

Oil & Natural Gas Technology

DOE Award No.: DE-FE0010667

Research Performance Progress Report

Quarterly Report: January 2013 to March 2013

Liquid-Rich Shale Potential of Utah's Uinta and Paradox Basins: Reservoir Characterization and Development Optimization

Project period: October 1, 2012 to September 30, 2015



Submitted by:
Utah Geological Survey
1594 W. North Temple, Suite 3110
Salt Lake City, UT 84114
DUNS # 176871572

Principal Investigator: Michael D. Vanden Berg
michaelvandenber@utah.gov, 801-538-5419

A handwritten signature in black ink, appearing to read "Michael D. Vanden Berg".

Prepared for:
United States Department of Energy
National Energy Technology Laboratory

Submitted: April 30, 2013



Office of Fossil Energy



TABLE OF CONTENTS

Executive Summary	1
Progress, Results, and Discussion.....	1
Conclusion	9
Cost Status	9
Milestone Status.....	11
Accomplishments.....	11
Problems or Delays.....	11
Products and Technology Transfer Activities.....	12

LIST OF FIGURES

Figure 1: Map of the Uinta Basin, Utah, showing the location of available Green River Formation cores and horizontal wells.....	3
Figure 2: Core from the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah (Bill Barrett Corp., 14-1-46)	4
Figure 3: Core from the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah (Berry/Lynn Energy, 2-30D-54)	5
Figure 4: Core from the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah (QEP Resources, GD-1G-35).....	6
Figure 5: Map of the Paradox Basin, Utah, showing the location of wells with picked Cane Creek shale top/base	7
Figure 6: Core from the Cane Creek shale of the Paradox Formation, Paradox Basin, Utah (Union Pacific Resources Company, Remington 21-1H)	8
Figure 7: Project costing profile.....	10
Figure 8: Project cumulative costs.....	10

LIST OF TABLES

Table 1: Project costing profile for Budget Period 1	9
Table 2: Milestone log for Budget Period 1.....	11

EXECUTIVE SUMMARY

During the month of January, the Utah Geological Survey (UGS) initiated several technology transfer activities to inform interested parties of the project's intended goals and objectives. Presentations were made at the annual Utah Governor's Energy Development Summit, attended by more than 1400 people, and the quarterly Uinta Basin Oil and Gas Collaborative Group meeting held in Vernal, Utah. In addition, the Principal Investigator (PI) presented a project overview to the UGS board and to several DOE/NETL representatives during the kick-off meeting in March. Furthermore, the PI completed the required Technology Status Assessment and a two-page Project Summary, both of which are available on the UGS project website.

The PI and other members of the project team continued their outreach to oil and gas companies in both the Uinta and Paradox Basins. The PI traveled to Denver to meet with geologists from Anadarko, Berry/Lynn Energy, Bill Barrett, Newfield, and QEP Resources. All companies agreed to help with the project by offering advice, as well as access to relevant core and data. Also during this trip, the PI was able to examine and describe four Uteland Butte cores (two from Berry/Lynn and two from QEP Resources) and one upper Green River Formation core (from Bill Barrett). Plans were also discussed for a geomechanics testing program that will benefit both the project and the companies involved.

The project team also continued data collection activities including compiling databases of formation tops information, horizontal well penetrations, and available cuttings from targeted intervals. Data collection will continue into the next quarter.

PROGRESS, RESULTS, AND DISCUSSION

Task 1.0: Project Management Plan

During the month of January, the PI wrote and submitted the project's first quarterly report for October to December 2012. This report was subsequently sent via email to all interested parties and posted on the UGS project website. The PI also wrote and submitted the Technology Status Assessment and a Project Summary, both of which are available on the project website.

Task 2.0: Technology Transfer

- The UGS project website was updated with new information - http://geology.utah.gov/emp/shale_oil
- The PI completed the first quarterly report and emailed it to all interested parties. It is also available on the project website.
- Presentations announcing the project and discussing the overall goals and objectives were made at the quarterly UGS board meeting, the annual Utah Governor's Energy Development Summit, and the quarterly Uinta Basin Oil and Gas Collaborative Group meeting.
- The PI presented, via teleconference, the project's overall goals and objectives during a kickoff meeting with DOE/NETL representatives.
- The PI traveled to Denver and met with geologists from several companies (Anadarko, Berry-Lynn, Bill Barrett, Newfield, and QEP Resources) to discuss operations in the Uinta Basin, seek advice on project goals, and describe several Green River Formation (GRF) cores.

