New Drilling Platform to Drill Methane Hydrate Research Well in Alaska Permafrost

Methane hydrates have been identified in many wells in the Alaskan North Slope, mainly from geophysical logging in conventional oil and gas wells. The total recoverable gas resource locked in Arctic hydrates is estimated at 11,000 to 24,000 trillion cubic feet (Tcf). However, details on its concentration, mode of occurrence, and physical and chemical properties are lacking.

On March 18, the industry team of Maurer Technology, Inc., Anadarko Petroleum Corporation, and Noble Engineering and Development plan to spud the first dedicated hydrate research well in Alaska. Drilling of this well (Hot Ice 1) is the culmination of over a year of planning, preparation, and tool design and development. The objectives of this 3-year, $10+ million cost-shared Cooperative Agreement between DOE and Maurer Technology are to evaluate the subsurface hydrate occurrence and its production potential. It is anticipated that it will require two to three months from spud through drilling/coring, logging and completion.

Specialized tools for drilling, coring and core analysis will also be tested to determine best practices for safe and economical drilling and production of gas from hydrates in the Alaskan permafrost. Chilled drilling fluids will be used to insure good core recovery in a safe and stable environment.

A 3,000-foot (1,000-meter) well located southwest of the Kuparuk River Oil Field will be drilled using a hard-rock mining rig. The rig will allow continuous coring through the hydrate stability zone. The rig will be deployed from an innovative Arctic Platform, patented by Anadarko and constructed in Houston. The modular platform will allow for an extended drilling and testing season, and will have less environmental impact than traditional arctic ice/gravel pads. Using Noble's DrillSmart System, operational personnel located in Houston will be able to view and evaluate the drilling and coring operations, providing the means for real-time support to technicians on site.

Right: **Dynatec's Coring Rig**
Below: **Artist rendition of Arctic Platform**

Core samples will be collected and analyzed on site in the specialized Mobile Core Laboratory where a core x-ray scanner built by Lawrence Berkeley National Laboratory (LBNL) will assess the presence of hydrate. The hydrate core analysis will be conducted before the hydrates in the core have an opportunity to dissociate. A complete range of core and fluid analyses will be completed under controlled pressure and temperature. Measurements will include porosity, permeability, compressional and shear wave velocity, resistivity, thermal conductivity, and NMR.

Interior of Mobile Core Laboratory

Existing and newly developed logging techniques for characterizing porosity and water saturation will be used to evaluate the gas-hydrate-bearing reservoir. Vertical seismic profiles (VSP) will also be obtained to better resolve lateral subsurface variations of the hydrate-bearing strata. Correlation of these seismic data with cores, logging, and other well data will be generated and used to calibrate and quantify information obtained from future hydrate wells.

LBNL X-ray Scanner

After the final logging and VSP services have been performed, the well will be completed with 4.5-inch casing and perforated.

The well will be equipped with down-hole pressure and temperature transducers to allow the well to be monitored during testing.

Well testing will commence shortly after the well has been perforated. The well will initially be produced with a large draw down to determine the productivity of a hydrate zone without thermal stimulation. The well will be produced for a short time to see if a stabilized rate can be obtained. The well will then be shut in and the bottom hole pressure recorded. This cycle will be repeated for approximately one to two weeks. Water and gas samples will be collected during each production cycle to determine if the composition is changing with time.

The ultimate goals of the project goal are to: 1) develop and test the best tools and methods for drilling and recovering hydrates, 2) determine the amount of gas that can be recovered from the reservoir and potential production rates, and 3) demonstrate a new drilling platform that extends the Arctic drilling season while protecting the environment.

Reservoir characterization data will be used to help quantify the hydrate reservoir simulation and production model (TOUGH2) being developed by LBNL under a separate contract with DOE. Reservoir modeling will focus on alternate strategies for hydrate production on the North Slope.

Project Participants

- U.S. Department of Energy, National Energy Technology Laboratory
- Maurer Technology
- Anadarko Petroleum
- Noble Engineering and Development
- University of Alaska, Anchorage
- U.S. Geological Survey
- Lawrence Berkeley National Laboratory
- Paulsson Geophysical Services
- Dynatec

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