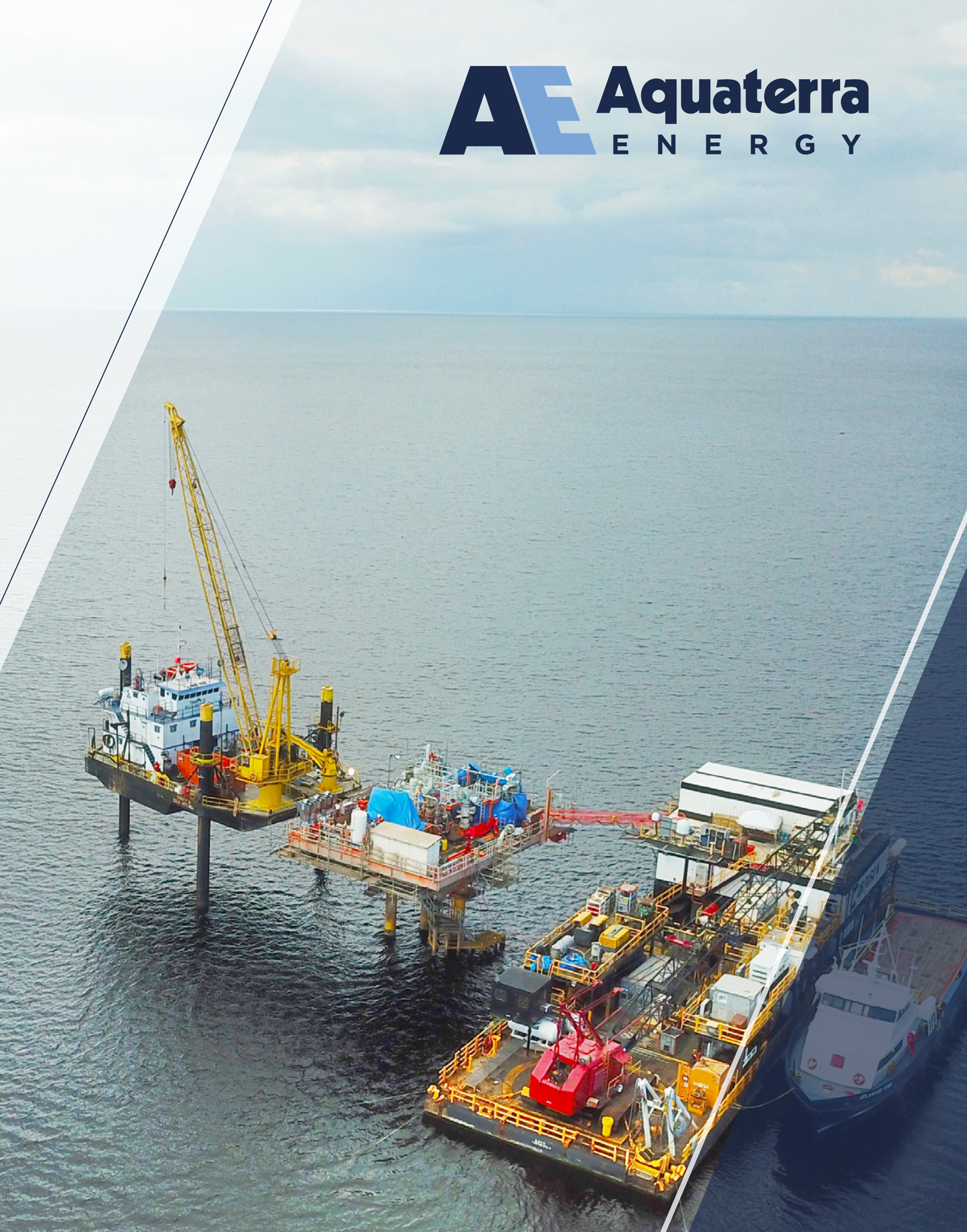
Aquaterra ENERGY

Sea Swift:
Platform Solutions
Key Projects and Experience



Sea Swift Offshore Platform

Our flagship offshore platform Sea Swift delivers rapid returns in shallower waters, designed to minimise build and implementation times, to reduce capex, emissions, and time to first oil or gas.

