

TULLOW OIL

TEN PROJECT





Workers preparing for lift and transfer of module onto FPSO, in Singapore

Tullow Oil plc is a leading independent oil & gas, exploration and production group, quoted on the London, Irish and Ghanaian stock exchanges (symbol: TLW). The Group has interests in over 120 exploration and production licences across 22 countries which are managed as three Business Delivery Teams.

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REALISING OUR POTENTIAL

Tullow’s operations began in Ghana in 2006, and a year later the world class Jubilee field was discovered and came on stream in 2010. Further exploration resulted in the Tweneboa, Enyenra and Ntomme (TEN) discoveries. The Plan of Development, to initially develop gross reserves of 300 million barrels of oil equivalent, and produce up to 80,000 barrels of oil equivalent per day was approved by the Ghanaian government in 2013. The total estimated gross cost of the project is \$4.9 billion. First oil is targeted for mid- 2016.

DEVELOPING THE TEN FIELD

The TEN field lies just 20 kilometres from the Tullow Oil operated Jubilee field and I am incredibly proud that Tullow Ghana is at the forefront of unlocking Ghana’s oil resources.

Tullow is committed to doing business in the right way; this means that we are developing the TEN Project in accordance with the highest international safety and environmental standards. It also means that we deliver on our commitment to create shared prosperity in Ghana by employing and training Ghanaian nationals, investing in capacity building and contracting Ghanaian companies.

We believe transparency and compliance with the laws of our host countries are key aspects of how we run our business.



CHARLES DARKU
TULLOW GHANA GENERAL MANAGER

Therefore, with the consent of the Government of Ghana, we have made our Ghana Petroleum Agreements public.

Tullow is committed to working with the Government of Ghana to ensure that the country continues to benefit as it develops its own oil sector and learns from countries with mature oil industries.

We continue to maintain a healthy working relationship with our regulator, the Petroleum Commission, which holds us to account.

TEN is a fantastic project and I am confident that Tullow and its partners will make Ghana proud.

Charles Darku,
Tullow Ghana General Manager

“The TEN Project is of huge strategic importance to both Ghana and Tullow, so it is pleasing to see it making good progress towards first oil in mid-2016.”

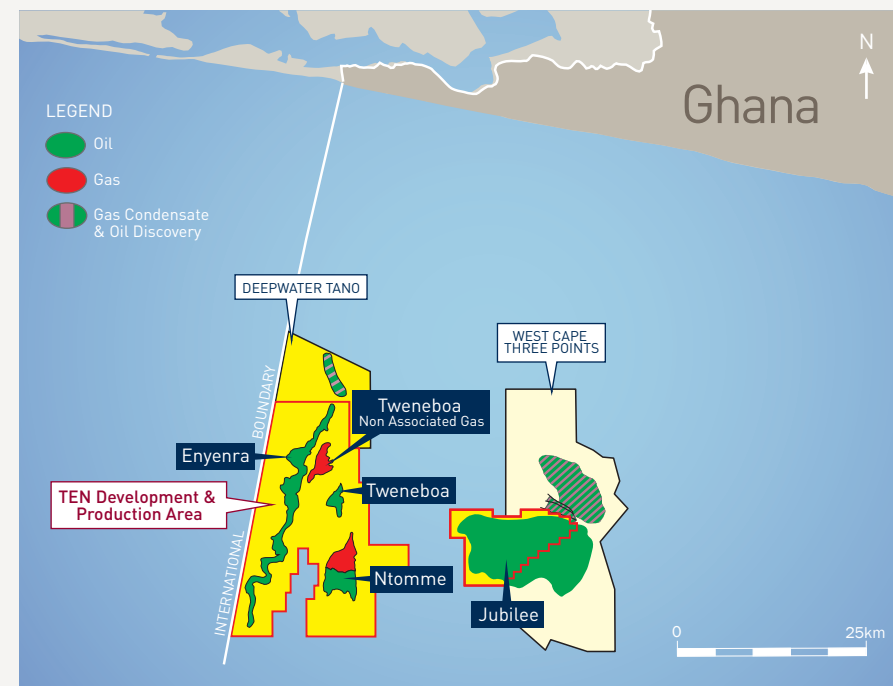
TWENEBOA, ENYENRA & NTOMME

Operated by Tullow, the TEN Project is Ghana's second major oil development. The project takes its name from the three offshore fields under development – **Tweneboa**, **Enyenra** and **Ntomme** – which are situated in the Deepwater Tano block, around 60 kilometres offshore Western Ghana.

