

# Break through

Multi-stage fracturing has emerged as one of the most important technologies in the development of natural gas resources in recent years, and its widespread use ensures that it will continue to be a game changer for years to come.

**Canada and the US have committed** to increasing their domestic oil and gas production. Junior Canadian companies have led the way in boosting recovery through innovation. Multi-stage fracturing is one of the most important new technologies in Canadian oil and gas. Calgary firm Packers Plus' StackFRAC techniques have increased the number of sand and shale reservoirs that are now economically feasible to exploit. The efficiency of the system allows operators to make enough profit to weather the low prices of the global economic downturn. When prices recover, multi-stage fracturing will open up an even wider range of reservoirs to profitable development.

Hydraulic fracturing as a method to achieve greater fluid flow from a well bore has been around since the 1940s. The principles behind conventional fracturing are simple. Water or another kind of fracturing fluid is pumped into a well at extremely high pressures, literally causing the rock to crack. A permeable particulate matter called a proppant (usually sand but in some cases ceramics) is inserted into the liquid during injection so that when fracturing fluid is removed, the proppant will hold open the fractured channels, creating greater fluid conductivity and exposing more of the rock face to the reduced pressure of the well bore.

Traditional fracturing methods have limitations. They rely on cementing and delivering fracturing fluids at high pressure. Cementing is both costly and time consuming. The time it takes to remove and re-rig a borehole further slows production. At greater depths or in horizontal wells, cementing and fracturing is very difficult and uneconomical.

One alternative technique, plug and perforating, uses inflatable plugs in a well bore to seal off a section of the well for targeted fracturing. Again, however, the time needed to reset the plugs in various stages along the bore limits this method's short-term production capability. In addition, inflatable plugs are often unable to withstand the pressures needed to fracture low permeability rock.

The advantage of multi-stage fracturing techniques is that they allow multiple targeted fractures simultaneously, greatly reducing the time needed to increase production. Packers

Plus is synonymous with multi-stage fracturing today. In 2001 the company's president and CEO Dan Themig began designing schemes to create multiple fractures along challenging horizontal well bores in Texas. Seeing the success of the company's StackFRAC method, US firms expressed considerable interest in the new technology and Packers Plus gained a reputation for the speed and effectiveness of their completion services. In 2007 Packers Plus solidified that reputation at home by dramatically increasing production at the Bakken reservoir in Saskatchewan. For 40 years oil and gas firms had attempted to make the Bakken economically viable. StackFRAC brought about a fivefold increase in production, earning Packers Plus the entrepreneur of the year award 2009 from Ernst & Young.

The basic advantage of multi-stage fracturing is simplicity. With this technique pumping equipment only needs to be rigged up and down the borehole once. Once in place the StackFRAC system allows an operator to target multiple portions of rock for treatment. The StackFRAC's open hole packers are designed to withstand pressures up to approximately 48,800 kilograms per square metre and temperatures of up to 232°C. An operator can then sequentially pump fracturing fluid into the various sealed off stages without cementing or having to adjust composite packers.

Firms throughout North America are re-examining unproductive reservoirs in the light of this new technology. Questerre, for example, is poised to extract significant shale gas resources in Quebec because the StackFRAC method makes it economically viable to do so. The obvious benefits of multi-stage fracturing have also caught the interest of international oil and gas players, due in part to the firm's partnership in 2005 with Schlumberger. Packers Plus is now engaged in Africa, Northern Europe, China and the Middle East. Even Saudi Aramco has employed the services of Packers Plus in an effort to bring Saudi Arabian oil reservoirs to greater stages of completion.

A home-grown Canadian initiative to engineer new methods of meeting unprecedented geological challenges has spread throughout the global oil and gas industry. ■

## FIGURES

### MULTI-STAGE FRACTURING COST BENEFIT

44 percent

Of conventional oil drilling approaches