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Implementation of Direct Electric Heating as Part of the Hydrate Control and Management System

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ABSTRACT

The use of Direct Electrical Heating (DEH) for sub-sea pipelines has become a method for hydrate and wax management control either by itself, or as part of other hydrate management and control techniques. The method is based on resistive heating of the steel pipe by leading electrical AC current in the flowline.

DEH has so far only been used in the North Sea, with the first system installed 8 years ago. To date 6 installations are operational with another 4 being implemented.

Simulations are carried out to determine whether or not the DEH technology is suitable for the Ichthys Gas Field development.

Details of 5 insulated sub-sea flow lines were provided as a basis for the investigation:

- To extend the no touch time required after a shutdown, i.e. to avoid depressurization of sub sea system, by keeping flowlines above hydrate formation temperature (this is considered the main objective of the study).
- To warm up a cold flowline from seabed temperature to the target temperature above hydrate formation and keep it at this temperature indefinitely.
- To melt hydrates after prolonged shutdown.

For both these scenarios, the electric power data for the DEH system are determined. Results from the simulations were compared with results from (OLGA) simulations concerning cool-down scenarios.

The thermal configurations for the pipelines and the operational conditions have been the governing parameters to provide DEH data.

For the application of DEH this method has also been compared with more traditional flow assurance systems regarding topside equipment, and there are obvious advantages concerning required volume and weight.

KEY WORDS

Pipelines; Hydrate Prevention; Electrical Heating; Finite Element Analysis; Electrical Power Requirements; Heat Generation.

INTRODUCTION

The purpose of the study is to evaluate the feasibility of using the Direct Electrical Heating (DEH) technology on subsea flowlines, as part of the Concept Development Phase of the Ichthys Gas Field Development.

The study is to confirm the electrical requirements in early indications that the use of DEH will provide the required heating for the subsea pipes/flowlines, as required preventing / inhibiting hydrate formation and also wax deposition in the flowlines, in the event of a shut down situation in the Central Processing Facility (CPF).

The second objective is to confirm the power requirements that will allow warming of the flow lines during or prior to regular cold starting of wells and associated flowlines.

The Ichthys Field is located in the Browse Basin on the North West Shelf of Western Australia approximately 440 km north of Broome, (Fig. 1). The permit encompasses an area of approximately 3,041 km^2 with water depth ranging from 90 to 340 m. Exploration programs have indicated the presence of significant natural gas and condensate volumes in the permit area.

DEH CONFIGURATION AND SIMULATION MODEL

The configuration of the heating system is shown in (Fig. 2), where the near and far end cable connections to the flowline are grounded to seawater, and thereby a part of the supply current (through the piggyback cable) will pass in seawater.