

### Feasibility of a marginal offshore development in the Guyana-Suriname Basin

The Guyana-Suriname Basin off the coast of Suriname possesses large amounts of hydrocarbons. Suriname therefore wants to engage in developments in the shallow areas (0 - 30 m) offshore through their local oil company Staatsolie Maatschappij Suriname N.V. The expected discoveries are marginal and the soil consists of extremely low strength clays. This and the local lack of experience regarding the offshore industry represent the main challenges for offshore developments in Suriname. The objective of this thesis is to assess whether offshore developments in this basin are technically and economically feasible, assuming that the discoveries are marginal. Because a reservoir is yet to be discovered, the reservoir characteristics (location, size, etc.) are unclear. Hence, the important figures are currently only best estimates. The reservoir is estimated to possess 30 million barrels (30 mmbbl) recoverable reserves.

In order to investigate possible development approaches, marginal field developments across the world were looked into. Based on this, it appears that mostly low cost, minimum facilities platforms are used for development of marginal fields across the world. By using similar approaches and taking into account the local (social and economic) aspects which are significant to this project, possible development scenarios for a field offshore Suriname are formed. The proposed scenarios are the all-land (treatment on land, 9 mbbbl/day), the sea-land (treatment at sea, 9 mbbbl/day) and the minimal production and logistics scenario (treatment on land, minimal CAPEX, 3 mbbbl/day). These scenarios consist of on- and offshore facilities of which the offshore platform is further assessed to investigate its technical feasibility. In order to determine the most suitable platform for each scenario a multicriteria analysis is performed. The technical feasibility of the selected platforms is analysed by performing a structural analysis. For the all-land scenario the proposed platform is a wellhead platform (WHP), consisting of 4 conductors which also function as the support structure (4-conductors support structure (4-CSS)). For the sea-land scenario a jacket with an adjacent WHP is proposed. For the minimal scenario the proposed platform is a freestanding conductor.

Because of the shallow water depth the wave loads are calculated using the 5<sup>th</sup> order Stokes waves. The environmental loads and the permanent & variable loads on the platforms are calculated and the structural integrity is assessed by performing ultimate limit state (ULS) strength checks, which are specified in ISO 19902. The foundation of the platforms is assessed by looking into the axial and lateral soil resistance. The checks are only performed for a static load case. By using WHPs the overall weight of the platform is limited (50 tons for 4-CSS and 15 tons for freestanding conductor). The weight of the jacket is kept relatively low by situating the well bay on an adjacent WHP. When only considering a static load, the jacket, 4-CSS and freestanding conductor are technically feasible in all water depths (0 – 30 m).

The economic feasibility is assessed by evaluating the total costs of each of the proposed scenarios. The main cost components are the drilling & exploration, the offshore and onshore facilities, storage, transport and OPEX. Based on analysis it appears that the minimal development scenario is ultimately the most attractive scenario for development of a 30 mmbbl reservoir. This scenario includes a freestanding conductor as offshore platform with 1 well in production. The raw crude is transported to the TLF refinery via tanker, where facilities are built for primary treatment. The initial investments for this scenario are about 120 MM€ lower than for the all-land and sea-land scenario while the net profit (NPV) over the field life span is about 65 MM€ less. The OPEX and price per barrel can vary significantly. The net profit is estimated with a market sales price of 35 €/bbl and an OPEX of 7.20 €/bbl. The low production rate indicates a longer field life span for the minimal development scenario, 30 years compared to 12 for the other scenarios. By combining the current onshore production with the offshore production, the feed to the refinery can be kept steady and no expansion of the refinery will be required. Because of the low initial costs and the guaranteed longer steady feed to the refinery, the minimal development scenario is proposed as the best development scenario for a marginal field offshore Suriname.

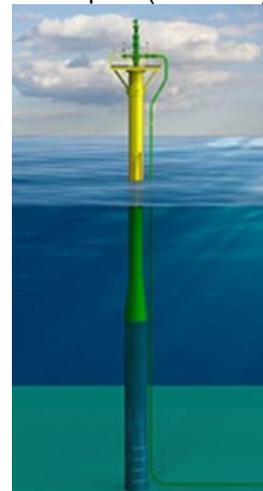


Figure 1 – Freestanding Conductor