First oil is scheduled for mid-2016 with a facility capacity of around 80,000 barrels of oil per day. The field will add significant high-margin production to Tullow's portfolio.

The TEN Plan of Development was approved by the Government of Ghana in May 2013, and by mid 2015 the project was over 65% complete. In Singapore, the conversion of the Centennial Jewel very large crude carrier (VLCC) into the TEN floating production, storage and off-loading (FPSO) vessel is nearing completion and the FPSO is on track to leave Singapore in late 2015.

All 10 pre-first oil wells were drilled ahead of schedule. Completion activities have commenced and should be finished by April 2016. In July 2015 construction vessels started to arrive at the field to begin installation of the subsea production system. The project remains on track and on budget and Tullow and its partners are working hard to deliver the TEN Project safely and successfully for Ghana.



TEN PROJECT KEY FACTS

FPSO facility capacity
80,000 bopd

Gas processing
Compression capacity
170 MMscf/d

Water injection
132,000 bwpd

Oil reserves being developed
240 mmbo

Gas reserves being developed
60 mmboe

Water depth
1,000 – 2,000 metres

Wells
10 wells at first oil; Up to 24 wells for full field development

Flowlines
70 km

Umbilicals
60 km

Risers
40 km



The West Leo rig which carried out drilling operations in the TEN field.

Partners' working interest

Tullow (operator) 47.175%, Kosmos 17%, Anadarko 17%, GNPC 15%, Petro SA 3.825%



THE TEN JOURNEY

Past, present and future project milestones

2013

May The Government of Ghana approved TEN Plan of Development

October Work began on FPSO conversion in Singapore

2014

Q2 All seismic work completed

July – August The FPSO's module support stools – fabricated in Ghana – arrived in Singapore

August FPSO entered dry dock

2015

January All 10 first oil wells drilled and project 50% complete overall

Q1 First subsea christmas tree assembly completed in Takoradi

Q2 Construction of the FPSO's mooring piles in Sekondi

Q3 First subsea installation vessels arrived in Ghana

Q3 FPSO turret testing to be completed

Q4 FPSO to depart from Singapore

2016

Q1 FPSO to arrive in Ghana

Q2 All pre-first oil wells to be completed

Q2 Umbilical and riser installation to be completed

Q2 Installation, hook-up and commissioning complete

Mid year First oil

2H 2016 Gradual production ramp-up



Module lift at Jurong shipyard, Singapore



Deck of FPSO before modules installed



TERRY HUGHES TEN PROJECT DIRECTOR

"We are proud to be on track to deliver first oil in mid-2016. The team is doing a fantastic job and we have hit every major milestone so far, including drilling 10 wells and achieving 65% completion of the FPSO conversion and subsea equipment fabrication. We remain focused on the major tasks ahead to deliver this huge project. The FPSO 'Prof. John Evans Atta Mills' setting off from Singapore to Ghana at the end of 2015 will be a significant milestone."



FPSO ON TRACK

The TEN FPSO will receive, process and store crude oil. The vessel, which is being converted from a tanker into an FPSO, will be permanently moored over the TEN field.

The conversion of the double-hull Centennial Jewel tanker began in October 2013 and it is on track to be ready to sail away from the Jurong shipyard in Singapore to Ghanaian waters in Q4 2015. The TEN FPSO will be named “FPSO Prof. John Evans Atta Mills”, after the late president of Ghana.

TEN FPSO KEY FACTS

- Length:** 340 metres
- Width:** 56 metres
- Total height:** 64 metres
- Accommodation:** 120 people
- Water depth:** 1,425 metres
- No. of risers/umbilicals:** 24
- Topside modules’ weight:** 18,000 tonnes
- Crude storage:** 1.7 million barrels



Centennial Jewel tanker arriving into Jurong shipyard, Singapore, prior to conversion into the TEN FPSO.