Task 3.0 and 4.0: Data Compilation and Core-Based Geologic Analysis

In February 2013, the PI traveled to Denver to meet with geologists from several companies (Anadarko, Berry/Lynn Energy, Bill Barrett, Newfield, and QEP Resources) to discuss the project goals, invite suggestions on potential research directions, and inquire about available cores for study. All companies were very helpful and agreed to provide data and access to core material. While in Denver, the PI examined and described in detail four Uteland Butte cores (two from Berry/Lynn and two from

QEP Resources) and one upper GRF core (from Bill Barrett) (figure1). The core descriptions are currently being drafted and plotted next to geophysical logs and other core analyses. The companies also provided high-resolution photographs of the core. Figures 2, 3 and 4 are from three different Uteland Butte cores showing the same tan/brown dolomitic interval from different areas of the basin. This highly porous dolomitic interval is one of the main horizontal drilling targets within the Uteland Butte. An east-west cross section through the central Uinta Basin is currently being drafted and will include many of the wells with Uteland Butte core, providing a more regional picture of this unit. The cross section will be displayed on the poster scheduled to be presented at AAPG in Pittsburgh in May. After the conference, it will be uploaded to the project website.

A database was compiled of all Uinta Basin horizontal wells targeting the GRF. Utah Division of Oil, Gas, and Mining (DOG M) records indicate a total of 91 producing or shut-in horizontal wells, most of which were drilled in the Uteland Butte Member or the lower Black Shale facies (figure 1). DOGM records also show that there are currently over 200 approved APDs for horizontal wells in the Uinta Basin; however, it is unclear how many of these wells will actually be drilled in the next few years.

Project team members completed a detailed description of the Remington 21-1H Cane Creek core (figure 5 and 6), which is housed at the Utah Core Research Center. High-resolution (0.5-foot spacing) x-ray fluorescence (XRF) analyses were made along the length of the core, 141 analyses in all. The core description will be drafted and placed alongside available geophysical logs and the XRF data. Currently, this is the only core available for study in the Paradox Basin, but efforts are underway to gain access to additional core material. In addition to the core description, team members also compiled a database of wells with picked Cane Creek stratigraphic tops/bottoms (figure 5). Geophysical log traces for several key wells were digitized for use in basin-wide cross sections.

Finally, a selected bibliography for each basin was created, highlighting particularly relevant publications about the target formations and the regional geology. This bibliography will be available on the UGS project website shortly.

Task 6.0: Well Completion Optimization

While meeting with companies in Denver, the PI developed a more refined plan for the geomechanics/well completion optimization portion of the project for GRF targets. Currently, production success is most prevalent in the central, over-pressured portion of the basin, where Newfield has a significant lease hold (figure 1). In areas farther to the south, east, and west, the GRF is under normal to only slight over-pressure, making economic production from targets like the Uteland Butte more challenging. The plan will be to conduct a comprehensive geomechanical program on cores from both areas with the goal of unlocking the economic potential of the more marginal fringe areas. During the next quarter, plans for such a program will be further developed.

