

## QUARTERLY PROGRESS REPORT

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## **Abstract**

The original proposal described the construction and operation of a 1 MMscfd treatment system to be operated at a Butcher Energy gas field in Ohio. The gas produced at this field contained 17% nitrogen. During pre-commissioning of the project, a series of well tests showed that the amount of gas in the field was significantly smaller than expected and that the nitrogen content of the wells was very high (25 to 30%). After evaluating the revised cost of the project, Butcher Energy decided that the plant would not be economical and withdrew from the project.

Since that time, Membrane Technology and Research, Inc. (MTR) signed a marketing and sales partnership with ABB Lummus Global, a large multinational corporation, and is working with the company's Randall Gas Technology group, a supplier of equipment and processing technology to the natural gas industry. Randall's engineering group found a new site for the project at a North Texas Exploration (NTE) gas processing plant, and we continue, but have as yet been unsuccessful in our attempts, to negotiate with Atmos Energy for a final test of the project demonstration unit. In the meantime, MTR has located an alternative testing opportunity and signed a contract for a demonstration plant in Rio Vista, CA. Several commercial sales have resulted from the partnership with ABB, and total sales of nitrogen/natural gas membrane separation units are now approaching \$2.6 million.

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## **Introduction**

The U.S. natural gas pipeline specification for inert gases is less than 4%. On this basis, about 17% of known U.S. reserves of gas are sub-quality due to high nitrogen content. Some of this gas can be brought to pipeline specifications by dilution with low-nitrogen-content gas; some is treated by cryogenic condensation and fractionation. Nonetheless, about 1.0 trillion scf of known reserves are currently shut in.

This project covers the first demonstration of a new membrane technology to treat this otherwise unusable gas. The objective of this project is to develop a membrane separation process to separate nitrogen from high-nitrogen-content natural gas. To demonstrate the process, a proof-of-concept plant was built for a North Texas Exploration (NTE) gas field in Texas. A short test of the unit was of limited success due to a smaller-than-anticipated feed stream at the test site.

## **Experimental Update, Results and Discussion**

MTR has recently identified a new field test site in California. Towne Exploration, a company based in nearby San Francisco, has signed a contract for conducting an onsite demonstration for the nitrogen removal technology; testing is scheduled to begin in Q3 2006. MTR personnel have made several visits to the site which is located in Rio Vista, CA in the Sacramento Delta Area.

MTR is supplying a test unit which will house three 12-inch elements and three 8-inch elements and will process about 2 MMscfd of gas containing between 9-15 mol-% nitrogen. The requirement is to reduce the nitrogen content to a level such that the gross Btu value of the product gas is at least 990 Btu/scf.

## **Commercialization Status**

MTR and ABB have now sold a total of six commercial nitrogen/natural gas membrane separation units related to the technology developed during this project. The status of each unit follows.

- The Omaha Public Power District (OPPD) unit, our first commercial nitrogen/natural gas unit, and has operated with virtually no downtime since it was installed three years ago.
- The Twin Bottoms, KY, system installed for Interstate Gas in November 2004 remains in continuous operation and is now operating at its maximum design capability.
- Interstate Gas ordered a unit like the Twin Bottoms unit in 2005, and it was shipped to the client in February 2006.
- First National Bank of Omaha ordered a unit that was shipped on schedule in February 2006, and on-site start-up and installation was completed in March.
- Syntroleum Systems (Tulsa, OK) ordered a unit in late 2005. The unit is ready for installation, pending resolution of internal issues at Syntroleum.
- Hiland Partners (Dallas, TX) ordered a unit in 4Q 2005 for a site it operates in North Dakota. It is four times the size of the OPPD unit, and is the largest unit of this type ordered to date.

- Hiland ordered a second unit in the first quarter of 2006. Fabrication of both Hiland units began in February 2006, for 3Q 2006 delivery.

Commercial sales of natural gas/nitrogen membrane separation units related to this project technology total \$2.6 million.

### **Conclusions**

MTR has successfully tested the nitrogen/natural gas separation process in a commercial unit and demonstrated its performance at one wellhead site in Kentucky. The successful demonstration resulted in the sales of several additional commercial units. All installed commercial units are operating at or better than guarantee conditions, and our clients have given us several good references for further development of this business. Total commercial sales of \$2.6 million have been made for the product line developed from this project. Further sales are expected in 2006.

### **References**

None cited.