

MULTI WELL SEMI-SUB ANALYSIS SOLUTION, PROVIDING MAXIMISED DRILLING ENVELOPES AND MINIMISED RIG DOWNTIME

CLIENT:
CAIRN ENERGY

PRODUCT:
SEMI-SUB RISER ANALYSIS

Cairn Energy required our analysis services for their semi-sub drilling operations over a range of water depths in Morocco, Senegal and Ireland in order to optimise tension and ensure the planned well equipment was fit-for-purpose. Aquaterra Energy used its experience to offer a comprehensive analysis service that maximised drilling envelopes, minimised rig downtime and saved costs.



BACKGROUND Across all locations, deep water riser analysis was required including tension optimisation, operability envelope generation, vortex-induced vibration (VIV) analysis and conductor strength analysis for a number of projects. All wells were to be drilled via a semi-submersible rig:

Morocco: Two wells located offshore Morocco with water depths of 100m and 1,545m. For the shallower water depth, contingency case with a capping stack installed was also assessed.

Senegal: Deep water analysis at depths of 1,170m, 1,500m and 2,000m for three wells, offshore Senegal. Analysis was conducted separately for the wells to reduce conservatism and maximise the operating envelopes and fatigue lifetimes.

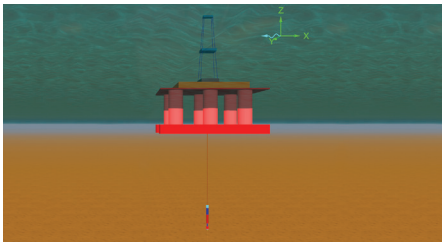
Ireland: Deep water analysis for one exploration well in a water depth of 407m offshore the west coast of Ireland. The well would be subjected to harsh Atlantic environmental conditions, with the 1 year and 100 year return periods significant wave height at the well location predicted to be 12.8m and 19.0m respectively. Due to the large bending loads arising from the high wave heights, potential fatigue damage to the wellhead and the conductor was of concern.

SOLUTION The projects presented a challenge due to the different water depths of each location. We were also faced with a combination of different environmental conditions, from relatively benign deeper water conditions offshore Senegal to the shallower harsh Atlantic conditions offshore Ireland.

In each case, the Aquaterra Energy in-house analysis team assessed the riser performance against API RP 16Q using OrcaFlex models, with supplementary calculations using the mathematical software Mathcad, to include rig response amplitude operators, riser joints, tension, subsea equipment, wellhead and conductors.

Metocean data was reviewed and load out calculations undertaken, the minimum and maximum tensions calculated, and tension sensitivity studies and drilling operation limits determined within an agreed timeframe of between 2-4 weeks in each case. For the VIV assessment, tension sensitivities using SHEAR7 (state of the art industry standard VIV software) were undertaken to predict VIV response under specified long term and extreme current profiles.

Conductor strength and capping stack analysis was performed using the worst case soft soil profile. In each case, wave induced fatigue analysis was assessed against industry standards DNVGL-RP-C203 and API RP 2A-WSD.



RESULTS Across all locations, we were able to optimise tension, ensuring the planned well equipment was fit-for-purpose. We also identified the maximum possible allowable combinations of rig offset and sea state for drilling and for keeping the riser attached to the well. For Cairn Energy, we were able to offer a multi well comprehensive analysis service that maximised drilling envelopes, minimising rig downtime and created saving costs to the client across all the planned wells.

We also demonstrated that wells were acceptable even with large surface casing cement shortfalls, which reduced operational risk and produced further rig time and cost savings. This allowed Cairn Energy to simplify their operations, as less contingencies were required to be procured, transported and stored on the rig.