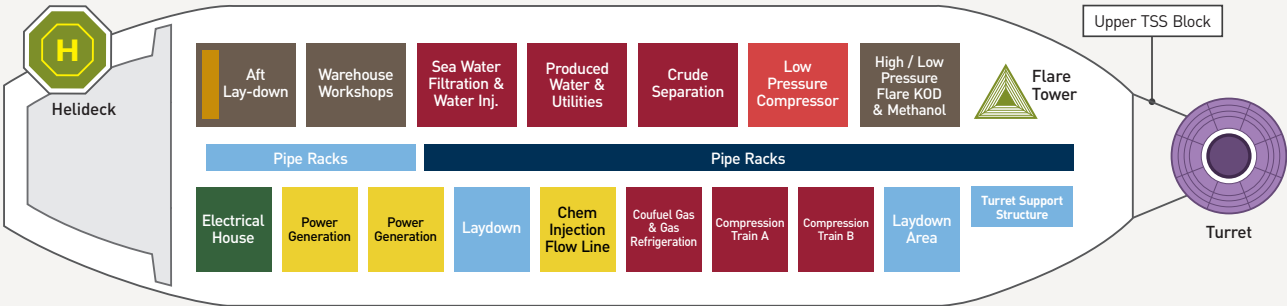
Modules installed on main deck of FPSO



FABRICATION YARDS FOR MODULE BUILDS

■	EPC Package #1 (ABB/WASCO – Batam)
■	EPC Package #2 (GPS – Batam)
■	Module Fabrication (DynaMac – Singapore)
■	Module Fabrication (DynaMac – Malaysia)
■	Module Fabrication (Aibel – Thailand)
■	Module Fabrication (JSL – (Singapore)
■	Module Fabrication (WASCO – (Batam)
■	Turret (Keppel – Singapore)
■	Helideck & Flare Tower (JSL – Singapore)
■	Metering Skid (Emerson – Singapore)

TEN FPSO MODULES



SUBSEA DELIVERY

The TEN Project will incorporate extensive subsea infrastructure; around 35,000 tonnes of equipment will be installed on the seabed.

This infrastructure is split into two work packages: Umbilicals, Risers and Flowlines (URF) and the Subsea Production System (SPS).

UMBILICALS, RISERS AND FLOWLINES (URF)

