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Heavy Oil Challenges: Transport, Blending, and Marketing

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Abstract

Heavy acidic crude oils create challenges for all key operations from well to refinery. The Grane crude oil is heavy with API of 18,7 and has a high viscosity and a high TAN, rather different from most other Norwegian crude oils. The Grane field was developed with a pipeline to the Sture terminal. This increased the market area and market flexibility as offshore loading operations were avoided. The pipeline has never created any production regularity problems, despite the high viscosity of the crude oil. The Grane crude oil is heated to 30-35⁰ C at the terminal. The naphthenic character, the yield structure and the acidity of the Grane crude oil make co-processing or blending with other, ideally paraffinic crude oils attractive, and Grane is a good feed for upgrading by either hydrocracking or by FCC. Grane has a TAN of 2,2 mg KOH/g, while the Naphtenic Acid Titration (NAT) method, which measures only the naphthenic acids, gives a value of 1,4 mg KOH/g. During the field development phase it became clear that marketing of Grane was going to be a challenge compared with the sweet North Sea crude oils Hydro had produced and been marketing. A strategy for marketing of Grane was established, based on building up Hydro in-house competence on all areas of relevance for refining of this type of crude oil, reducing the Grane initial marketing and pricing uncertainty. When Grane was introduced to the market, a price discount related to additional technical cost and market related factors had to be accepted, related to the fact that the refining properties of the oil have not been tested in large-scale operations. Since start-up we have been through periods with large price fluctuations, and the price discount compared with Brent has varied significantly, in the range 4 – 11 USD/bbl. The competence established through this project will be applied in all heavy, acidic crude oil Hydro projects, securing maximum value from these fields both for Hydro, partners and authorities involved in these projects.

Introduction

Heavy acidic crude oils create challenges for all key operations from well to refinery. This paper will present how Hydro tackled the challenges related to transportation, marketing and refining of the Grane crude oil.

Grane Crude Oil from Platform to Customer

The Grane field was discovered in 1991 and the PDO recoverable reserves of approximately 700 million barrels will be produced over a 25 years period. A long-term oil production test of the Grane field was carried out in 1996. Detailed analyses were carried out on the well stream and the crude oil produced. The crude oil is heavy with API of 18,7 and has a high viscosity and a high TAN, rather different from most other Norwegian crude oils. The partner group decided to construct a 212 km long pipeline from the Grane field to the Sture crude oil terminal at the west coast of Norway. Landing of the oil at an onshore terminal increased the market area and market flexibility as we avoided offshore loading operations.

From platform to customer

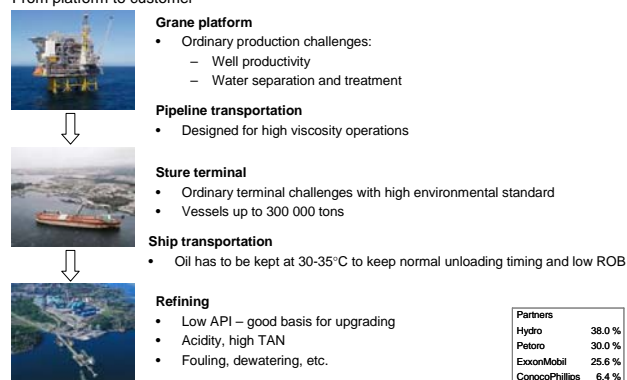


Figure 1. Grane Crude Oil from Platform to Customer

The 28 inch pipeline from the platform to the Sture oil terminal has a capacity of 250 000 bbl/d and a design pressure of 206 bar. The crude oil enters the pipeline at a typical operating pressure of 113 bars and a temperature of approximately 70⁰ C, but is cooled down to 5 – 7⁰ C, due to the low seawater temperature at the sea bed. The viscosity of Grane is 100 cSt at 40⁰ C, and in the range of 1000 cSt at this low temperature. The pipeline system was designed for this low temperature and high viscosity, and the start-up situation of a completely cooled down pipeline was especially evaluated before final design. The pipeline has now been in operation for