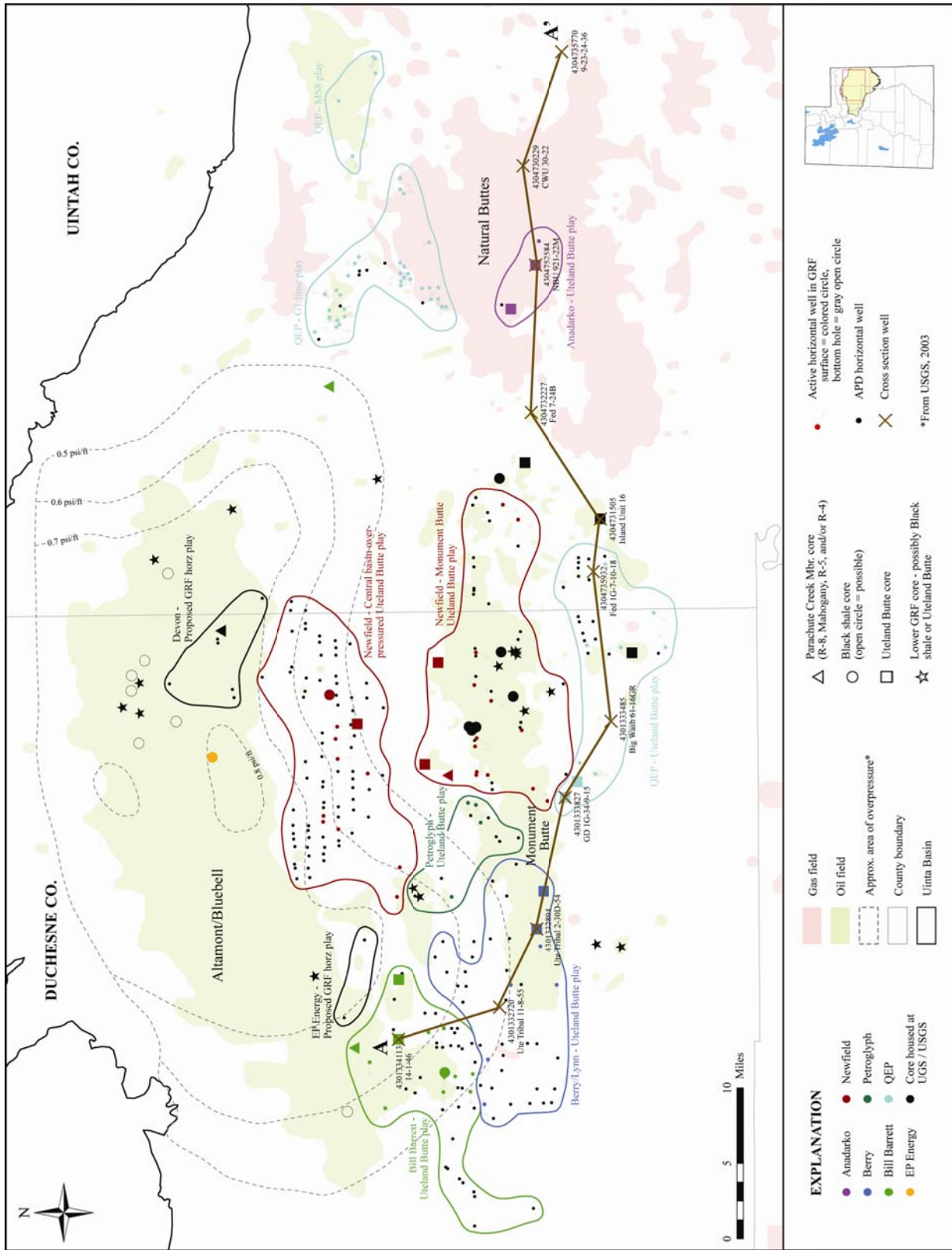


Figure 1. Map of the Uinta Basin, Utah, showing the location of available Green River Formation (GRF) cores and horizontal wells.

