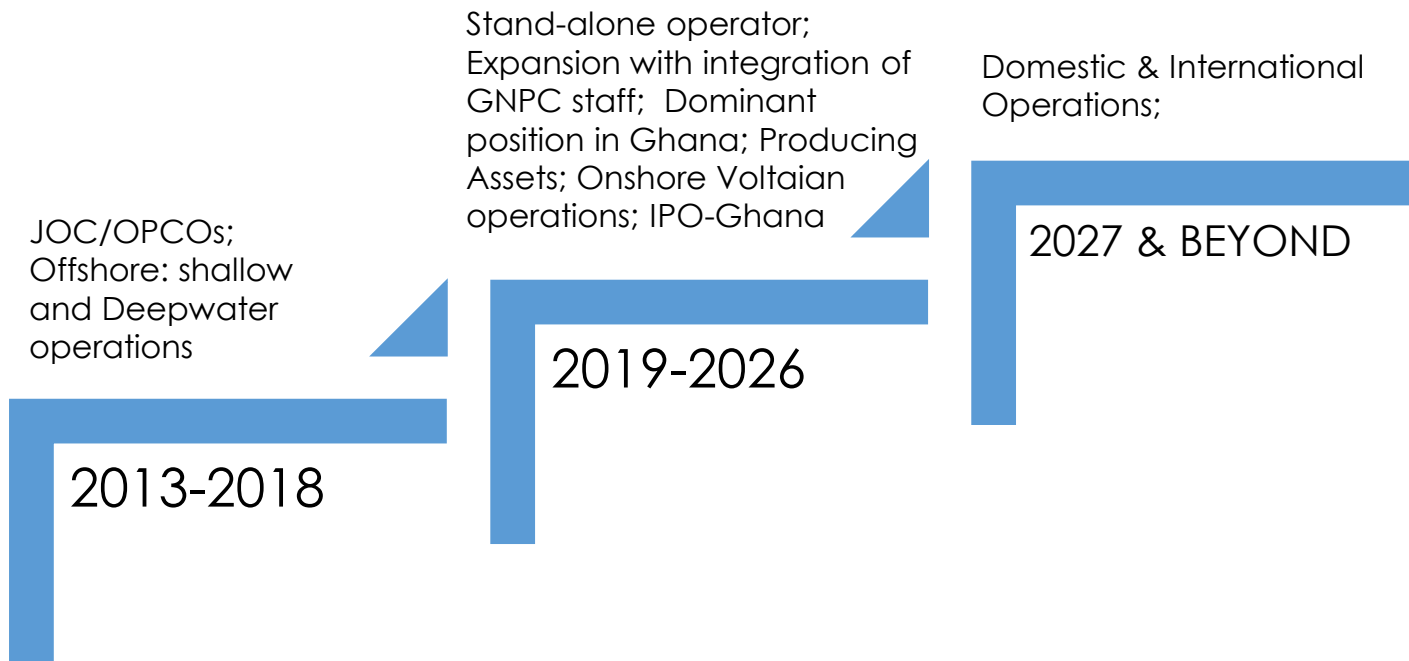
SDWT

Operator: AGM Ghana
Blk Size: 3482sq.km
Location: Ultra
Deepwater Tano
Water Depth: 2000 –
 3500m
Explorco%: 24