Modular by design, Sea Swift can be adapted to meet a range of field development requirements:

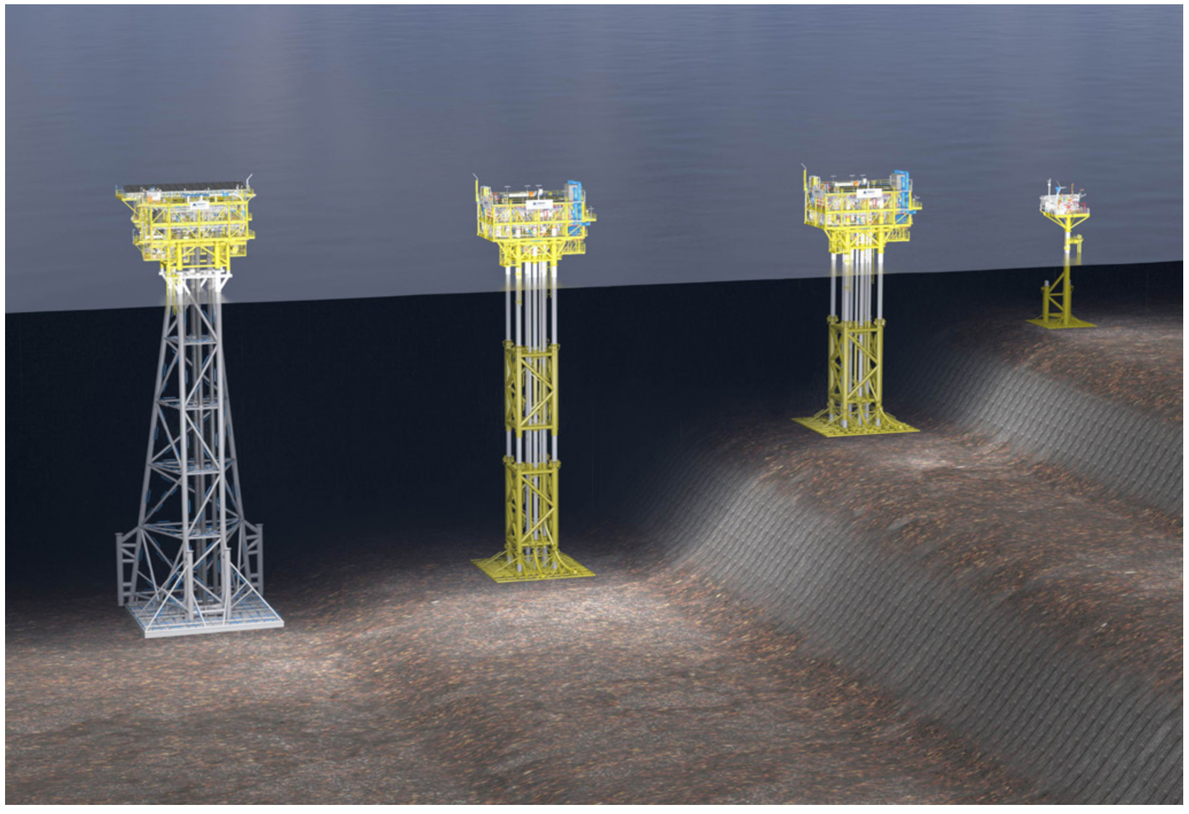
- Monopile designs – quick to deploy, for when you only need a minimal topside or have one or two wells
- Conductor supported designs with up to 500Te topsides – ideal as a stand-alone platform in water depths of up to 100m, or the perfect bolt on to an existing platform when you need extra capacity
- Jacket supported designs – for when soil conditions or topsides requirements mean that you need that extra bit of support, or where a CSP is not the preferred option
- Smart designs – enhance your topsides with the latest in digital onshore monitoring technology, to reduce offshore trips and day-to-day maintenance/inspection

Due to Sea Swifts modularity, it can be fabricated in-country no matter the size of the fabrication yard. It also means it can be installed by infrastructure you might already have in-country, such as a jack-up rig. This approach maximises the use of the assets that are a “must have” for the overall development, whilst removing (where possible) the need for additional installation assets. By doing this we aim to not only reduce the overall cost of your development, but also provides a verifiable reduction in the overall carbon footprint, supporting your project decarbonisation efforts.

Sea Swift platforms can be delivered faster than traditional offshore platforms, typically around 10 – 18 months - our phased approach to installation means that drilling can begin, whilst topsides structures are finalised.

The end-to-end, simplified design, reduced steel requirement and focus on using in-country logistics and fabrication facilities keeps expenditure low and helps control project costs.

