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Pre-Salt Santos Basin — Extended Well Test and Production Pilot in the Tupi Area — The Planning Phase

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Abstract

This paper describes how Petrobras is assessing the realistic pre-salt potential of the Santos Basin, offshore Brazil, in water depths between 1,900 and 2,400m (6,230 and 7,870ft). Three integrated ultra fast-track projects were planned to start production of the giant pre-salt reservoirs in an area known as Tupi. The carbonate reservoirs in this area contain an estimated recoverable volume between 0.8 and 1.27 billion m^3 (5 and 8 billion barrels) of a 28^o API crude, with high GOR and a CO_2 content in the dissolved gas of 8-12% vol. They are located below a 2,000m (6,560 ft) salt layer, in vertical depths around 5,000 m (16,400 ft) from the sea level. Besides the good expectations based on the seismic interpretation and geologic modeling, the two wells drilled in the area presented good productivities in the well tests, pushing Petrobras and its partners to implement the fast track production projects.

The objective of the three projects is to obtain relevant reservoir and production data, to support the design phase of the remaining production units of the full field development [1]. First, the Extended Well Test, EWT, which comprises the sequential connection of two sub-sea wells to a turret moored FPSO, scheduled to start production in April 2009, will be shown. Second, the paper will cover an eight well Pilot System (five producers, two water-alternating-gas injectors and one water injector), using a spread moored FPSO, with flexibilities to be expanded in the future to become its first production module. First oil of the Pilot Phase is scheduled for late 2010. The third project is a 216km (134mi) long, 457mm (18in) OD diameter gas pipeline, from the Tupi area to the Mexilhão platform, in shallow waters. From Mexilhão, the export gas will be sent to the Caraguatatuba onshore gas plant, through an 864mm (34in) OD multiphase pipeline.

The paper also addresses the main technical challenges, such as drilling of complex wells with intelligent completions, qualification of ultra-deepwater risers, flow assurance through long subsea flowlines, and CO_2 capture and sequestration.

INTRODUCTION

The Tupi Area is part of the original exploratory block BM-S-11, located in the central portion of the Santos Basin, offshore the Rio de Janeiro State, at approximately 290 km (180 mi) from the coast, under water depths around 2,200 m. It represents one of the most important offshore production frontiers in the World [2]. The BM-S-11 block has the following working interest among its partners: Petrobras (operator - 65%), BG (25%) and GALP (10%).
After the declaration of discovery in 2006, filed with the Brazilian Petroleum Agency, ANP, the consortium holds its remaining area, known as the RJS-628 evaluation plan area, depicted in Fig. 1.

The first well drilled in the block was the RJS-628, completed in August 2006. The well was designed to test the carbonate section of a reservoir of the Aptian age. It found hydrocarbon bearing reservoirs in carbonates of microbial origin, named SAG reservoir. A secondary microbialite reservoir, named RIFT reservoir, was also found. Both reservoirs are located below a thick layer of salt that occurs regionally in this portion of the basin. Because of this, these reservoirs were classified as pre-salt reservoirs. The well was tested and produced, after an acid stimulation and with the choke constrained, 378 m^3/d (2,380 bpd) of a 28^o API crude oil, with a GOR of approximately 220 m^3/m^3 (1,240 scf/bbl).