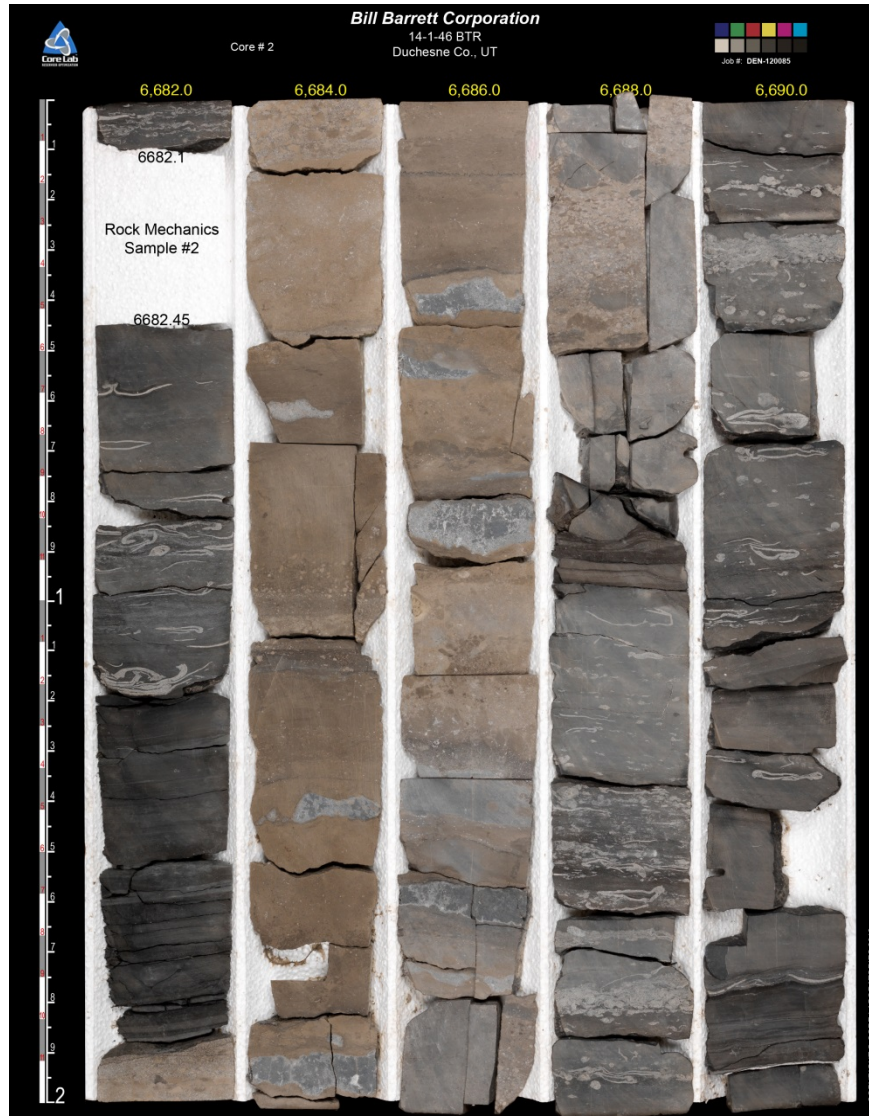


Figure 2. Core from the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah (Bill Barrett Corp., 14-1-46). One of the productive horizontal targets is the roughly 5-foot-thick tan dolomitic bed with porosities ranging from 20 to 30%. The oil is sourced from the surrounding darker gray organic-rich limestones, which contain abundant shell fossils, indicating that these layers were deposited in a freshwater lake.



Figure 3. Core from the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah (Berry/Lynn Energy, 2-30D-54). The lighter tan interval at right is equivalent to the productive zone in the Bill Barrett core (figure 2), but is much thinner in this area (~2 feet thick).



Figure 4. Core from the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah (QEP Resources, GD-1G-35). The lighter tan interval shown in this box is equivalent to the productive zone in the Bill Barrett (figure 2) and Berry/Lynn (figure 3) cores, but is thicker in this area (~8 feet thick).