- Lower capex
- Accelerated time to oil or gas
- Robust design
- Adaptable for a range of field development requirements
- A natural fit for the energy transition, can also support CCS, wind and hydrogen developments



Supporting your decarbonisation efforts

Our Sea Swift platform offers a number of inherent decarbonisation advantages to help customers adapt to the energy transition:

Lower manufacturing and shipping emissions

Can be designed with up to 30% less steel than off-the-shelf jacketed options, Sea Swift incurs lower manufacturing and shipping emissions.

In-Country Infrastructure

Installation via jack-up removes the need for heavy-lift barges, which are highly emissions-intensive due to fuel consumption – especially if they must travel long-distances between projects.

Local Content

Sea Swift is modular and can be fabricated in-country no matter the size of the fabrication yard. This both reduces transportation emissions and brings increased economic benefit to local markets.

Renewable

Sea Swift can be fully powered by renewable sources, such as wind and solar. This eliminates the need for traditional diesel generators for power, significantly reducing emissions including those associated with the maintenance and logistics for refuelling visits to the platform.

Transparency of Emissions

Using our own in-house Carbon Calculator, our team of engineers include a full breakdown of project related emissions with our proposals – from steel to delivery.

Location:

Angola

Platform Design:

Stacked Template Structure/
Conductor Supported Platform

Key Features:

- 62m water depth
- 8 slots, 12 wells for production (single and dual completions)
- 42” Conductors have dual functionality of providing structural support of the platform and 36” well conductors
- 8m x 8m well configuration
- Fully installed by jack-up rig
- Standard rig operations used
- Dual access to the platform by surfer boat via ladder
- Functionality for ESP and ASD equipment
- Flexible production and water injection pipelines and power umbilical used
- 163T mudmat; L:22m x W:22m x H:4m
- 315T lower subsea structure; L:9m x W:9m x H:20m
- 286T upper subsea structure; L:9m x W:9m x H:20m
- 130T drilling Deck Module; L:11m x W:13m x H:6m
- 337T production deck module; L:12M x W:20m x H:8m

Background

Our client required the development of new assets to create further production for Angola, with a primary objective to improve skill sets within local communities under the mantra “Built in Angola, by Angolans, for Angola”. This would create a new factory model for their future project delivery.

Fabrication and assembly were to be conducted in Cabinda, using facilities which hadn’t produced platforms since the initial development of its field assets dating back to 1970s. The existing field blocks had untapped reserves, and the challenge was to bring new production online in a timely and cost-effective manner, using local fabrication facilities and resources.

A Stacked Template Structure design (STS) was considered for inland fabrication in small module packages to allow road transport by trucks to the new construction site for final assembly, and loadout at the newly built quayside. The loadout facilities we only available to accommodate up to 500Te modules. Mobile cranes were to be used for each modular loadout onto PSV’s, due to quayside water depth restrictions.

Cost and time were key project drivers, along with developing local resources to support and create the infrastructure for future STS factory model platform production. Previous concept designs had been challenged by Aquaterra Energy to reduce the equipment requirements ensuring only functional operation equipment was required. Previous iterations of concept design had indicated a 1500Te + topsides weight due to electrical equipment was needed to exploit the reservoirs

Limiting the complexity of the offshore facility was a key project driver, to ensure the full installation works could be completed with the use of a jack-up rig only removing the requirement for mobilising a heavy lift vessel.

Solution

Throughout the detailed design, Aquaterra Energy worked closely with suppliers, the client and the Angolan fabricator to design the STS structure into modular units for fabrication in the existing facilities. This also allowed them to be transported by road using trucks to the assembly area for final erecting to build the STS platform modules.

The STS factory model was the first of its kind to be constructed in Angola since the 1970’s. There were several challenges during the design phase that required careful consideration for a diverless installation. Each structural item was designed be erected under water with the use of a jack-up and an ROV.

Aquaterra Energy engineered a solution for the 62m water depth consisting of a mudmat and Lower/Upper Subsea Structure that was supported using a drilling deck module for early production (if required), plus a topside containing all the electrical and production facilities.

The substructure design was the third configuration successfully used to reduce cost, complexity, and time to first oil. The STS was designed not to exceed the weight limit and to ensure that all structural items had the ability to be lifted from the offshore support vessels using the jack-up rig within its operational capabilities.

Production utilises integrated ESP and associated ASD equipment on the 24 x 12m topside which is managed from a remote location.

Results

The platform was designed both in the UK and Angola, with all construction completed in Cabinda and delivered to the quay side - increasing the local content skill set. We supported with training operations teams and driving long term engagement with the local operations team.

