Gulf deep shelf gas drilling expected to increase

THE MINERALS MANAGEMENT Service (MMS) has been encouraging the drilling of deep gas wells on the Gulf of Mexico shelf for several years. However, even with the MMS' incentives including royalty relief for a certain amount of initial production from wells below 15,000 ft, it appears that exploration in the area has only recently become active.

This may change in 2004, however, as more becomes known about deep gas formations and the challenges of drilling for them.

Confidence in the E&P industry stepping up its deep gas drilling also comes from **Rowan Companies**, which is building four new Tarzan Class jackups targeted primarily at this market.

The first rig, the Scooter Yeargain, will be delivered this year. Additionally, some drilling contractors have upgraded jackups for this market.

MORE GAS

When deep shelf gas exploration and production does begin to ramp up as expected, the MMS says there may be significantly more gas to be found than it previously thought. The agency recently increased their resource potential by 175%.

According to MMS officials, new data and a better understanding of the deep gas potential due to recent discoveries led them to increase their resource estimate up to 55 trillion cubic ft of gas from a previous estimate of up to 20 tcf.

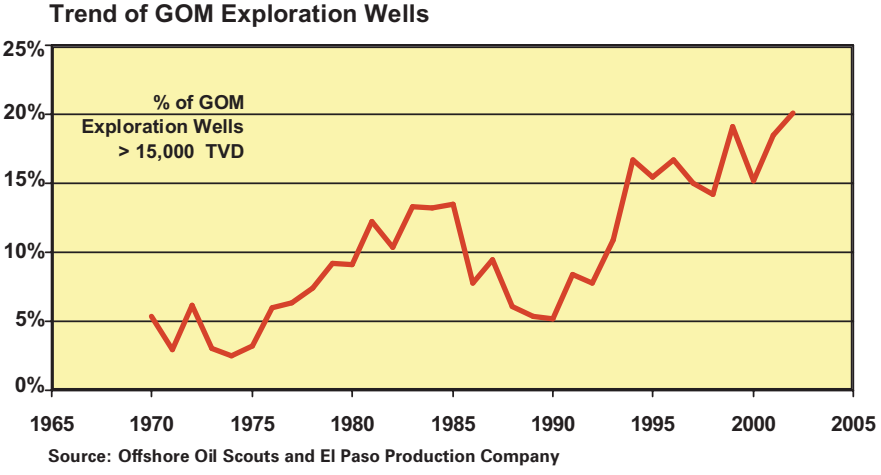
The MMS uses a complex series of calculations to account for the probability of discovering recoverable amounts of natural gas, and the new estimate is seen as the possible greatest amount of deep natural gas in the region.

The agency revised its estimate based upon several events. One is a better understanding of deep potential derived from deep discoveries that are currently producing, including **Shell**'s Alex discovery, **Anadarko**'s Hickory and **El Paso Production**'s South Timbalier Block 204 prospect.

Other announced discoveries that entered into the calculations are **McMoRan's** JB Mountain and Mounds Point in the South Marsh Island area.

Additionally, new seismic data acquired and processed using the latest technology improve imaging at increased subsurface depths. Also, conceptual plays that were outlined and mapped using the new seismic data and incorporating gravity and magnetic data in MMS interpretations played a part in the new estimate.

MMS Director **Johnnie Burton** said the new estimate is a hopeful sign of where additional gas supplies may be found. She said the Department of Energy is predicting natural gas supply shortfalls and it is imperative that diverse sources of gas be found.



"Gas discovered domestically in very deep waters of the Gulf or in shallow waters but deep into the shelf remains a key supply source," Ms Burton said.

Deep shelf gas production increased by an estimated 137 bcf between 2000 and 2002, according to the MMS. Production in 2000 was 284 bcf with an estimated 421 bcf in 2002.

That figure could increase in 2004 as some of the more than 66 new deep shelf wells started by operators in 2003 begin to come on stream.

DEEP SHELF GAS POTENTIAL

Of the more than 47,000 wells that were drilled on the Gulf shelf region, less than 3,000 (about 6%), exceeded 15,000 ft total vertical depth (TVD), according to **Reese Mitchell**, Vice President, Drilling for **El Paso Production Company**. Less than 300 wells are deeper than 18,000 ft.

"The nature of the deep wells are high pressure, high temperature and high rate," Mr Mitchell said.

"They have pressures greater than 10,000 psi and bottom hole temperatures about 300° F," he continued. "These wells have high rates as well as high reserves which equals a high rate of return."

The mean reservoir size on the shelf has been decreasing, Mr Mitchell noted. For each 10-year period from pre-1960, when the mean pool size was 528 bcfe, it has dropped to 27 bcfe during the last ten year period from 1990-1998.

"However, if you take the deep shelf work out of the last four to five years," Mr Mitchell said, "it would be a lot less then the 27 bcfe on the shelf."