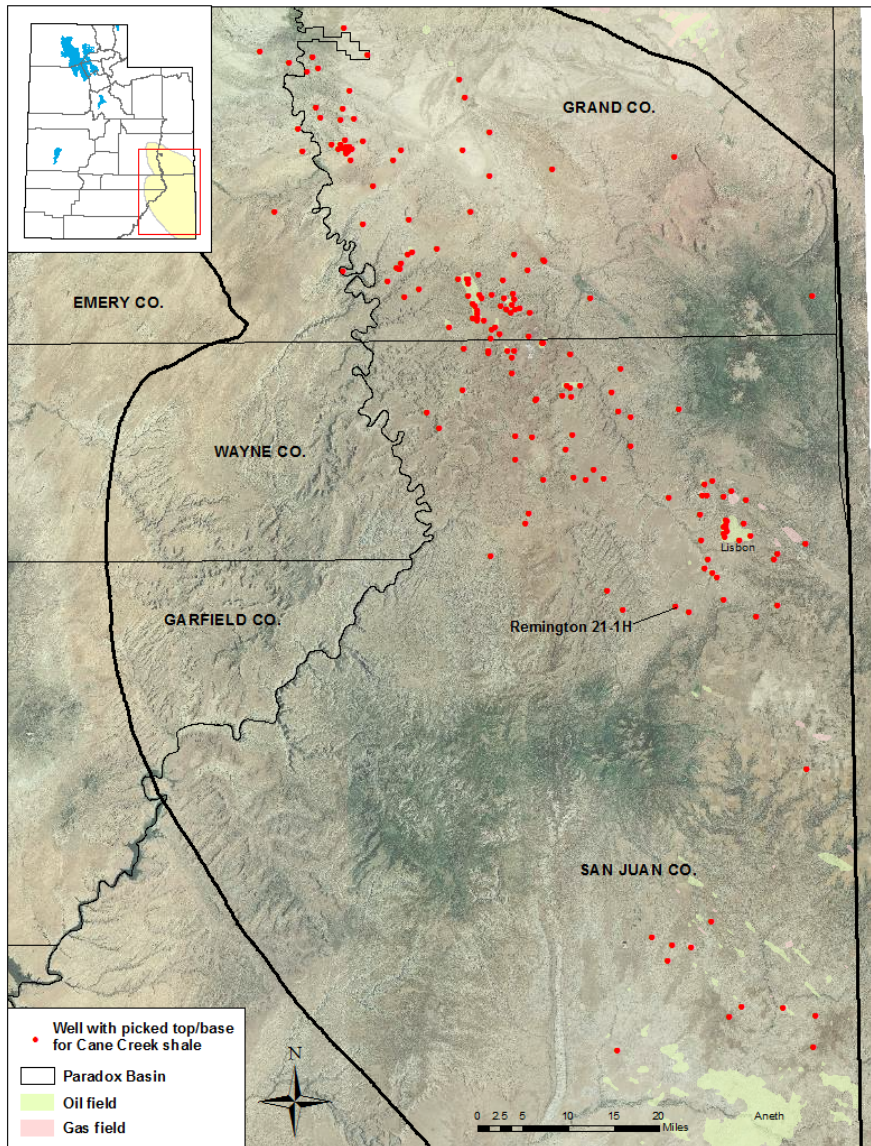


Figure 5. Map of the Paradox Basin, Utah, showing the location of wells with picked Cane Creek shale top/base.



Figure 6. Core from the Cane Creek shale of the Paradox Formation, Paradox Basin, Utah (Union Pacific Resources Company, Remington 21-1H). The source of the oil is the dark gray to black, organic-rich shale intervals, which are interbedded with mottled anhydrite (lightest gray).

CONCLUSION

Several presentations were made during the month of January introducing the project to various groups and stakeholders. In addition, the PI traveled to Denver to meet with companies to get feedback on the proposed research and inquire about material available for study. The data collection part of the project continues as team members have begun compiling well databases and have described available core. Discussions will continue on the direction of the geomechanics program, with more firm plans available later this year.

COST STATUS

Table 1. Project costing profile for Budget Period 1.

	Jan 2013		Feb 2013		Mar 2013	
	Plan	Actual	Plan	Actual	Plan	Actual
UGS-personnel	\$7,607	\$3,753	\$7,607	\$5,982	\$7,607	\$6,535
Travel Expenses ¹			\$1,970	\$1,012		
Analyses						
Miscellaneous ²	\$500	\$250		\$1,365	\$450	\$367
SUBTOTALS	\$8,107	\$4,003	\$9,577	\$8,360	\$8,057	\$6,902
UGS OVERHEAD (34.44%)	\$2,792	\$1,378	\$3,298	\$2,879	\$2,775	\$2,377
SUBCONTRACTS						
EGI	\$6,771	\$0	\$6,771	\$0	\$6,771	\$0
Eby						
GRAND TOTALS	\$17,669	\$4,305	\$19,646	\$11,239	\$17,602	\$9,279

¹Travel to Denver to visit companies and describe core, travel to the Uinta Basin for UBOGCG meeting

²January – AAPG-RMS (Sept 2013) exhibit booth; February – Fee to view core in Denver, fee for XRF, AAPG short course fee (May 2013), poster lamination; March – AAPG (May 2013) exhibit booth fees