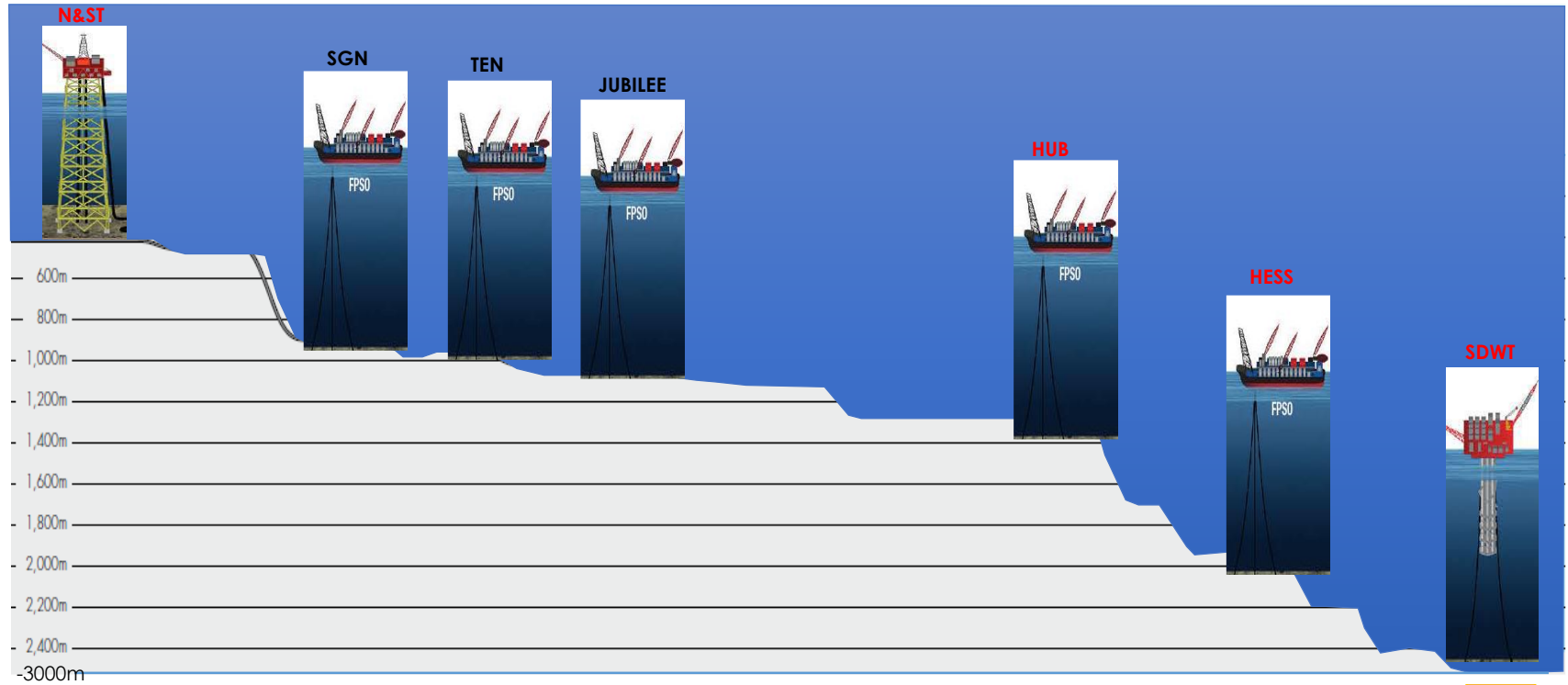
EK

Operator: Heritage
Blk Size: 2239sq.km
Location: Ultra
Deepwater Keta
Water Depth: 2900 –
 3500m
Explorco%: 11.6

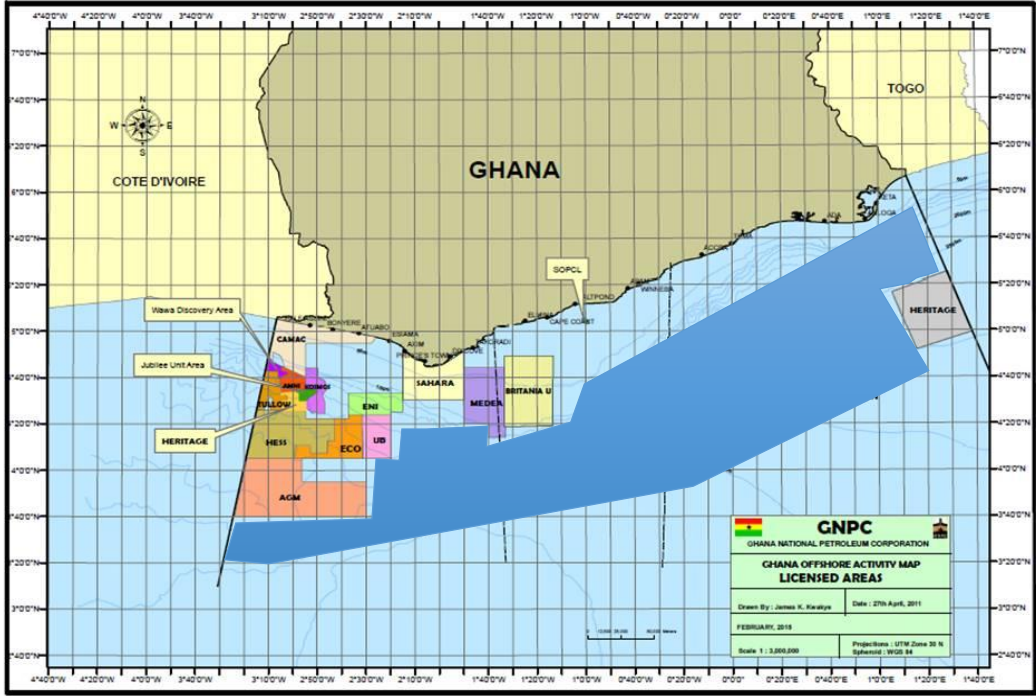
EXPECTED GROWTH



PROJECTED DEVELOPMENTS OFFSHORE GHANA



DEEPWATER EXPLORATION OPPORTUNITIES



Conclusion

- Ghana's oil and gas sector is nascent and very promising
- Ghana has a strong legal and regulatory framework governing upstream petroleum operations.
- GNPC is the commercial arm of government venturing into full scale upstream petroleum activities and has shed of all quasi-regulatory functions to the Petroleum commission
- GNPC per its mandate is focused on developing the upstream sector, and is evolving to become an integrated company with assets within various aspects of the value chain due to its gas resources
- Significant efforts are being put in place to build national capacity to actively participate in the sector
- GNPC has interest in projects across the upstream value chain - exploration, development and production
- Ghana's upstream sector is growing; Explorco is expected to be a key player in the industry

FPSO J.E.A Mills

For the TEN project



Thank you

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