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Albacora Leste Field Development: Reservoir Aspects and Development Strategy

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Abstract

Albacora Leste, one of the largest Campos Basin deep-water oilfields, was discovered in March of 1986. Oil field development area involves 141km² and water depth ranges from 800 to 2000m. In order to exploit the field, 30 horizontal wells - 16 producers and 14 injectors - will be connected to an FPSO unit (P-50). Expected total reserves are 565 million barrels of oil.

Albacora Leste main reservoirs are Miocene sandstones with high porosity and permeability. The depositional model is interpreted as a complex turbidity system, mainly represented by channels, lobes and overbank facies. Net thickness ranges from 5 to 35m, suggesting horizontal well drilling. After the deposition stage, erosive channels introduced flow barriers that generated different reservoir compartments. These compartments impacted drainage pattern design and were checked through reservoir pressure data after long term pilot well production, log interpretation, and fluid samples analyses. Small gas caps showing different gas/oil contacts were detected all over the field area, introducing an additional challenge for field development.

Intensive application of the following technologies was important to make field development technically and economically successful: (1) high quality 3D seismic; (2) image logs and LWD (logging while drilling); (3) long gravel-packed horizontal wells; (4) thermally insulated flowlines, allowing flow assurance for distant satellite wells; and (5) massive sea water injection for sweep, and reservoir pressure maintenance. In order to avoid scale deposition as a result of sea water injection, a Sulphate Removal Unit was installed in the P-50 FPSO.

This paper presents the key aspects of the reservoirs, the drainage modeling and design, as well as the strategy adopted during project implementation, in order to overcome main reservoir uncertainties, such as fluid type, connectivity,

and net pay, accomplishing at the end a successful project execution.

Introduction

The Albacora Leste deep-water giant oil field is located on the northern part of Campos Basin, in southeastern Brazil, about 120km from the São Tomé Cape, Rio de Janeiro State coast, in water depths ranging from 800 to 2,000m (Figure 1). The reservoir depths range from 2,300 to 2,600m, referenced to sea level. Albacora Leste reservoirs are high quality siliciclastic reservoirs from the Tertiary (Miocene sandstones) with average porosities of 30% and average absolute permeabilities of 3,000mD. Oil gravity ranges from 16.5 to 21.5° API.

In order to develop the field, a consortium was formed by PETROBRAS and REPSOL-YPF. PETROBRAS is the operator and holds 90% of working interest, while REPSOL-YPF holds 10%. The field OOIP volume is 3,800 MMBBL. Total recovery for Albacora Leste is estimated to be 565 MMBBL of oil and 10 billion m³ of gas, with proven reserves of 411 MMBBL of oil and 7.3 billion m³ of gas.

The Albacora Leste Field was discovered in 1986. The challenging field environment - deep-water, large development area, low API, and viscous oil, very friable sandstones with net reservoir thicknesses ranging from 5 to 35m - slowed field development, since it could only be supported by technologies emerging at that time, such as long horizontal and gravel-packed wells and thermally insulated flowlines. The drilling of development wells only started in 2002 and the last development well will be completed in September 2006. Production is scheduled to start by the end of the first quarter of 2006. P-50, an 180,000 bbl/day oil capacity FPSO, will collect field production. The peak of oil production will be reached at the end of 2006, when all production wells will be on production.

Further development, which is heavily dependent on ongoing research, is being evaluated aiming at the production of the spread and small heavy oil reservoirs, containing less than 16° API oil.

Seismic

The first 3D seismic data comprising Albacora Leste field was acquired in 1987, but its acquisition parameters and processing routine were not good enough for reservoir characterization purposes. During 2001, PETROBRAS purchased a new 3D seismic including all the Albacora Leste ring-fence area, which actually supported the reservoir characterization for the field development. Figure 2 shows the