An energy future based on shale gas?

Accelerating demand for energy means a sharper focus on unconventional gas reserves is inevitable, says Ghasser El-Badrashini, Halliburton Vice-President, Middle East and North Africa.


The most common sediment on earth

This much we know about the future: Worldwide demand for energy will continue to grow. Many estimates suggest that, by 2030, global energy demand will be double what it was in 1990.

This goes along with projections for a 55 per cent rise in population, a 150 per cent increase in the number of passenger vehicles on the road, and a doubling of the number of commercial jets in service.

This is sure to drive up energy costs as conventional sources become more scarce over time. Coal and liquid hydrocarbons drove the unprecedented growth of the last century. What will sustain the accelerating economic growth of the next 20-40 years?

Forecasts of the imminent end of the hydrocarbon future have been with us for a generation. In recent years, the development of unconventional gas resources, especially shale gas, has significantly changed those forecasts.

Natural gas, led by the vast reserves of shale gas located all over the world, has the potential to extend the hydrocarbon era for several decades and provide a bridge to whatever energy forms prove economical after that.

Natural gas has a mature infrastructure of pipelines, storage facilities and delivery systems in much of the world already. Its energy is stored in chemical form, so it can be transported to meet shifts in demand. It is highly versatile – it can be used for direct heat, power generation and transportation. Today, there are already more than 11mn natural gas vehicles in service worldwide; this number could grow rapidly under certain economic scenarios.

The abundance of natural gas has been vastly underestimated. Gas production in the United States and other countries in the Western Hemisphere has climbed in recent years, yet advances in technology and accumulated experience are continually making new reserves. Consumption is increasing, but reserve estimates are increasing faster – they have grown by thousands of trillion cubic feet. Some are predicting that shale will provide as much as 50 percent of U.S. natural gas by 2030. Reserve estimates for shale gas in the Middle East and North Africa are likely to increase as development accelerates in the coming years.

Shale is the most common sediment on earth, but its composition varies radically from one formation to the next. Even within one formation, the variation can be substantial. Consequently, each development offers a unique and complex set of challenges from formation evaluation through drilling to completion and production.

Developing each shale gas formation involves climbing a steep learning curve. Accelerating that learning process is the operator's biggest challenge.

Today's integrated service companies are active in unconventional gas basins around the world. They are increasingly structured as learning organizations – networks of specialists who can share knowledge and accelerate the learning process. Shale gas development in the Middle East and North Africa will benefit from the knowledge acquired by service companies developing basins in North America. As a result, Middle East and North Africa operators will climb the learning curve much faster than their North American counterparts.

The service company learning process has three main elements that work together to shorten development times and reduce costs: creating new discrete technologies and new ways to integrate technologies that are especially applicable to unconventional formations; structuring their organizations to both acquire knowledge faster and apply it to the whole development challenge; and creating new commercial frameworks that marshal the knowledge of operators, service companies and supply chains for maximum effect. All three of these processes will help Middle East and North Africa operators as they develop their unconventional resources.

The solutions to the technical challenges are interrelated. They include better and faster formation evaluation, more cost-effective completion design, and overall integration of services to optimize the asset.

Horizontal wellbores expose more of the formation to production, and advances in horizontal well technologies have enabled the dramatic growth of unconventional gas development. Successful horizontal wells, in turn, depend on accurate wellbore placement, efficient stimulation, and cost-effective completions. Advances in all these areas depend in part on better, faster data acquisition and interpretation.

The InSite ADRTM azimuthal deep resistivity sensor is a recent breakthrough technology that delivers high-resolution images to help navigate complex formations with greater precision. The sensor acquires data in 32 discrete directions around the tool at 14 different depths of investigation up to 18 feet into the formation. The images created give early warning of fractures, thin beds, dip and other changes in lithology and geologic structure. This new source of while-drilling formation data helps the drilling engineer look ahead of the bit and drill faster with less risk of leaving the payzone.

Efficient stimulation by hydraulic fracturing is a make-or-break operation because of the extremely low permeability of shale formations and tight gas formations. Fracturing can account for as much as 50 per cent of the cost of a well. Accurate, timely information about what is happening in the formation is key to designing effective, economical treatments.

Microseismic fracture mapping, the process of installing geophones in an offset well to monitor the microseisms around the wellbore caused by hydraulic fracturing, is a new and increasingly important method of learning what is happening in the formation in real time and then designing the stimulation treatment accordingly. For example, when the data show the treatment affecting the formation outside the payzone, the frac engineer can shut down the treatment early or lower the treatment rate. Modifying the treatment immediately is a much more effective way to maximize the stimulated reservoir volume than assessing the treatment after the operation.

The economics of unconventional gas basins have led to constructing horizontal wells with many frac stages – 20 or more stages are now common in shale gas wells in the United States. This is being made possible by a new generation of efficient completion technologies that can reduce completion time by 30-50 per cent. There are a number of such technologies that are proving effective; the choice depends on the specific conditions. There are typically two main questions: Is cement needed, or can the well use an openhole design and swellable packers? And does stimulation require a cluster of entry points and a perforated design, or a single entry point with sleeve technology?

Delta Stim® sleeve technology is one solution for multi-stage completions with a single point of entry. It helps overcome the limitations of plug-and-perforate completion methods that require intervention for each stage and typically allow only one or two zones to be stimulated in a 12-hour period. The Delta Stim sleeve system uses sliding sleeves that enable fracture placement control by consecutively opening the sleeves for sequential treatment of each zone. This enables the stimulation of as many as nine zones in 12 hours.

The complexity of these unconventional reservoirs has spurred the use of integrated optimized solutions – the combination of technologies and disciplines managed together in real time to optimize the whole. This ability to integrate and optimize across disciplines is the great frontier of innovation and value creation that will continue to drive down costs in unconventional gas plays.

The ADT® drilling optimization service is one example of such an integrated workflow. The ADT service mobilizes experts in all the relevant disciplines to optimize drilling rates, improve operational efficiency and minimize the impact of unplanned events. Using a process of "model, measure, optimize," the ADT service leverages expertise, specialized software and downhole measurements to learn the exact conditions at any point in the drilling process, reduce uncertainty, determine the root cause of unplanned events and provide effective solutions. The service mobilizes resources in three areas: drillstring integrity, hydraulics management and wellbore integrity.

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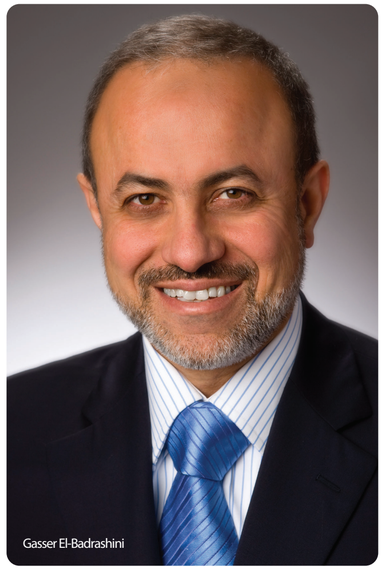
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