

# Oil at great depths

**Massive** Alfa Laval plate heat exchangers, diesel purifiers and desalination equipment are helping Petrobras, Brazil's national oil company, recover oil from ocean depths only Jules Verne could imagine.

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**USING NEW ADVANCED TECHNOLOGY** that allows offshore oil production at depths of 2,200 metres and soon will make exploration for oil possible at more than 7,000 metres, Brazil is quickly becoming one of the top oil-producing countries in the world.

Drilling at such extreme depths in the Atlantic Ocean has become the hallmark of Brazil's oil exploration.

Brazil's state-owned oil company Petrobras (Petroleo Brasileiro SA) is responsible for the deep-sea oil exploration and production and is considered one of the leaders in the field.

Brazil has proven oil reserves estimated at 12.6 billion barrels, according to the latest BP Statistical Review of World

Energy, which puts the country between Algeria and China in terms of oil reserves. A majority of these reserves are situated below a 1,400-kilometre swath of ocean between Florianópolis, south of São Paulo, and Vitoria in the north.

The most productive field is located in the Campos basin, which has an area of 100,000 square kilometres. In the area some 60 active wells account for 80 percent of Brazil's total crude oil production, which at end of 2007 was more than 1.8 million barrels per day.

One of the biggest wells in the Campos basin is the Marlim Leste field, 120 kilometres southeast of Rio de Janeiro, which is expected to come online in late 2008 at a depth of more than 1,000 metres.

As at other such deep-sea oil wells, oil is recovered not through traditional four-legged oil platforms but rather through floating production storage and offloading (FPSO) facilities. In essence these are retrofitted, immobile oil tankers with production facilities onboard built on three-storey-high skids attached to the hull.

A typical FPSO facility pumps oil up from the bottom of the ocean through pipes cemented in the seafloor. When oil is pumped up from below the ocean floor, it is often mixed with gas, water and sand. To separate these elements, the mixture is heated to between 70 and 140 degrees Celsius, to

liquefy it and ease separation. The oil is subsequently stored on the FPSO (process capacity – 180,000 barrels per day) before it gets offloaded to smaller tankers.

These FPSO facilities can cost upwards of 1.5 billion US dollars to build. The latest one, the P-53, which will drill the Marlim Leste field, is one of the most efficient and well planned. The P-53 is designed to produce oil nonstop for the next 25 years.

When designing the P-53, special attention was given to maximizing the space onboard and minimizing the weight of the equipment, as well as its environmental impact. For example, eight Alfa Laval T-50 plate heat exchangers are used on the P-53 to recover the heat that is used to separate the oil from the water and gas. Each of these weighs 30 tonnes and is as tall as a London bus.

The Alfa Laval T-50 heat exchanger is often referred to as “the giant from Lund,” as it is one of the largest in the world. This is the first time T-50s have been used in the offshore industry, although Alfa Laval has been a preferred supplier to the Brazilian oil industry for the past 30 years.