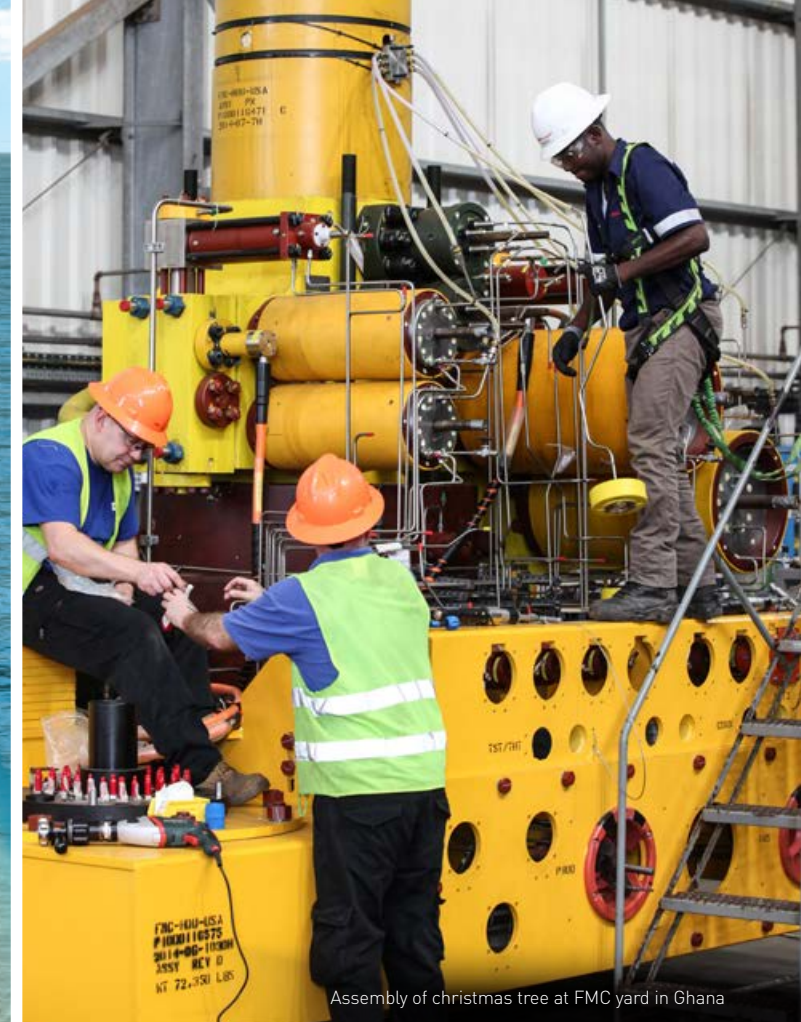
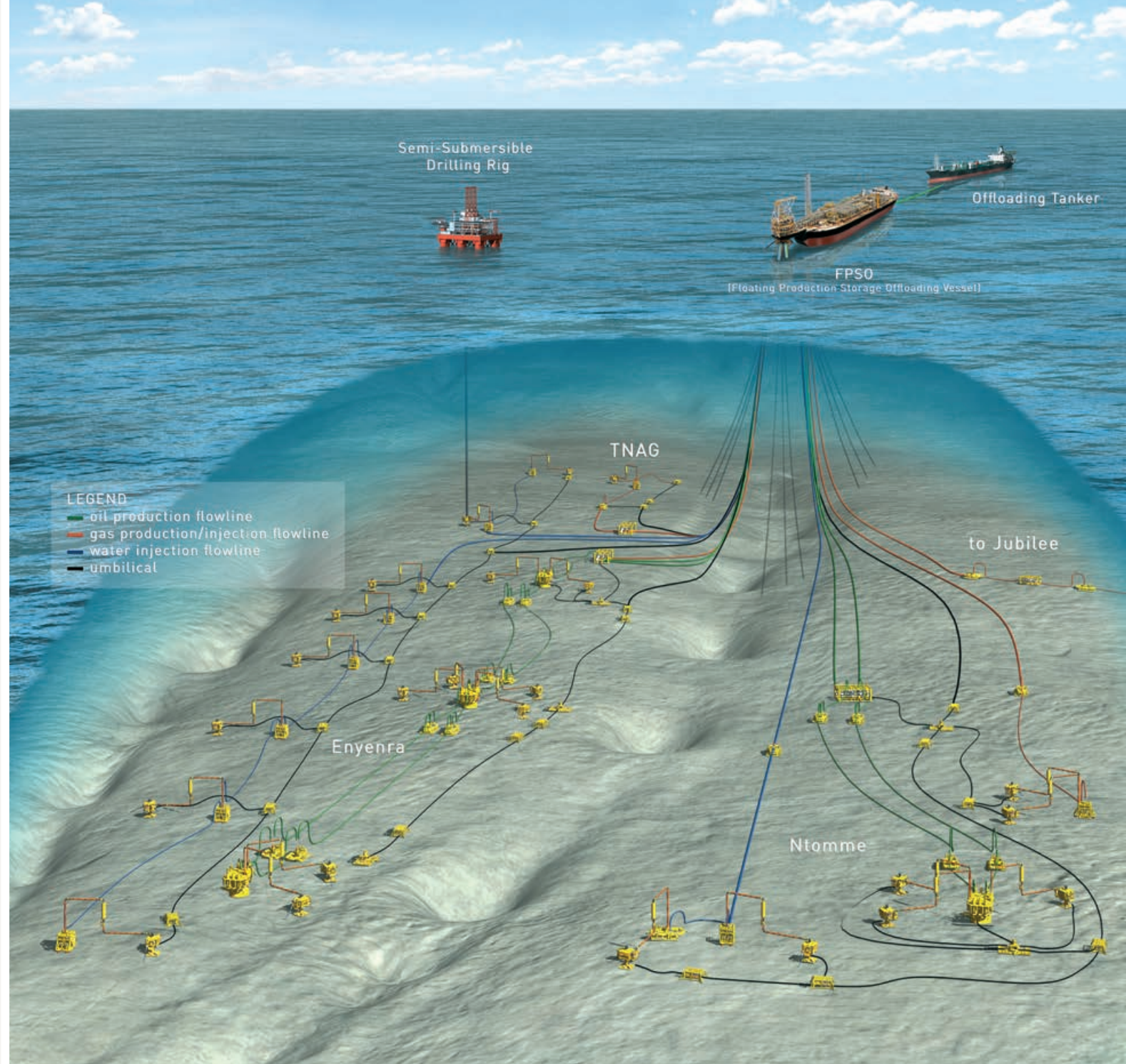
The URF component includes the flowlines and risers, which enable oil and gas to flow up to the FPSO. The umbilicals facilitate the transmission of electrical power, data, and hydraulic power from the FPSO to the subsea control system, enabling the wells to be monitored and controlled from the vessel.

