

Espirito Santo: The New Deepwater Frontier in Brazil

Petrobras has been active in five simultaneous exploration and production frontiers in the Espirito Santo basin, namely gas in shallow water, light and heavy oil in deepwater, and light oil in ultradeep water and onshore. Petrobras has invested in new infrastructure projects including pipelines, processing plants, and a new port to support offshore operations. The company also has participated in research projects in partnership with the Federal University of Espirito Santo.

Introduction

Petrobras' activities in the state of Espirito Santo, in southeastern Brazil, encompass the Espirito Santo basin (onshore and offshore) and the northern portion of the Campos basin (offshore). Activities began in 1957 with an onshore focus. In 1968, Brazil's first offshore well was drilled in the Espirito Santo basin. In 1978, the Cacao field was the first offshore commercial discovery in the Espirito Santo basin, in a water depth of 19 m.

Onshore production began in 1973, reaching maximum production of 25,000 BOPD in 1984, declining to 9,000 BOPD in 1998, when new fields were discovered by use of new technologies (e.g., 3D seismic). In early 2001, the first commercial deepwater discovery was the Jubarte field in the

northern Campos basin, followed in 2003 by the discovery of light oil in deep waters in the Espirito Santo basin (Golfinho field).

Projects

Jubarte. Production began with a 2-month extended well test (EWT). This field produced approximately 20,000 BOPD through the *Seillean* floating production, storage, and offloading (FPSO) vessel. Phase-1 field development began December 2006 through FPSO *P-34* with a production capacity of 60,000 BOPD. Phase 2 is planned for 2010 through FPSO *P-57*, with a capacity of 180,000 BOPD.

Heavy-oil-production technologies include use of long horizontal wells to increase the production, use of electrical submersible pumps (ESPs) installed on the seabed as the main artificial-lift method with gas lift as backup, and the conversion of the FPSO *P-34* to process heavy oil.

Neighboring the Jubarte field, Cachalote, Baleia Franca, and Baleia Ana fields were discovered in 1500-m water depth. Production is scheduled to begin in 2012. The Baleia Azul field (1300 m water depth), south of Jubarte, may begin operation in 2014. The Caxareu, Pirambu, and Manganga fields were discovered in 2006 and are in the study phase to define the production systems.

The Nautilus, Abalone, Ostra, and Argonauta fields are being developed in two phases, with the first phase in 2009, through an FPSO with capacity for 100,000 BOPD.

Catua. The Catua field (in water depth of 1800 m), is 50 km southeast of Jubarte and contains 42°API oil in a carbonate reservoir. Discovered in 2005, an EWT is planned for 2008 to define the technical and commercial feasibility.

Golfinho. Exploitation of this field, discovered in 2003 in 1300 to 1640 m water depth, showed two reservoirs with 28 and 40°API oil and one reservoir with nonassociated gas. First oil production occurred 18 months after project sanction. The field was developed with horizontal wells by use of conventional and one-trip completions with sand-control production, and it was equipped with both continuous gas lift and ESPs. The Golfinho gas will be produced through a 66-km pipeline for processing and delivery to the market.

The Canapu gas field, 20 km east of Golfinho, will be produced through a pipe-in-pipe production line to the *Cidade de Vitoria* FPSO. The use of the pipe-in-pipe gas pipeline is necessary to avoid hydrate formation.

The Camarupim field (in 800 m water depth) will be produced through an FPSO with capacity for 20,000 BOPD and 35 MMcf/D of gas. A 60-km gas pipeline will transport gas from Golfinho, Canapu, Camarupim, and Carapo fields and from the Peroa area to the Cacimbas gas processing unit. A fixed production platform is under study to be installed in shallow waters as a substitute for the FPSO.

The Carapo field (in 1300 m water depth) was discovered in 2006 and is 40 km southwest of Golfinho. The type of production system to be used is still under study.

Together, these fields represent a volume of oil in place of approximately 2.4-billion bbl oil equivalent.

Peroa. The Peroa field is a nonassociated gas field in 60 m water depth. It was discovered in 1997 and will use a fixed production platform, a gas pipeline to shore (56 km), and gas treatment at the Cacimbas unit. With an increased number of wells, as well as platform and gas-plant upgrades, 333 MMcf/D will be produced by the end of 2008. **JPT**

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