Oil & Natural Gas Technology

DOE Award No.: DE-NT0006553

Progress Report
Second Half 2012

ConocoPhillips Gas Hydrate Production Test

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National Energy Technology Laboratory

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Executive Summary

Accomplishments
- Completed database QA/QC
- Completed data analysis

Current Status
- Final report preparation is under way

Introduction
Work began on the ConocoPhillips Gas Hydrates Production Test (DE-NT0006553) on October 1, 2008. This report is the eleventh progress report for the project and summarizes project activities from July 1, 2012 to December 31, 2012. Work in this period focused on database QA/QC, data interpretation and preparation of the final report.
Cost Status

Expenses incurred during this period were below the Baseline Cost Plan as shown in Exhibit 1.

<table>
<thead>
<tr>
<th>Project Phase --&gt;</th>
<th>Phase 1, Site Identify</th>
<th>Phase 2, Field Test Planning</th>
<th>Phase 3A</th>
<th>Phase 3B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Reporting Quarter --&gt;</td>
<td>Q400</td>
<td>Q199</td>
<td>Q299</td>
<td>Q309</td>
</tr>
<tr>
<td><strong>BASELINE COST PLAN</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Share</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Non-Federal Share</td>
<td>220,078</td>
<td>167,366</td>
<td>300,675</td>
<td>333,875</td>
</tr>
<tr>
<td>Total Planned</td>
<td>220,078</td>
<td>167,366</td>
<td>300,675</td>
<td>333,875</td>
</tr>
<tr>
<td>Cumulative Baseline Cost</td>
<td>220,078</td>
<td>455,744</td>
<td>646,619</td>
<td>1,106,049</td>
</tr>
</tbody>
</table>

**ACTUAL INCURRED COSTS**

| Federal Share | - | - | - | - | - | - | - | - | - | 540,322 | 7,000,603 | 5,364,335 | 3,319,503 | 5,774,404 | - | - |
| Non-Federal Share | 121,612 | 195,669 | 255,448 | 354,447 | 354,447 | 359,001 | 327,267 | 256,579 | 308,856 | 540,322 | 7,000,603 | 5,364,335 | 3,319,503 | 5,774,404 | - | - |
| Total Incurred Cost | 121,612 | 195,669 | 255,448 | 354,447 | 354,447 | 359,001 | 327,267 | 256,579 | 308,856 | 1,020,632 | 7,000,603 | 5,364,335 | 3,319,503 | 5,774,404 | - | - |
| Cumulative Incurred Cost | 121,612 | 327,111 | 582,859 | 936,295 | 1,289,230 | 1,647,231 | 1,924,133 | 2,211,584 | 2,498,034 | 3,481,594 | 11,460,062 | 12,388,851 | 14,662,100 | 23,138,430 | 28,623,372 | 28,623,372 |

**VARIANCE**

| Federal Share | - | - | - | - | - | - | - | - | - | 540,322 | 2,553,168 | (2,614,850) | 146,119 | (66,435) | (340,835) | 281,258 | - |
| Total Variance | 121,612 | 195,669 | 255,448 | 354,447 | 354,447 | 359,001 | 327,267 | 256,579 | 308,856 | 540,322 | 2,553,168 | (2,614,850) | 1,869,346 | (500,435) | (1,550,771) | 281,258 | - |

Exhibit 1: Cost Plan/Status
Database

The Ignik Sikumi #1 database contains all of the information recorded during the field trial along with corrections and calculations performed. Data was recorded from a number of sources including an on-line gas chromatograph (GC), three downhole gauges, flow meters, pumps, temperature and pressure sensors, distributed temperature sensing (DTS), and water production rates. Schlumberger (SLB) provided the data logging for the entire test with data fed from other vendors, including Halliburton (DTS) and Expro (production, separation). All data were fed to a main data logger from the various sources (Figure E1) and recorded in a MySQL database with daily tables. Eight table types were used with variables categorized based on their function (e.g., flow, temperature, pressure, etc).

![Diagram of data streams and data logger](image)

Figure 1. Data streams and data logger used during the field trial.

To help future interpretations of the field trial, a number of supporting documents have been included in the database. This includes the piping and instrumentation diagrams from EXPRO and SLB for all surface facilities. Volumes have been estimated for all surface lines/equipment in the injection and production streams as well as the wellbore volumes. An operations log gives a compilation of all the notes from the well supervisor, SLB, EXPRO, well work, and the production engineers during the pilot. A master
variable list is provided to identify each data stream including all available supplementary
information (i.e., sensor type, model, calibration parameters, scaling parameters, etc). In
addition, a supporting data document is provided which highlights known issues, lists
corrections made to the raw dataset, and gives detail on how various calculations where
performed.

The “clean” dataset was formed using the original data streams from each vendor. A
number of corrections were made in order to create the “gold-standard” dataset. This
included correcting for time-stamping errors, reprocessing all of the GC data, correcting
data spikes and noise (especially from the downhole gauges), and renormalizing the DTS
data. In addition, because of the large amount of data points, one-minute and five-minute
time averaged datasets were created. All injection and production calculations were done
using the one-minute time-averaged data. Spreadsheets containing all injection and
production calculations are provided with the database as well.

The final database is in MS SQL 2008 R2 format and contains a data extraction tool that
will allow users to extract CSV format files of select data. Finally, DTS playbacks in
mp4 format have been provided at three ranges (full wellbore, 2150-2350 ft, and 2230-
2280 ft) for the entire test.

**Interpretation**

Work to interpret the data has been completed and includes analysis of the following
phases: perforation; injection; and injection. This work will be reported in the final
project report that is currently being prepared.