The flowline system for TEN includes:

- Two oil production flowline loops;
- Three discrete water injection flowline systems;
- One gas production flowline system;
- One gas injection flowline system; and
- A gas export pipeline

SUBSEA PRODUCTION SYSTEM (SPS)

The SPS work package includes the subsea christmas trees, one for each well, which control the flow of oil, gas and water into and out of the wells. In addition, four production manifolds and two riser bases will be installed on the seabed. Oil and gas flows from the production wells to a manifold, where it is gathered and then passed along a flowline to a riser base. From the riser base, it flows directly to the FPSO.



Assembly of christmas tree at FMC yard in Ghana

FMC TECHNOLOGIES

Global oil services provider FMC Technologies, is fabricating subsea infrastructure for the project, including the christmas trees and manifolds.

The components for the christmas trees are being made at FMC's Headquarters in Houston, USA, before being shipped to Ghana. The kits are being assembled and tested at the FMC facility in Takoradi. This is the first time that this process has been carried out in Ghana, as the recently upgraded Takoradi yard, now boasts the state of the art equipment required.



Flexible riser system to be installed by Deep Pioneer



CHRISTMAS TREE

The primary function of the Christmas Tree is to control the flow of fluids out of or into the well. The tree has various valves to control the flow; it also provides chemical injection points and instrumentation to allow control and monitoring from the FPSO.



MANIFOLD

The subsea manifold is the facility that connects up to four subsea trees to the production flowlines. Its valves control the flow direction and inject the required chemicals.



RISER BASE

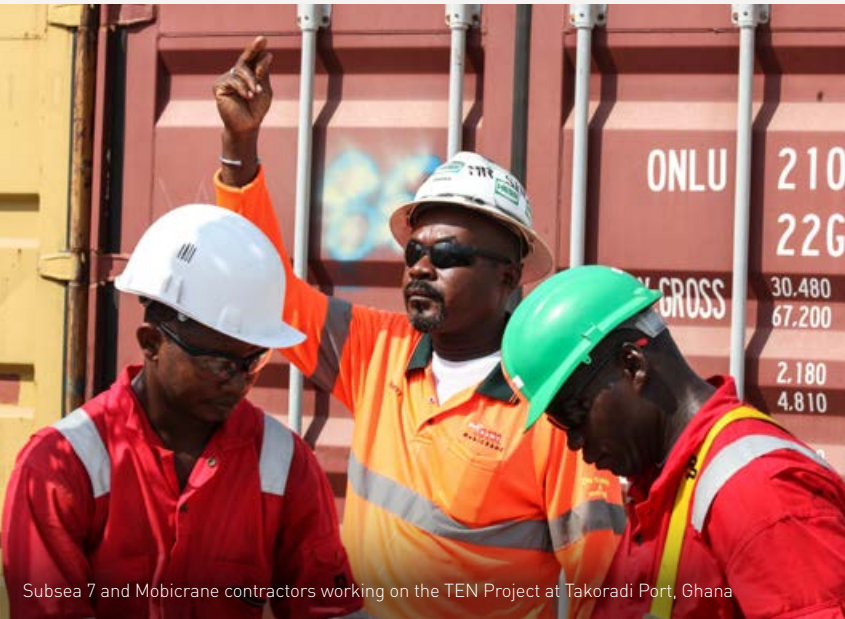
A riser base is the structure connecting the subsea flowlines to the risers. It injects gas into the production fluids, in order to enhance the lifting of the fluids on to the FPSO.