The project was successfully fabricated, and installation completed during the Covid-19 pandemic.

ESG:

- 100% fabricated in-country
- Approx. 30% less steel required for Stacked Template Structure (STS), compared with a standard conventional jacket
- Generated over 1m local content hours of employment
- Zero LTIs
- Utilising existing in-country infrastructure for installation created savings on transport emissions
- Knowledge transfer and in-house training of platform and usability which supported enhanced skill set of local workforces

Location:

Trinidad and Tobago

Platform Design:

Braced Monopile Platform

Key Features:

- 20m water depth
- Single well platform
- Powered by wind and solar energy
- Designed to withstand seismic loads
- Intelligent monitoring systems
- Access to the platform is by boat transfer, via a landing platform and stairs
- 83T subsea structure; L:6m x W:7m x H:15m complete with Integral Mudmat; L:12m x W:12m
- 40T topside; L:8M x W:8m x H:5m

Background

Following the success of a previous platform with the same operator, Aquaterra Energy were approached with the challenge of delivering rapid returns and reduced CAPEX and OPEX while simultaneously reducing carbon emissions across the project lifecycle. We were also tasked with creating a minimum facility platform that was 100% powered by renewable energy, in a region with highly changeable weather conditions that added additional challenges around energy intermittency risks.

The team also had to contend with the conflicting requirements of having a platform in 20 metres of water in an area with very high-seismic loads, while also minimising the carbon-intensive steel used in the platform. The project was completed in 31 months, amidst the Covid-19 pandemic.

Solution

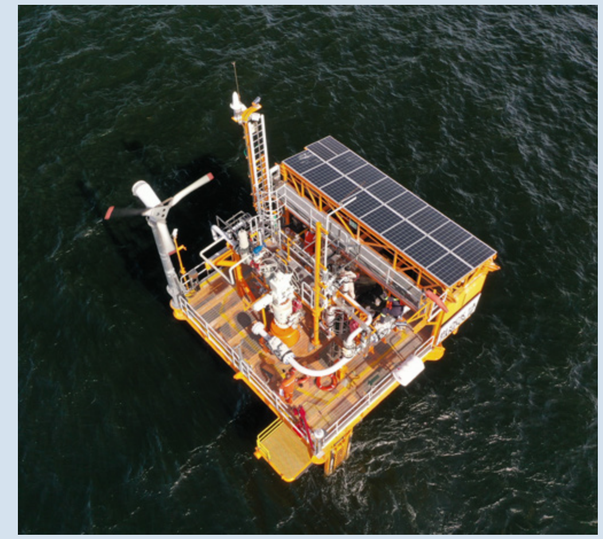
The platform was designed to use a combination of Wind and Solar power, alongside four days of additional power capacity via batteries. This eliminated the need for traditional diesel generators or cables connecting to the grid for power.

Aquaterra Energy's engineers harnessed a novel steel bracing support structure with legs locking monopiles together to withstand seismic activity. Removing the need for a huge carbon-intensive steel platform on the seabed.

Results

The project's modular design meant it could be 100% fabricated in-country and that it could be transported in prefabricated parts and assembled on-site. It was installed using the already in-country, jack-up rig.

Intelligent monitoring and predictive maintenance allow the platform to operate 100% unmanned and a reduction on average maintenance visits. A pipeline to the nearby Iguana field enables the platform to share processing facilities with the existing Iguana Platform.



ESG:

- 100% renewably powered
- 100% fabricated in-country
- Generated approximately 371 local jobs
- Generated 476,613 employment hours
- Delivered with 56.4% local content spend
- Utilising existing in-country infrastructure for installation – creating savings on transport emissions
- Monopile design created a reduction in steel requirements

Location:

Nigeria

Platform Design:

Conductor Supported Platforms

Key Features:

- 28m and 50m water depth
- 6 slots, 8 well slots
- 7.3m x 7.3m well configuration
- Single and double stacked structure supported platform designs
- 4 off 36” conductors providing structural support of the platform with 2 off 36” additional central well conductors leaving 2 remaining wells for future
- Access to the platform by surfer boat via ladder
- Well stream exported to central platform by High pressure / low pressure pipeline
- Local power generation with excess capacity to support existing satellite platform

Anyala platform

- 215T lower subsea structure;
  L:8m x W:8m x H:19m complete with Integral Mudmat L:15m x W:19m
- 174T upper subsea structure;
  L:8m x W:8m x H:17m
- 89T drilling Deck Module;
  L:12m x W:15m x H:6m
- 365T production deck module;
  L:12M x W:22m x H:11m

Madu platform

- 162T subsea structure;
  L:7m x W:7m x H:18m complete with Integral Mudmat L:13m x W:13m
- 85T drilling Deck Module;
  L:12m x W:15m x H:5m
- 331T Production Deck Module;
  L:12M x W:22m x H:11m

Background

Aquaterra Energy were tasked to deliver two minimum facility platforms for offshore Nigeria.

