



OTC 19880

Challenges and New Technologies for the Development of the Pre-Salt Cluster, Santos Basin, Brazil

R. L. C. Beltrão, C. L. Sombra, A. C. V. M. Lage, J. R. Fagundes Netto and C. C. D. Henriques; PETROBRAS

Copyright 2009, Offshore Technology Conference

This paper was prepared for presentation at the 2009 Offshore Technology Conference held in Houston, Texas, USA, 4–7 May 2009.

This paper was selected for presentation by an OTC program committee following review of information contained in an abstract submitted by the author(s). Contents of the paper have not been reviewed by the Offshore Technology Conference and are subject to correction by the author(s). The material does not necessarily reflect any position of the Offshore Technology Conference, its officers, or members. Electronic reproduction, distribution, or storage of any part of this paper without the written consent of the Offshore Technology Conference is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of OTC copyright.

Abstract

Pre-salt carbonate reservoirs from Santos Basin represent a great opportunity and probably the most important recent oil discovery. Tupi area (estimated to have recoverable volume of 5 to 8 bboe), which is the most known amongst several other leads in the cluster, is going to be a great insight for the production project.

From the production point of view, this new frontier has technological challenges that are being addressed by PETROBRAS and partners. Special attention is being dedicated to anticipate solutions to potential problems. This will require a balance between innovative and field proven solutions.

This paper addresses the most critical points, where Petrobras is making a great R&D effort, which are:

Well technology, where casing stability, well cost and productivity are addressed, in a scenario of water depths beyond 2,200m, target depths greater than 5,000m, crossing salt layers that can reach 2,000m in thickness.

Poorly known microbial carbonate reservoir, heterogeneous in vertical profile, spread over very large areas, with wettability concerns, requiring careful evaluation of the performance of the waterflooding method and EOR.

Wax deposition, due to low temperature in the ocean bottom, imposing limitations to the subsea layout.

Gas processing and exporting technologies concerning environmental issues: CO₂ compact removal units aiming the minimization of emissions to the atmosphere.

Production units placed in more than 2,000m water depth, with oceanic conditions quite severe and dealing with high CO₂ content stream.

These challenges deserve all Petrobras attention, but also count with the confidence in achieving good technological solutions, supported by the history of successful developments of the company.

Introduction

The history of success built by Petrobras in deep water Brazilian coast – mainly Campos Basin – was largely supported by successive discoveries of heavy oil in turbidite sandstones, step by step towards gradually deeper and deeper water depths (Carminatti *et al.*, 2009). The Pre-salt discoveries of Santos Basin represent discovery of huge volumes of light oil (28 to 30 degrees API), with high gas content, in a very short time span, close the most important consuming centers in Southeastern Brazil, and formation tests in the first wells have presented very high flow rates with no indication of barriers. All are excellent news, although PETROBRAS and partners recognize that the Pre-salt of Santos Basin represents a challenging scenario: ultra-deep water (greater than 2,000 meters), deep carbonate reservoirs (deeper than 5,000 meters), spread over very large areas, with high gas-oil ratio (GOR in Tupi area greater than 200 m³/m³), CO₂ content (8-12% in Tupi), high-pressure and low temperature, laying immediately bellow a thick salt layer (more than 2,000 meters of salt), located around 300 km from the coast, with oceanic conditions more severe than Campos Basin. This scenario demands using sometimes present day technology in the limit, and other times, adaption and development of technologies specific for such conditions. This paper addresses the most critical points to the development of production in the Pre-salt of Santos Basin, where Petrobras is making an R&D effort to develop and qualify new technologies, including well technology, reservoir technology, flow assurance, gas processing and exporting technologies, and production units. Additionally, the paper discusses briefly how PETROBRAS has organized its structure to face these technological challenges, including the creation of a technological program – PROSAL – focused on Pre-salt objectives.