

# Hydraulic Fracturing Potential, Challenges Highlighted in Conference

Ted Moon, *JPT Online* Technology Editor

A distinguished panel of operating company representatives assembled earlier this year to share their views on how hydraulic fracturing is being applied today, and what challenges must be overcome to achieve further gains. The panelists took part in the plenary session “Hydraulic Fracturing: Think Global But Act Local” at the SPE Hydraulic Fracturing Technology Conference 2009 in The Woodlands, Texas.



**Holditch**

Stephen Holditch, Department Head and Samuel Roberts Noble Foundation-endowed Chair in Petroleum Engineering at Texas A&M University, moderated the plenary. He opened with a discussion of the so-called “resource triangle” theory that states that hydrocarbon resources are distributed log-normally in nature, with easily developed conventional reserves—which are a relatively small portion of overall volume—located at the top of the triangle. “As you get deeper into the resource triangle [closer to the base], the amount of unconventional resource plays is tremendous,” Holditch said.

A method developed at A&M to evaluate the ratio of conventional to unconventional resources in a basin suggests that there is approximately 10 times more technically recoverable oil and gas from unconventional resources than from conventional reserves. This method was developed from data-rich basins in the US Rockies region, but Holditch is confident that this same ratio should be found in basins around the world.

“We are looking at more basins with this technique, and if the 10-to-1 [unconventional to conventional] ratio holds up, this means there is an enormous amount of unconventional resources yet to be produced around the world,” he said. “Technology transfer on techniques such as hydraulic fracturing will be key to unlocking these resources.”



**Bartko**

Kirk Bartko, Senior Petroleum Engineering Consultant with Saudi Aramco's Petroleum Engineering Support Division, spoke next about his company's stimulation efforts in Saudi Arabia. He said that as of 2006, the country had more than 5% of the world's known gas reserves with 230 Tcf. “Domestic demand is 7 Bcf per day, and by 2025 this is expected to grow to 14 Bcf per day due to increasing industrial requirements and electricity generation,” he continued.

In addition, Saudi Aramco has a goal of adding 100 Tcf of gas reserves to its portfolio over the next 10 years, which will require greater movement into tight-gas sands and basin-centered gas. Much of this effort will be focused on the Rub Al Khali region, a 250,000-sq mile area with complex formations.

Bartko presented results from a hydraulic fracture field trial that used a slotting technique to pump approximately 150,000 lbs of proppant into a highly unconsolidated reservoir. Gas production increased significantly, from 1 MMscf/D at 100 psi prior to fracturing to 8 MMscf/D and 1,100 psi post-fracture. He also presented results of a multistage fracturing job in a tight-gas well in which the company ran a single highly slanted lateral across several layers with permeabilities ranging from 0.5 to 2 md. Three successful acid-fracturing stages were conducted which tested at 40 MMscf/D and stabilized to a rate of 15 to 20 MMscf/D after 8 months.



**Flesher**

Stimulation in tight-gas sands was the next topic presented by Robert Flesher, Vice President of Drilling and Production for ConocoPhillips. Fracturing plays a large part in ConocoPhillips' North American production, with 80% of the company's US land and Canada production coming from hydraulically fractured wells. In addition, 95% of US land and Canada fractures are in tight-gas or unconventional resource wells.

Flesher quoted a 2007 American Research Institute estimate that the North American unconventional resource play prize (consisting of tight gas, shale gas, and coalbed methane) exceeds 800 Tcf equivalent recoverable, and there is little reason to doubt that significant resource plays also exist in other continents. He listed several critical challenges preventing greater recovery of this sizable resource, including the need for improved techniques to optimize large, onshore drilling programs; better permeability creation technologies; and achieving better performance from low-gas-rate wells.

Flesher also provided a “wish list” of enabling technologies to progress unconventional plays: improved fully gridded and coupled geomechanics/stimulation modeling of fractured reservoirs; reliable and cost-effective multistage fracturing technology and zonal isolation; high-temperature frac fluids and smart proppants; and more economic pinpoint stimulation systems.

Hydraulic fracturing challenges from a European perspective were next provided by Jacques Alfenore, Corporate Head



**Alfenore**

of Engineering for Well Productivity with Total. "We are not a major hydraulic fracturing operator, but we will take our share of challenges," Alfenore said. These challenges are linked to technology, economy, and logistics, he continued, and are being felt at various Total assets around the globe.

Specific challenges include how to effectively fracture deeply buried, low-permeability, high-temperature/pressure reservoirs in the Norwegian North Sea; how to exploit tight-gas reservoirs in remote areas with sensitive and low-permeability formations; and the need to develop fracturing additives that can drastically reduce capillary pressures such that phase trapping (spontaneous imbibition brought about by subnormal initial water saturation) does not occur.



**Heinze**

Jim Heinze, Manager of Operations Engineering for Devon's Central Division Midcontinent Area, provided his company's perspective on the challenges in stimulating gas shales in the

US and Canada. For 2008, Devon's Central Division performed approximately 3,400 frac stages and pumped 1.1 billion lbs of proppant in the Woodford (Oklahoma) and Barnett (Texas) shales alone.

This level of activity has dropped off in 2009, brought about by lower oil prices, but additionally by other challenges such as tight proppant supplies, insufficient numbers of trained employees and contractors, and difficulties in moving best practices and learnings from one play to another.

Heinze highlighted that a major challenge going forward would be problems with water resources, both supply and disposal. The company has been testing a technology from Canadian manufacturer Aqua-Pure known as Nomad (mobile, on-site vapor distillation units that heat and separate brine from water used to fracture gas formations) in the Barnett. A total of seven Nomad units are operating in the Barnett and have allowed Devon to process 9 million barrels of produced water to generate 7.1 million barrels of distilled water. This recycled water was subsequently used to fracture 87 wells.

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*Read more about this plenary session, including the discussion during the question and answer session, at [www.jptmagazine.com](http://www.jptmagazine.com).*

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