The platforms were to act as unattended autonomous platforms, close linked to an FPSO, sending gross products through either a production or testing manifold. A gas lift was to be deployed onto the facilities to stimulate production when water cut began, automated switchover and throttling of this system was to be engineered as part of the solution.

Enhanced recovery using the digital oilfield principle was requested by project partners, managing the data received from the depletion of the reservoirs to make the best use of the marginal field.

We were required to drive local engagement through our engineering and operations to ensure the facilities could be operated and maximised through local engagement once commissioned.

Solution

We engineered a 2 x 2 bay subsea structure solution, the second of its kind in the world. It used our conductor supported platform solution, which was deployed to reduce cost, complexity, and time to first oil.

All local fabrication capacity was used and extended to deliver both platforms in tandem. We supported in further developing one facility in Lagos, to support longer term project and oilfield goals.

Our platform solutions included digital topside monitoring and control for the facilities by a global control and monitoring system. This supported in being able to trend analyse the depletion of reservoirs and manage efficiency of topside equipment.

Results

Both platforms were built simultaneously in Nigeria at two fabrication facilities in both Port Harcourt and in Lagos, maximising the local content capacity at each of the facilities. Our team supported with training and driving long term engagement with the local operations team.

The topside production facilities were engineered by a Nigerian team who focused on mechanical, piping, instrumentation and electrical design and engineering, verified by our core team in the UK.

Innovative structural design was used to reduce the steel requirement and remove complexity from the fabrication to develop more yard capacities within the country, and to remove entrained carbon from the design.

ESG:

- 100% fabricated in-country
- Supported the redevelopment of a dockside fabrication site in Lagos
- Generated approximately 1m hours of local content hours of employment
- Zero LTIs
- Knowledge transfer and in-house training of platform and usability which supported enhanced skill set of local workforces
- Utilised existing in-country infrastructure for installation – creating savings on transportation emissions

Location:

Trinidad and Tobago

Platform Design:

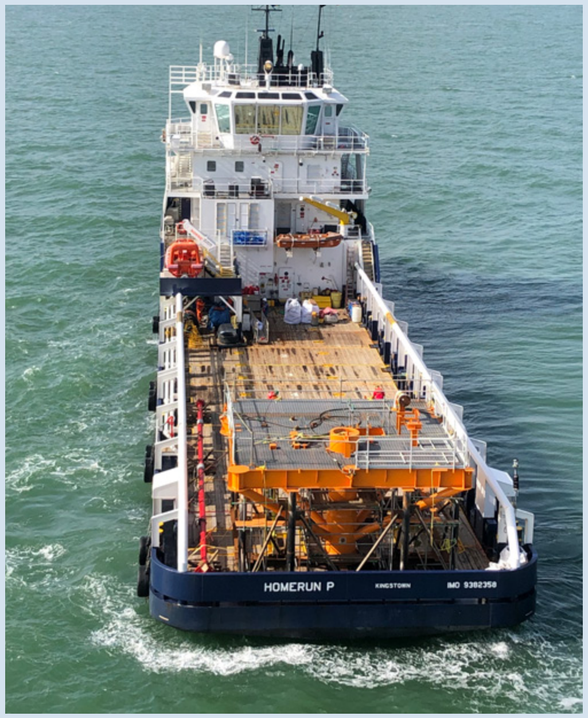
Conductor Supported Platform

Key Features:

- 27m water depth
- 4 well platform
- 6.3m x 5.5m well configuration
- Access to the platform is by boat transfer, via a landing platform and stairs.
- 3 off 36” load bearing conductors with 1 additional 30” central conductors
- 3 off 36” skirt piles on subsea structure
- Well stream exported to shore by 14” pipeline
- Local power generation by Thermal Electric Generator units
- 148T subsea structure; L:8m x W:7m x H:12m
- 159T topsides; L:20m x W:14m H:6m

Background

In February 2017, we were asked to deliver a fast turnaround Sea Swift platform destined for the Iguana field, offshore of Trinidad. The platform was to be located in an extremely seismically active region, which meant extra engineering would be required to ensure its robustness should seismic activity occur.



