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Improving Reliability and Reducing Intervention Costs of Ultra-deep Subsea Technology at the Design Stage

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Abstract

The current trend in offshore exploration and production (E&P) is geared towards developments in greater depths and harsher environments. The challenge of realizing fields at depths of greater than 5,000 feet normally requires unproven technology operating in harsh environments.

Deferred production is a function of reliability and intervention times. Harsh operating conditions in deep waters will have a negative impact on reliability. Long mobilization times for intervention vessels and availability of spare parts are also drivers of the performance of subsea facilities. High day rates for intervention vessels operating in deep waters represent an additional risk to project economics.

Target levels of reliability and production availability can be ensured during early design phases through a systematic and rigid reliability management program. As part of the early design optimization effort, a comparison of alternative intervention philosophies and their impact on project economics should also be evaluated. Alternative subsea intervention philosophies may be on an:

1. On demand basis - which is subject to the availability of resources and costs at the time.
2. Contract basis - where intervention resources are available based on agreed contract agreements.

This paper describes the potential risks involved with the reliability of novel subsea solutions required for deep water production, the impact of capital intensive intervention costs and a risk-based approach that can be applied to optimize subsea reliability, design and intervention planning. Det Norske Veritas (DNV) has successfully applied detailed simulation modeling techniques within a risk based approach to optimize subsea developments. DNV has supported operators with the following:

- Estimates for the reliability of novel ultra deep subsea equipment.
- Prediction of produced and deferred production volumes.
- Criticality analysis.
- Concept evaluation.
- Evaluation of alternative intervention philosophies.
- Gains in Net Present Value (NPV) based on optimization of design, reliability and intervention planning.

Deepwater hydrocarbon production is expected to grow from 10% to 25% of total offshore production by 2015 as hydrocarbon deposits in shallow waters and in more accessible regions become depleted. More is being invested in subsea technology to face the increasing demand for systems and equipment to recover hydrocarbons in deep and ultra-deep waters (greater than 5,000 ft / 1,500 meters). This shift in industry focus will result in some key challenges in the decade ahead.

The overall through-life Net Present Value (NPV) of a subsea project is dependent on three factors:

1. Capital Expenditure (CAPEX).
2. Operational Expenditure (OPEX).
3. Revenue Losses.