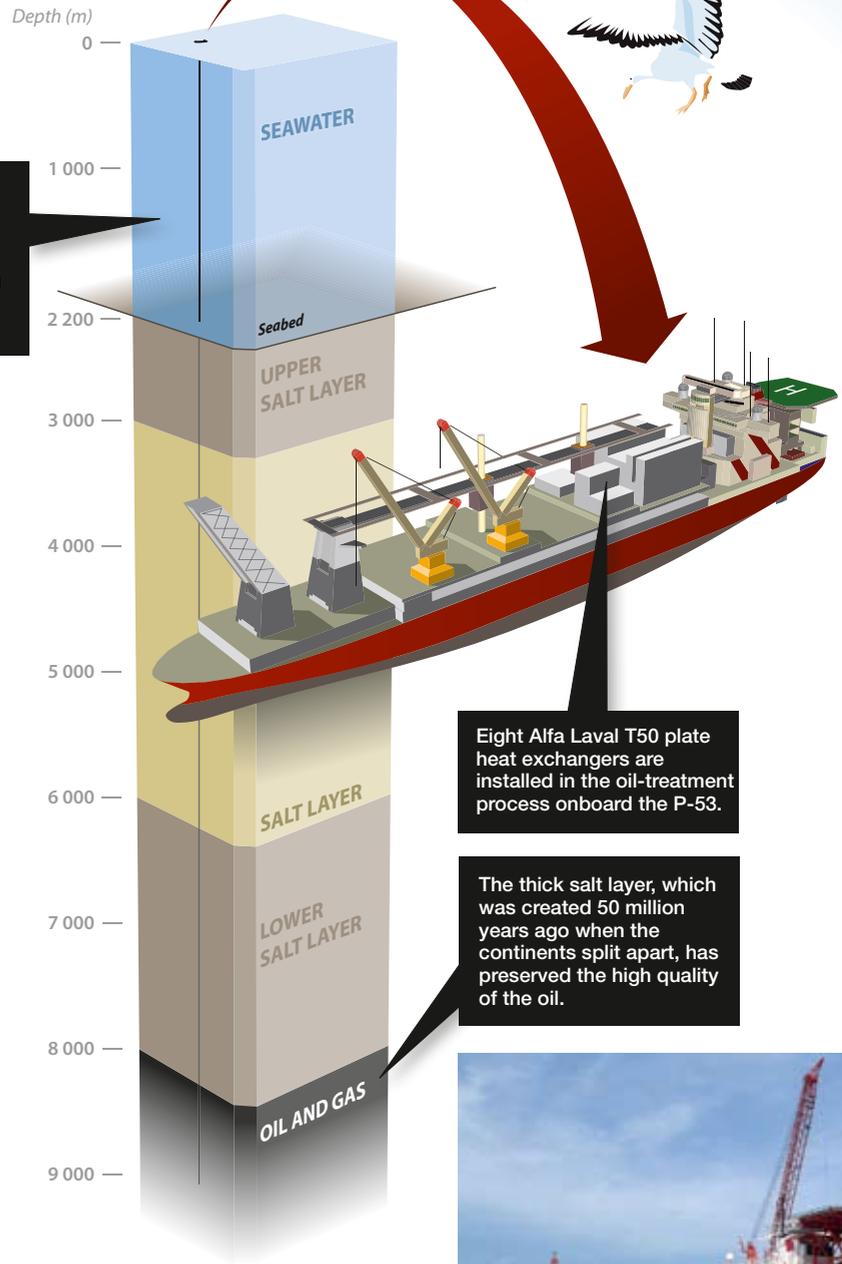
“The solution we adopted initially called for 16 heat exchangers, but we wound up with eight,” says José Miguel Simao Filho, the engineering director of QUIP, the company formed to manage the P-53 for Petrobras. “This represented a dramatic reduction in the space and the amount of maintenance required.”

The use of Alfa Laval T-50s also translates into cost savings, due to a reduction in energy consumption and service needs.

Besides heat exchangers, Alfa Laval has supplied diesel purifiers and desalination equipment to the P-53, which will be used to supply fresh water onboard the P-53 as well as to neighbouring rigs.

“Alfa Laval products have shown high reliability and therefore a high operability,” says Edmilson Soares de Medeiros, P-53 project manager. “In addition to that, the company has shown itself to be very good at providing technical assistance.” ■

In 2003 Petrobras reached a production depth of 1,886 metres. Now it is looking at reaching a depth of 3,000 metres.



Eight Alfa Laval T50 plate heat exchangers are installed in the oil-treatment process onboard the P-53.

The thick salt layer, which was created 50 million years ago when the continents split apart, has preserved the high quality of the oil.



FPSO vessels can store up to 2.8 million barrels of oil.

► [www.alfalaval.com/here/oil/brazildeepsea](http://www.alfalaval.com/here/oil/brazildeepsea)

► Offshore oil

## Deeper and deeper

– Petrobras challenges the limit for deep-sea oil production

With a majority of its oil reserves located out in the Atlantic Ocean, Brazil’s Petrobras state-owned oil company is one of the world’s leaders in offshore oil production. And since oil was found in the Campos basin in 1974, the limits of deep-sea drilling have steadily been pushed upwards – or actually downwards.

In 1977, oil was recovered at 124

metres in depth. By 1994, oil could be recovered from more than 1,000 metres in depth. Today, oil is being pumped up to the surface from depths of more than 2,200 metres, according to the Petrobras website.

In 2007, Brazil made oil industry headlines by announcing the discovery of the world’s biggest oil field. The Tupi find is a mega oil bed 300 kilometres from Santos, Brazil,

**“We don’t think we have any insurmountable challenge on the technology side.”**

and has estimated reserves of 8 billion barrels of light crude. The catch: It is 7.2 kilometres below the ocean’s surface.

“We don’t think we have any insurmountable challenge on the

technology side,” Petrobras’ CEO told the *Herald Tribune*.

According to the BP Statistical Review of World Energy, the Tupi find puts Brazil ahead of Mexico in terms of proven reserves. ■