Solution

The platform was designed with three additional skirt piles in addition to the three load bearing conductors to maintain its integrity during any earthquake scenario. All the conductor/pile slots integrated into a single subsea structure designed to fit within the 45ft x 20ft cantilever skid envelope available on the on-site jack-up.

The topsides feature local power generation using Thermal Electric Generator (TEG) units. The feed gas for these units is taken from the produced gas and is then conditioned to allow it to be used as both an instrument gas feed and as fuel for the TEG units.

The platform also features a wellhead control panel and an integrated communication/control arrangement, with dual redundancy, which allows the platform to be controlled from the same control room used for the onshore gas receiving plant.

To deliver a swift solution, the platform was fabricated in Louisiana where it could be easily transported by barge to Trinidad. To make use of the vessels already on site and reduce costs, the platform was installed using a combination of the Well Service Rig 110, the small jack-up being used to drill the wells and a crane barge which was in the region and available at short notice.

Results

The fast turnaround project saw the platform installed in December of the same year, exactly 10 months after the purchase order was received. This provided the operator with a quicker route to first gas.

ESG:

- Zero LTIs
- Conductor supported design created a reduction in steel requirements
- Utilised already in-country jack-up and crane barge – creating savings on transport emissions
- Onshore control system reduced requirement for offshore personnel trips

Location:

Egypt

Platform Design:

Jacket Supported Platform

Key Features:

- 23m water depth
- 4 leg (complete with 2 inner conductors) jacketed platform
- 6m x 6m well configuration
- 4 of 30” conductors through legs with 2 additional central conductors
- 4 of skirt piles on jacket
- Access via helideck or boat transfer
- Well stream exported to central platform by 10” pipeline
- Local power generation with excess capacity to support existing satellite platform
- 328T jacket; L:23m x W:23m (skirt pile to skirt pile) x H:36m
- 392T topsides; L:18m x W:20m x H:13m (22m x 22m at helideck)

Background

Aquaterra Energy was tasked to deliver a platform in a seismic region. The original scope was for the platform to be supported by four conductors; however, final geotechnical data showed the soil was significantly weaker than the preliminary data suggested. This meant additional pile supports would be needed to withstand the seismic load in the area.

The final platform design would to be suitable for installation by the already in-country heavy left vessel and suitable for fabrication in small module packages, to allow road transport by trucks to the new regenerated construction site for final assembly, and loadout at the quayside.

The topside equipment consisting of gas lift, water injection wellhead control panel, chemical injection unit and Nav Aids etc. would be operated from local generation, consisting of two diesel generators, one providing emergency back-up. At the time of engineering, there was further requirement to upgrade an existing production platform to increase production.

Solution

The platform design was changed moving away from a CSP to a jacket style structure which would overcome the soil conditions. The jacket design was based around the original CSP substructure and well spacing with the additional pile sleeves and steelwork added. This approach allowed the design of the topsides to continue without interruption, as the locations of the interface to the jacket and key topsides equipment remained unchanged.

The platform jacket and topsides were engineered to fabricated in modules in Alexandria and transported to Zeit Bay on the Gulf of Suez for final fabrication which ensured local content was maximised. All modules were able to be installed from the heavy lift vessel which, had already been sourced locally. The topsides incorporated a helideck, along with a small accommodation module for emergency purposes, power generation and a test separator. A bridge link was made to gain access to the existing production platform and link the two platforms together.

Our Aquaterra Energy team were on-site throughout the project to oversee fabrication and pre-commissioning, prior to loadout and offshore installation.

Results

We successfully and safely designed, fabricated, and installed the AMAL-C platform for a seismically active location in the Gulf of Suez.

The platform was fabricated in modules and transported using trucks to a reconstructed fabrication facilities that had been closed for several years. This method dramatically reduced the costs of the platform, whilst maximising the local content capacity of each facility.

During the engineering process the need to increase the structural performance and increase the CSP to an innovative jacket structure design was completed to suit the location.

In conjunction with the drilling activities the production platform of AMAL-B was upgraded adding an additional 90Te of piping to increase the production flow rate. A joining bridge-link was placed to allow easy access between the two platforms.

