An Approach to Recover Hydrocarbons from Currently Off-Limits Areas of the Antrim Formation, MI, Using Low-Impact Technologies

DE-FC26-06NT42931

Goal

A consortium consisting of Michigan Technological University, Western Michigan University, and Jordan Development Company, LLC of Traverse City, MI, is collaborating to develop and test a new horizontal drilling strategy for satisfying environmental restrictions that currently place large tracts of prospective Antrim Shale acreage in the Michigan Basin off-limits to exploration and production.

Performers

Michigan Technological University, Houghton, MI
Western Michigan University, Kalamazoo, MI
Jordan Development Company, LLC, Traverse City, MI

Results

Work on this project is in the early stages, with it having started in October 2006. On December 14, 2006, permit number 58153 was issued by the State of Michigan Department of Environmental Quality to Jordan Development Company, LLC, to drill and operate the natural gas well, AG-A-Ming 4-12 HD and HD1 in the Antrim Formation (API numbers 21-009-58153-00-00 and 21-009-58153-01-00).

The project team met in March, 2007 and a presentation was given on the geologic descriptions and gas producing capabilities of the Antrim Shale and its sub-formations, Lachine, Paxton, and Norwood. Also, discussions were held on the demonstration well, the project team was provided detailed plans and the preliminary field work performed for the drilling of the horizontal demonstration well.

Work is continuing on the structure and isopach maps for the Lachine, Paxton, and Norwood formations in the Northern Michigan Antrim Trend. A spot map showing the identity of the formation immediately under the glacial till (Glacial Till in the Michigan Stratigraphic Code) is almost completed. It is apparent that the sub-till facies distribution is complex and not easily generalized or mapped. At present, the feeling is the spot map is the best representation. It is clear that prospect development will have to proceed at a very small map scale in the area of interest if the Antrim is to be mapped at the Member level. Analysis will continue on this problem but will likely conclude that the large-scale map is suggestive at best. More detailed interpretations of the Antrim will be attempted when the maps are complete.

Benefits

Significant portions of Antrim Shale acreage in Northern Michigan is currently off-limits due to State regulations requiring that wells be cased within 100 ft of the surface. This requirement is intended to reduce or eliminate contamination of groundwater and aquifers and to prevent gas leakage to the surface. The impact of such contamination on the subsurface is evident, while the impact to the atmosphere from these operations is less obvious but potentially more damaging. This project addresses both of these concerns. The proposed horizontal drilling effort will be much more efficient in producing the Antrim Shale, thus requiring far fewer wells than would be needed to drain an equivalent amount of acreage using conventionally drilled vertical wells. As a result, the environment will be less impacted and more resource will be developed.

Background

The Antrim Shale in Northern Michigan has been a very prolific unconventional gas producing horizon, having yielded 2.4 tcf to date. As the play has matured, efforts have been made by producers to extend the producing acreage into regions that are more challenging to gas development. A great deal of potentially productive shale lies within areas that are off-limits to gas development due to surface constraints such as topography, wetlands, or housing. Northern Michigan has become a desired area for vacation and retirement living, resulting in high-priced

real estate that commingles with the fairway of the Antrim Shale play. In addition to the surface constraints on Antrim Shale development, the Michigan Department of Environmental Quality (MDEQ) requires that 100 ft of surface casing be set into bedrock below the surficial glacial drift for all drilling. This requirement is in effect to protect groundwater resources within the glacial drift. In addition to this requirement, fracture stimulation cannot be conducted within 50 ft of the base of the surface casing string. Fracture stimulation is a vital step in improving the deliverability of wells to a point that they are commercial producers. As a result of these regulations, a vast amount of productive Antrim shale can neither be accessed nor completed in a conventional manner. State casing statute Instruction 1-94 presently eliminates much rock that is virtually certain to be productive in the Antrim Formation. Less than 50 percent of the Antrim Formation has been drilled to date, with large areas to the north and northwest of the heavily drilled area void of wells. This is largely due to the restrictions in Instruction 1-94. The project performers' proposed solution is to drill a horizontal well offset from the target, cement and case the vertical leg as required by the regulations, then penetrate the target with a lateral offset.

Summary

A critical project milestone was achieved in November-December 2006 with the application to the Michigan DEQ for the permit of the project demonstration well. This permit, 58153, was issued on December 14, 2006, for the AG-A-Ming 4-12 HD and HD1. This well is tentatively scheduled to be drilled when the State of Michigan frost laws are lifted in the late spring, probably May-June timeframe. Tasks 1 and 2 involving data collection and mapping are under way, and most data have been assembled for the project. It is expected that the maps and preliminary reports will be produced during the annual meeting in March.

Current Status (July 2007)

The project kickoff meeting was held on October 16, 2006, in Kalamazoo, MI. A project update meeting was held on December 13-14, 2006, in Traverse City, MI. A project meeting is scheduled for March 12-13, 2007, in Tampa, FL. All project tasks are on schedule. Tasks are nearing the 6-month time frame. Late spring is the scheduled time frame to begin drilling. Tasks 1 and 2 are in progress. Task 3, regulatory analysis, will begin in March, 2007.

Mapping activities have all started and some are nearing completion. The next major phase will be the demonstration well itself, scheduled to spud in late July-early August. The major accomplishment since the project began is convincing the Michigan Department of Natural Resources that the approach to tapping Antrim gas reserves via a novel approach involving drilling a lateral through the required casing zone and then angling back up met regulatory requirements. The DNR had no objections and is favorably impressed by the further advantage of the approach in lessening environmental impact as a result of requiring fewer wells and (potentially) providing more efficient drainage.

Funding

This project was selected under solicitation, DE-PS26-06NT15570, Low Impact Natural Gas and Oil (LINGO).

Project Start: October 1, 2006
Project End: September 30, 2008

Anticipated DOE Contribution: $499,672
Performer Contribution: $635,171 (77 percent of total)

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