

Bigger not necessarily better for shale gas

By Jeff McDaniel
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In 2000, natural gas production from hydrocarbon-rich shale formations (shale gas) represented just 1% of gas production in the lower 48 states of the US. By 2009, shale gas production accounted for 14% of gas production. As this growth continues, shale gas is one of today's most rapidly expanding trends in onshore oil and gas exploration and production. The US Department of Energy estimates that in 2011 the major source of gas reserves growth will come from shale gas reservoirs.

But with gas prices remaining stubbornly low – less than \$4/million BTU (MMBtu) – the economics of some of these resources are marginal. As a result, the search is on to find the best ways to profitably develop shale gas resources. The current alternatives include waiting and hoping for gas prices to rise enough to make it profitable to put shale gas into gas pipelines; promoting the use of gas as a less carbon-intensive feedstock than cheaper coal for electricity production; or converting shale gas into other more valuable products, such as ethylene and other chemicals, in a chemical plant. All have their drawbacks.

An alternative: distributed GTL

The use of distributed gas to liquids (GTL) plants to convert shale gas into ultraclean liquid fuel at or near the production site shows great promise for improving profitability. Existing GTL plants, such as the Sasol Oryx and Shell Pearl GTL plants in Qatar, operate on a very large scale and are only economical where there are huge gas fields. Pearl, for example, was designed to produce 144,000 barrels per day (bbl/d) of GTL product, as well as 150,000 bbl/d of natural gas liquids, and is expected to produce about three billion barrels of oil-equivalent over its lifetime.

In contrast, distributed GTL plants based on the use of microchannel reactors are designed to economically and efficiently produce 5000 to 15,000 bbl/d of clean liquid fuels, and can be scaled to match the available resource. Several skid-mounted microchannel reactor modules can be run in parallel configuration to increase production volumes, making it relatively easy and inexpensive to alter production levels as necessary.

Very small is beautiful

The key to the efficient production in distributed GTL plants lies in the use of microchannel technology, a developing field of chemical processing that intensifies chemical reactions by reducing the dimensions of the reactor systems. This enables reactions to occur at rates 10 to 1000 times faster than in conventional systems.

Microchannel Fischer–Tropsch (FT) reactors contain thousands of thin process channels filled with FT catalyst, interleaved with water-filled coolant channels. Because the small-diameter channels dissipate heat more quickly than conventional reactors, more active catalysts can be used. For example, the Velocys microchannel FT reactors take advantage of a highly active FT catalyst developed by Oxford Catalysts to accelerate FT reactions by a factor of 10 to 15 times compared to conventional reactors.

This microchannel reactor technology will be demonstrated in 2012 in a small, integrated GTL facility located at the Petrobras refinery in Fortaleza, Brazil. Several other companies are also conducting engineering studies on GTL facilities that could make use of this microchannel reactor technology.



GTL skid for the Petrobras demonstration site at Fortaleza, Brazil



A microchannel reactor

All in all, distributed GTL could have a lot to offer the expanding shale gas industry. Based on the number of known small gas fields and present oil prices, this approach could unlock an estimated \$500 billion worth of value annually from these undervalued resources. When it comes to monetizing unconventional hydrocarbon resources, bigger, it seems, may not always be better.

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