ESG:

- Zero LTIs
- 100% fabricated in-country
- We supported the re-commissioning of in-country fabrication site
- Platform was installed using already in-country heavy lift vessel, reducing additional transportation emissions
- Supported the redevelopment of the AMAL-B platform, increasing its field life
- 500,894 local content hours reported by fabricator

Location:

Benin

Platform Design:

Conductor Supported Platform

Key Features:

- 26m water depth
- 4 off 30” legs with provision for 5 single wells (including central installation conductor)
- 5.5m x 4.5m well configuration
- Installed by Jack-up Rig and in field pipelay vessel
- Access to the platform by surfer boat via ladder
- Minimal topsides facilities with well stream transported to shore via a 15km long, 8” pipeline
- Functionality for ESP equipment
- Power / comms supplied via one combined subsea power and fibre optic data communication cable
- 123T subsea structure; L:6m x W:7m x H:14m
- 208T topside; L:14M x W:17m x H:6m

Background

This project had a strong focus on keeping costs low. But that wasn’t the only challenge. As each of the wells on the platform featured an electric submersible pump (ESP) the electrical equipment on the platform was substantial.

Solution

Minimising the number of facilities was a major factor in keeping costs low. This was achieved by interrogating the perceived norms and applying a stripped-down philosophy to equipment engineering. Costs were further reduced by maximising onshore installation and pre-commissioning of the platforms.

The subsea structure was installed with a jack-up, which then used the subsea structure as a drilling template to ensure positional space-out and aid well verticality whilst the conductors were drilled and cemented into the seabed. The topside platform installation was performed utilising the pipelay vessel to remove the requirement of contracting a specific heavy lift vessel. The lower deck of topsides predominantly became an equipment deck. The main (production) deck was designed to accommodate and provide access to the wellheads and trees.

The produced crude oil is then transported to shore via a 15km long pipeline to a 12,000 bpd processing facility, where it is then transported offshore through a second pipeline to an offloading buoy.

Results

The platform was safely and successful installed via the drilling jack-up rig with support from the in-field pipelay vessel, with optimised topside equipment. This created many efficiencies for the operator and supported the key challenge of the field development to keeping costs low.

ESG:

- Utilising existing in-country infrastructure for installation – creating savings on transport emissions
- Steel saving design utilising a conductor supported platform compared with a standard conventional jacket
- Zero LTIs

Location:

Malaysia

Platform Design:

Conductor Supported Platform

Key Features:

- 65m water depth
- 9 slots, 28 well, Wellhead Support Structure
- 8m x 8m well configuration
- 36” Conductors have dual functionality of providing structural support of the platform and well conductors
- Bridge linked to MOPU
- Installed by jack-up rig and heavy lift vessel
- Flexible hose and connections from platform to MOPU
- 78T mudmat L: 18m x W: 18m x H: 5m
- 285T lower subsea structure; L:10m x W:10m x H:21m
- 272T upper subsea structure; L:10m x W:10m x H:21m
- 450T topside; L:14M x W:14m x H:8m

Background

Following our success in a competitive design tender, Aquaterra Energy were contracted to design, engineer and fabricate a conductor supported platform for oil production operations offshore Peninsular Malaysia in the South China Sea.

From conceptual design, the project needed to bypass traditional project phases such as the FEED stage to ensure the platform was commissioned within a 12-month timeline. In addition, the platform was to have a significant topsides scope, and was to be installed in water depths of 65 metres. The platform also had a requirement for a minimum design fatigue life of 10 years.

Solution

A first of its kind to be installed in water depths of 65 metres in Asia, the topside platform was to be bridge linked to an adjacent mobile offshore production unit (MOPU), where the produced oil is processed before returning to the platform for export via a dedicated pipeline to a remote FSO.

The platform was to utilise the four outer environmental well conductors, with two subsea structures bracing the subsea span, to provide structural support to the topsides. The topsides provided a cost-effective solution to accommodate 28 well completions and accompanying oil production, gas lift and water injection flowlines, manifolds, instrumentation and control and safety systems necessary to produce from this marginal field.

The platform allowed the use of dry Xmas trees, and reduced the overall development costs and delivery timeframe, whilst employing proven drilling rig techniques to install. The use of the conductor supported platform design resulted in a relatively small subsea footprint of only 8 x 8 square metres.

Results

The platform established new limits for conductor supported platform design. It has an installed mass of over 400 tonnes and is supported by four 36” x 2” leg conductors tied together by two subsea structures. The two subsea structures provide the required strength and stability needed to ensure the performance of the platform is maintained. The design was also demonstrated to the satisfaction of third-party classification bodies.

