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May 5, 2013 12:54 pm

Cutting-edge technology plays key role for Repsol in hunt for oil

By Guy Chazan

For the secret of Spanish energy group Repsol's success in finding oil around the world, look no further than the Torre Girona chapel in Barcelona.

The deconsecrated church, with its carved wooden doors and Romanesque arches, houses MareNostrum, one of Europe's most powerful supercomputers.

It is the foundation for Repsol's Kaleidoscope project, a unique collaboration between computer geeks and geologists that symbolises the growing role of science in the hunt for oil.

"As access to reserves gets harder, technology is the key," says Santiago Quesada Garmendia, Repsol's director of E&P and gas technology. "It is the key driver for the future of the oil industry."

Kaleidoscope was established in 2007 to develop tools for visualising rock structures deep below the ground and so reduce the uncertainty that dogs the business of oil prospecting.

It has helped locate oil buried in some of the world's most complex geological structures, such as the legendary "presalt" fields of Brazil's Campos Basin.

"Kaleidoscope helped us discover Brazil," said Antonio Brufau, Repsol's chief executive in an interview.

The idea behind the programme was to create a new class of seismic-imaging codes – the computer algorithms that turn raw seismic data into detailed images of the subsurface.

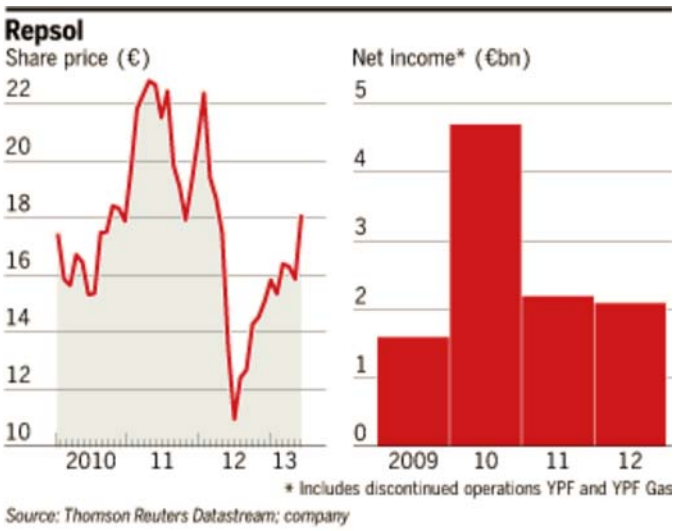
Francisco Ortigosa, Repsol's Houston-based director of geophysics, says the company wanted to analyse the insides of the earth "with a new lens".

"It's like when you look at the sky: you can use conventional binoculars or the Hubble telescope," he says. "Kaleidoscope is like a Hubble for the earth's subsurface."

Repsol is not alone in using cutting-edge computer hardware to find oil.

BP's supercomputer complex in Houston was the world's first commercial research centre to achieve a petaflop of processing speed – or one-thousand trillion calculations a second.

BP's experience shows that the demand for computing power in the oil industry is rising exponentially. The company says its computing needs are 10,000 times greater than they were in 1999.



One of the reasons is that geologists and geophysicists are looking for crude in ever deeper waters, further below the seabed, and often under thick layers of salt that plays havoc with traditional methods of seismic imaging.

So they need supercomputers to correct for the salt-related distortion. BP's engineers now have the processing power to complete an imaging project in one day that would have taken four years using hardware from just a decade ago.

The story of Kaleidoscope began in 2004 when Mr Brufau was appointed chief executive of Repsol in 2004.

At the time, it was known as the "oil company with no oil". Instead it had a lot of refineries and petrol stations and YPF, the Argentine unit it acquired in 1999.

"When I joined, it was very good in downstream with high risk in Argentina but nothing more than that," Mr Brufau said. "At that moment, we decided we had to grow in the upstream."

Mr Brufau reassigned hundreds of engineers and technicians who had been working in Repsol's plastics and chemicals division to the company's thinly staffed exploration and production arm – with a mission to find oil.

Knowing they could not compete with bigger rivals such as Royal Dutch Shell and ExxonMobil on land, they ventured into the deepwater offshore, particularly in Brazil.

It soon became apparent to Repsol's bosses that they needed to reduce the uncertainty of exploration drilling in such frontier areas.

"When you're a small company and you're spending $150m per well, you have to be very careful," Mr Brufau says.

The solution lay in technology. Repsol teamed with Barcelona Supercomputing Centre, using its MareNostrum to test complex mathematical algorithms that would then be used by the company's supercomputer in Houston to crunch production data at a speed that outclassed the

company's rivals.

The Houston computer was based on a chip developed by IBM for the Sony PlayStation. Adapting it was a big challenge.

"We were programming something for seismic imaging that was conceived for video gaming," says Mr Ortigosa. "We had 80 times more lines of code than a traditional chip."

Since starting up in 2007, the computer has processed more than 100,000 square kilometres of 3D seismic data.

The results have been impressive. With the help of Kaleidoscope, Repsol has been able to make a string of significant discoveries in Brazil, the US Gulf of Mexico and Bolivia.

With these finds due to come on stream in the coming years, the company is targeting production of 500,000 barrels of oil a day by the end of 2016.

The company's reserve replacement ratio, which was just 35 per cent in 2007, was 204 per cent last year.

Repsol's exploration success has provided some compensation for the setbacks it has had on other fronts.

The company was rocked by last year's seizure of YPF by the Argentine government, which forced it into a sweeping strategic review. In the ensuing months, it battled to maintain its investment-grade credit rating and was obliged to sell assets to cut debt.

Meanwhile, Repsol is struggling to maintain its competitive edge in technology, as bigger rivals with deeper pockets invest heavily in research and development.

BP is building a supercomputer in Houston that will boast total memory of 546 terabytes – the equivalent of 147,000 iPods.

Santiago Quesada Garmendia insists that Repsol must keep up. "The main thing is people understand that technology is a great engine for growing the company," he says. "Everyone recognises it's key."

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