



OTC 19953

Santos Basin's Pre-Salt Reservoirs Development—The Way Ahead

José Miranda Formigli Filho, Antônio Carlos Capeleiro Pinto, and Alberto Sampaio de Almeida, SPE, Petrobras

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

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ABSTRACT

This paper describes the current studies for the future development of the Pre-Salt reservoirs operated by Petrobras in the so called Santos Basin Pre-salt Cluster, offshore Brazil, in deepwater.

The development of the whole area was divided in three phases:

- Dynamic Information Gathering Phase, composed of Extended Well Tests (EWTs) and Production Pilots. The EWTs will be implemented in parallel with the exploratory appraisal campaign and intends to evaluate the long term production behavior of the wells and the reservoir, as well as the fluid lift and flow assurance. The Pilot Projects, to be implemented after the EWTs in some areas, as in Tupi, will anticipate production and injection (water and/or gas+CO₂) information, resulting in a better understanding of the secondary recovery mechanisms and reducing the risks of the future development systems
- Phase 1, extending to 2017, will comprise conventional subsea completion systems and, wherever possible, standardization of the FPSO hulls and respective topside equipment, as usually done with the wells and subsea equipment applied in the development projects. In this phase many uncertainties will be still present, and the production systems will be planned to provide flexibility for different reservoir drainage solutions.
- Phase 2, which will consider non-conventional solutions, starting no later than 2017. Some of the concepts under evaluation by Petrobras are: the use of dry completion units; gas processing hubs; floating liquefied natural gas; digital field management; oil transportation through pipelines; gas storage in caves in the salt layer; EOR in selected areas considering the CO₂ captured from the associated gas of neighboring areas, among others.

One of the most important issues to support the development plans is logistics. In the remote Pre-Salt cluster, all areas related to the production will also have to be planned in advance, such as: hiring and training new employees, construction of onshore basis, transportation schemes (boats, helicopters), oil transportation and refining strategy, gas transference and commercialization strategies and other topics. Regarding the supply of the long lead items, it comprises the acquisition or leasing strategy of the critical production systems such as rigs, floating production units, pipeline laying vessels, flexible and rigid pipelines, X-mas trees, among others.

INTRODUCTION

The area known as the Pre-Salt Cluster, in the Santos Basin, is located in ultra deep waters, between 1,900 and 2,400 m, approximately 290 km offshore the Rio de Janeiro Coast, Southeast Brazil. Figure 1 shows the main blocks of the Pre-Salt cluster, currently in the Appraisal Plan Phase. The structure was created around 160 millions years ago, when the supercontinent Gondwana began to break apart, giving place for the South American and African continents. The rift phase created the conditions for the deposition of sediments on the trough between the two continents. The rift phase created the conditions for the deposition of sediments on the trough between the two continents. As the separation continued, the sea water began to fill the space, creating a low energy and high salinity environment, propitious to the growth of special bacterial colonia, such as the stromatolites. The secretion of these microorganisms, together with the precipitation of carbonate salts, created nucleus to form carbonate rocks, known as microbialites, where the oil in the Pre-Salt was discovered. Later on, due to the severe climate change on Earth, the salt dissolved in the sea water in this low energy environment precipitated, forming a thick salt layer that became a perfect seal for the hydrocarbon that migrated to the microbialites.