The platform was successfully and safely installed using the jack-up rig, which created substantial cost savings for the project as no further equipment was required to be transported into country.

ESG:

- Steel saving
- Utilising existing in-country infrastructure for installation – creating savings on transport emissions by installing via a jack up rig
- Fully fabricated in country

Location:

Angola

Platform Design:

Conductor Supported Platforms

Key Features:

- 25 and 27 m water depth
- 3.25m x 3.75m well configuration
- 10-year design life
- Designed to support a minimum of three well conductors
- Designed with sufficient deck space for the process facilities equipment
- Installation by the Todco 185 jack-up rig
- Access via small crew boat via ladder
- Export lines and umbilicals to each structure to provide support for the required power cables
- Fabricated in Great Yarmouth, England with testing and pre-commissioning completed before shipping to Angola utilising client rig supply vessels

Airoga platform

- 43T subsea structure; L:6m x W:5m x H:9m
- 80T topside; L:12m x W:14m x H:6m

Solha platform

- 43T subsea structure; L:6m x W:5m x H:9m
- 80T topside; L:12m x W:14m x H:6m

Background

The Airoga and Solha rig assembled conductor supported platform structures are both part of the Morsa West field development architecture, located in Block 2/05, offshore Angola.

It's a marginal field development with oil reserves of between 16 and 29 MMBbls which presented various challenges to the development team due to heavy faulting, fracturing and limited pressure support within the reservoir. Subsea completions and conventional jacket production platforms were uneconomic, meaning an innovative solution was needed.

Solution

The development plan called for ten wells from three drill centres, with export of production to an FSU located at the Canuku field, however this changed to Lombo East production platform due to the planned decommissioning of the Canuku platform.

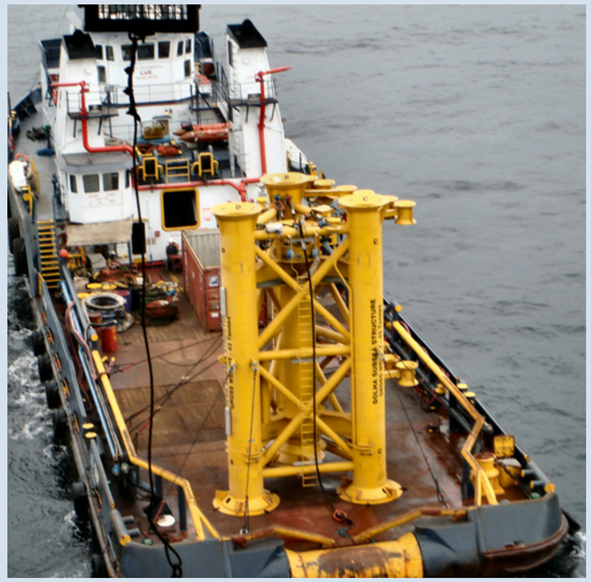
Aquaterra Energy were contracted to design/engineer, fabricate and install two satellite platforms for this development, one at the Airoga location and the second at the Solha location.

The design and configuration of each platform would be near identical, although Solha would have an extra production well. The platforms were designed to accommodate minimum processing facilities, and to be rig installable to minimise installation costs. In addition, installation needed to fit in with the drilling programme, to reduce downtime, as much as possible was done offline.

The resultant platform designs allowed for:

- Installation by the Todco 185 jack-up drilling rig, without other specialist installation vessels
- Rig supply vessels used for transportation of the structure and topside
- Designed and constructed to:
  - Be suitable for a 10-year design life
  - To provide for a minimum of three well conductors
  - To provide support for the required power cables, export lines and umbilicals to each structure
- Allow manned access from a small crew boat via ladder
- Provide sufficient deck space for the process facilities equipment
- Consider the constraints of the drilling operation

All structures were fabricated in Great Yarmouth, England with testing and pre-commissioning completed prior to shipping to Angola utilising rig supply vessels.



Results

The platform installations were considered a complete success by the client with all operations being seamlessly integrated into the drilling programme and completed on schedule, safely and without incident.

The installation of the facilities equipment, risers and I-tubes were successfully completed without impacting the drilling program leaving the rig to resume drilling operations.

ESG:

- Steel saving design utilising conductor supported platform design, compared with a standard conventional jacket
- Utilising existing in-country infrastructure for installation – creating savings on transport emissions
- Zero LTIs