SUPPLY CHAIN MANAGEMENT IN A GLOBAL OPERATION

TEN is a truly international project, with major work being undertaken in Singapore, Malaysia, Thailand, France, Norway, the USA and Ghana.

Effective supply chain management plays a critical part in the delivery of the TEN Project. As a global project requiring contractor services from various parts of the world, supplier management is a core focus in order for our contractors to deliver the project in a safe, cost effective and sustainable manner.

The project is committed to maximising local content and all major contractors were required to submit local content development plans in their tenders. This has seen significant work completed in Ghana, including the construction of the FPSO's module support stools and mooring piles, the fabrication of subsea mud mats and the assembly of subsea christmas trees.



Subsea 7 and Mobicrane contractors working on the TEN Project at Takoradi Port, Ghana



Suction piles under construction at Subsea 7 yard, Takoradi, Ghana



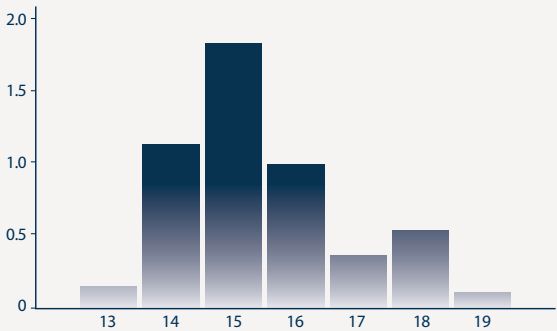
Propeller of TEN FPSO during construction in Singapore

COUNTRIES INVOLVED IN SUPPLYING INFRASTRUCTURE



- UK** – Main project team
- USA** – Christmas trees
- Singapore** – FPSO conversion, power generation and fabrication
- Ghana** – In-country project team and numerous services from local suppliers
- France/Norway** – Subsea production equipment
- Thailand** – Gas compression
- Malaysia** – Laydown area and fabrication of pipe racks

FULL PROJECT CAPEX (\$ BILLION)



BUILDING CAPACITY

GNPC SECONDEES

Tullow has an agreement with the Ghana National Petroleum Corporation to develop a number of GNPC employees through secondments at Tullow. Four GNPC engineers are seconded to the project team in London until first oil to gain experience of managing a major offshore development project. Three more GNPC secondees have joined the FPSO team in Singapore to gain experience of an FPSO conversion project.

SUPPLIER WORKSHOPS

In collaboration with the Ghana Petroleum Commission, Tullow Ghana ran a series of workshops for Ghanaian small and medium sized enterprises (SMEs) to learn more about accessing TEN Project contracts. Held at the Enterprise Development Centre in Takoradi, TEN contractors presented their work package requirements and tendering processes to the SME representatives and answered questions from suppliers. The workshops received positive feedback from the attendees.



RESPONDING TO LEGISLATION

Ghana's local content and local participation law, passed in 2014, requires that Ghanaians are prioritised in terms of employment and local business opportunities in the petroleum industry. To achieve this objective, the local content legislation also outlines the support required by international companies to develop local capability through education, knowledge and skills transfer.

We began our commitment to the local sourcing of goods, services and expertise in 2008 when Tullow was designated field operator. In response to the new legislation, Tullow has focused on building local capacity so that Ghanaian businesses can bid successfully for contracts in the oil and gas industry. As a result, a number of local companies are now part of our supply chain.



Welding operations at Seaweld plant in Takoradi, Ghana



GNPC engineers on secondment in Tullow's London office

EHS IN THE TEN PROJECT

Tullow is committed to protecting the health and safety of its employees and contractors and manages the TEN Project's EHS performance through a comprehensive EHS management plan. Embedded in supplier contracts are Tullow's EHS standards which set out what we require of our major contractors and their sub-contractors. While Tullow does not have operational control at any of the TEN construction sites, we have a range of EHS initiatives to influence behaviours and ensure our standards are being upheld. One example of such an initiative is our "Behaviour is a Choice" programme that sets out practical advice on how to intervene on site and provide feedback on any 'at risk' behaviour observed. This was supported by the 'At Risk' behaviour pocket guide, which is available in seven languages and used by the workers on our sites across the globe.