New seismic data and higher natural gas prices resulted in increased gas drilling, including deep shelf activity. At the end of 2003, approximately 20% of the Gulf of Mexico exploration wells were greater than 15,000 ft.

"Some of the true potential is great to look at," Mr Mitchell said, "but if you don't have the revenue it is hard to rationalize drilling the wells."

He noted the South Timbalier 189/204

discovery with **ChevronTexaco** in 2001, which was used by the MMS in re-estimating potential deep gas reserves.

Initial production rates from all but one of the eight wells were above 50 MMcf/d. Cumulative production to September 2003 was 186 Bcf of gas.

"That is good testimony of the real potential of the deep shelf," Mr Mitchell noted. "We have had other fields that approach that type of success rate."

"We have been very pleased with the permeability and porosity that exists in the deeper Miocene sands on the shelf," he continued. "We are seeing better reservoir conditions than of lot of people expected."

DEEP AND DEEPWATER

Robert A Meize, Offshore Division Drilling Manager for **Anadarko Petroleum**, said that some of the wells being drilled in deepwater show a bit of the future as drilling goes deeper and deeper on the shelf.

Mr Meize said several wells on the shelf have already been drilled below 20,000 ft.

In fact, Anadarko's Hickory discovery in about 328 ft of water, also used by the MMS to estimate higher potential deep gas reserves, was drilled to about 22,000 ft. The Green Canyon 518 in about 4,000 ft of water, was drilled to approximately 27,000 ft.

"We are finding nice quality sands at those depths," Mr Meize said, "and the good news is that we are also finding hydrocarbons associated with them."

Mr Meize noted that Anadarko has a couple of wells planned for 2004 approaching 30,000 ft.

"If we can step away from the shelf and look at some of the issues we experience in the deep water, it gives us a glimpse of what we have to look forward to (on the shelf)," he said.

One well in progress in late 2003 was scheduled to reach 29,000-30,000 ft in early 2004. This particular field has a large, approximately 12,000 ft thick salt section.

Drilling in subsalt areas was very difficult about 10 years ago, with numerous wells hitting salt sections at 15,000-16,000 ft. Drilling operations were halted at the time because the salt structure could not be penetrated. Experience with this particular problem is leading to better E&P results in deep prospects.

"A lot of the deep plays have big salt structures associated with them," Mr Meize said, "and with a lot of work the industry has done, people have now figured out subsalt drilling."

As the industry becomes more experienced with deep and ultra-deep wells, more will be drilled.

"Everyone who has experienced one of these deep wells knows the difficulty and expense of drilling the wells for the first time," Mr Meize said. "Once the first well is down, you can go back and design subsequent wells."

"We have seen a lot of fields show as much as a 50% improvement on the second well just by digging through the data from the first well."

DEEP SHELF CHALLENGES

While the industry is gaining more experience and success with deep shelf gas plays, there still are numerous challenges to reach the reservoir objective and producing it successfully.

Mr Mitchell with El Paso says drilling challenges include:

- Well design;
- Pore pressure prediction;
- Casing design and casing point selection;
- Rig and mud system selection;
- Well control.

He also notes that there are several areas that need improvement, including MWD and LWD tools for HPHT and high solids mud environments with long MTBF.

He also said improvements can be made in the area of wireline logging tools and surface equipment that can handle deeper depths and HPHT environments.

Directional drilling equipment for HPHT environments with long MTBF is another area for improvement.

Mr Mitchell also said the industry needs a new generation of shallow draft drilling equipment, and jackup rigs would be helpful.

"Some of our work is in 6-8 ft of water," he said, "and they also need equipment to handle necessary mud weights at 20,000 ft."

Mr Mitchell said the industry needs to increase the availability of technical and operational personnel.

"It's nothing against the people we have today," Mr Mitchell explained, "but we are seeing more and more operators drilling these types of wells and there are not that many people in the industry that have the expertise."

Mr Meize notes several special challenges for ultra-deep drilling, including:

- Drill pipe – High torque connections and joint strength;
- Fishing – back-offs, rotary table torque versus drill pipe torque;
- Wireline tools – capstan and line size;
- Hole volumes;
- Hydraulics;
- Trip times;
- MWD tool pressure limits;
- Pressure at 27,000 ft.

"The area is relatively unexplored and it is going to take a bit of money," Mr Meize said, "but as more information and confidence is gained, the industry can push these wells deeper where we are finding sands and hydrocarbons."

As the industry starts pushing the envelope and reaching 800,000 lb drillstrings, it needs everything it can get from the rig, including deck space; variable deck loads; hook loads and combined rig loading; hydraulics; and offline pipe handling capability.

Mr Meize also said it is important to run full-cycle well construction models to understand all of the drilling and production loads, and plan cement volumes and casing pressure tests.

"Despite the challenges and difficulties associated with deep and ultradeep wells, the future is expected to be exciting as some of the large fields come on line during the next few years," Mr Meize said.