In 2014, we achieved our Lost Time Injury Rate target of 0.7 (the number of Lost Time Injuries per million man hours worked) with a rate of 0.67. Nevertheless, we continue to review and incorporate learnings from each incident and circulate an 'EHS wake up call' presentation across all of our contractors on a monthly basis so they can learn from each incident.

CONTRACT MANAGEMENT CRITERIA

Technical & Operational

The operational performance of the contract and contractor's progress against their technical plan.

EHS

The contractor's EHS performance represented by Tullow's EHS scorecard, comprised of leading and lagging indicators.

Commercial

The commercial performance of the contract, including payment performance, cost recovery and commercial progress against plan/budget.

Local Content

The contractor's execution of their Local Content plans, including staff numbers, training and development, and procurement of local goods and services.

Compliance

The contractor's compliance with Tullow's Code of Business Conduct and Anti-Bribery and Corruption legislation, and its ability to demonstrate controls to that effect.

GLOBAL SUPPLY CHAIN FACTS

80%

of hours worked on Tullow projects completed by contractors.

\$2 billion

Spent with suppliers.

2,240

suppliers working directly for Tullow in Uganda, Kenya and Ghana.



HON. EMMANUEL ARMAH-KOFI BUAH
MINISTER FOR ENERGY AND PETROLEUM

"I am delighted that the TEN Project remains on track and is delivering benefits to Ghana. I visited the FPSO last year and it was fantastic to see components made in Ghana installed on the deck of the vessel.

"Earlier this year I was able to see for myself the capacity building that is ongoing when I visited the new fabrication facilities in Sekondi-Takoradi and I am optimistic for the future of our young oil industry in Ghana."

LOCAL PARTICIPATION

The TEN Project has built on the achievements of the Jubilee development to increase the amount of work undertaken in-country and achieve a number of firsts for Ghana.

TEN is Ghana's first oil and gas project where important FPSO components have been fabricated in-country. The FPSO's module support stools, which attach modules to the deck of the vessel, were fabricated in Takoradi and Tema by indigenous Ghanaian firms, Seaweld Engineering Ltd and Orsam Ltd.

FPSO's nine anchor piles, which will anchor the vessel to the seabed, were fabricated at a new facility in Sekondi, Ghana. They were completed on time and have now been successfully loaded out for installation.

Vital subsea production equipment is also being fabricated in Ghana. Harlequin International Ghana Ltd is making the subsea mud mats, and Subsea 7 has constructed a new fabrication base in Sekondi where it is fabricating anchor piles for the subsea manifolds. The subsea christmas trees for the project will be assembled and tested by FMC Technologies at their state-of-the-art facility in Takoradi.

In addition, Hydra Offshore Group is supplying Ghanaian engineers for the project.



Anchor piles for FPSO being loaded onto vessel in Sekondi, Ghana



Orsam fabrication yard, Tema, Ghana



Harlequin staff, Tema, Ghana

INVESTING IN GHANA

HYDRA OFFSHORE GROUP

Accra-based Hydra Offshore Group is a Ghanaian-owned offshore and subsea engineering services company. The group, which was founded two years ago, has been engaged by TEN Project engineering services contractor, Wood Group Kenny, to provide engineers for the development.

Ghanaian engineers from Hydra are now working with Wood Group Kenny in their London and Houston offices, enabling the knowledge transfer that will see Hydra engineers working on all stages of the TEN Project.

HARLEQUIN INTERNATIONAL GHANA LIMITED

Harlequin International Ghana Ltd has been engaged by TEN Project subsea contractor FMC Technologies to manufacture subsea mud mats for the development. The mud mats will sit on the seabed in the TEN fields, supporting subsea production equipment.

Following the award of the TEN Project contract, Harlequin has opened a new fabrication base in Takoradi to supplement its modern workshop facility in Tema.

The award of the contract has also enabled Harlequin to send some of its staff to South Africa to gain internationally recognised welding qualifications.





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