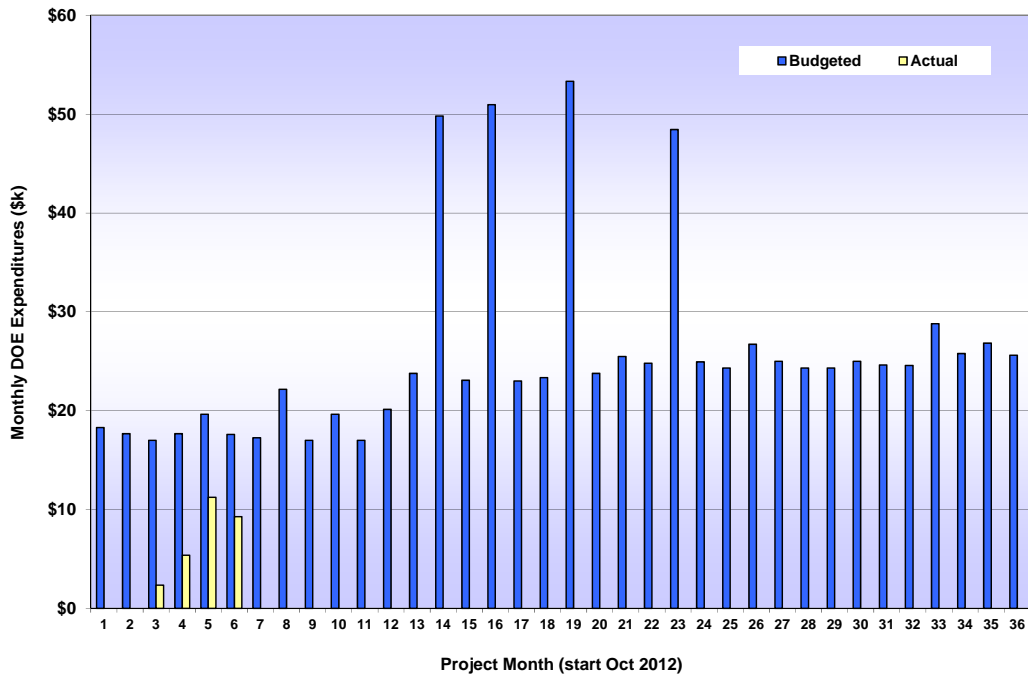


Figure 7. Project costing profile.

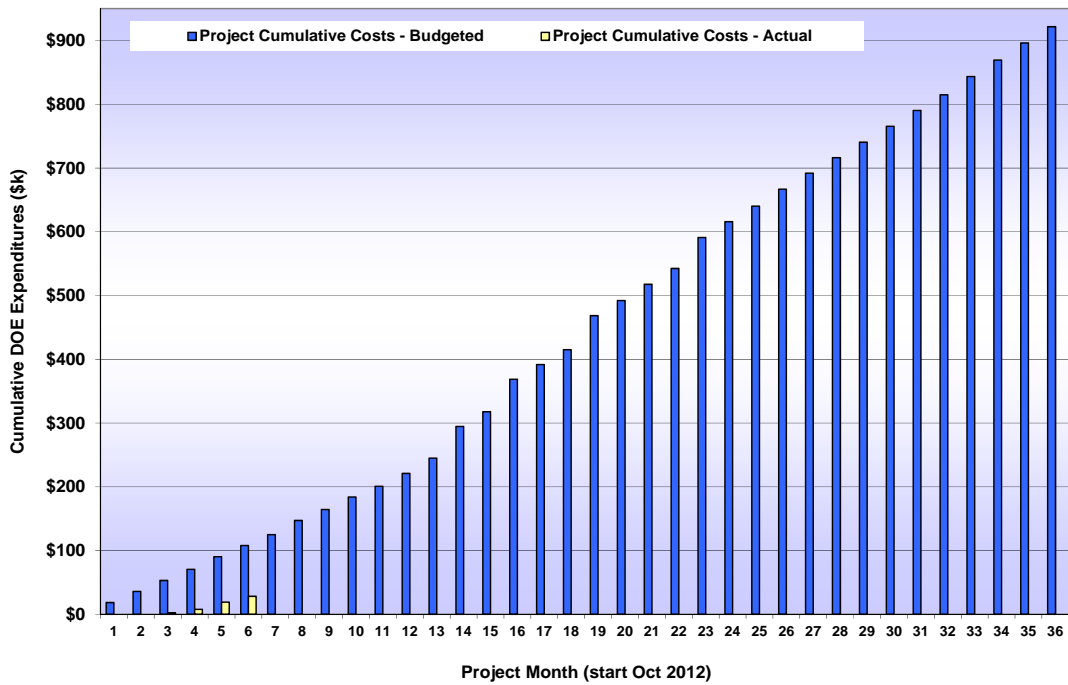


Figure 8. Project cumulative costs.

MILESTONE STATUS

Table 2. Milestone log for Budget Period 1.

	Title	Related task or subtask	Completion Date	Update/comments
Milestone 1	Project Management Plan	Task 1	12/21/2012	Completed and approved by DOE
Milestone 2	Establish project website	Subtask 2.1	12/31/2012	Website is up and running
Milestone 3	Quarterly website updates	Subtask 2.1	Quarterly	
Milestone 4	Quarterly reports	Subtask 2.2	Quarterly	Completed
Milestone 5	Select bibliography	Subtask 3.1	3/31/2013	Completed
Milestone 6	Prelim. Well database – cores/cuttings info	Subtask 3.2	3/31/2013	Completed
Milestone 7	Technical presentations at National AAPG	Subtask 2.4, 2.5	5/20/2013	Abstract on Uteland Butte was accepted to National AAPG in Pittsburgh (May 2013)
Milestone 8	Updated select bibliography	Subtask 3.1	9/30/2013	
Milestone 9	Final well database	Subtask 3.2	9/30/2013	
Milestone 10	Core descriptions	Subtask 4.1	9/30/2013	Six core descriptions completed
Milestone 11	First debriefing meeting	Subtask 2.3	9/2013	
Milestone 12	Technical presentations at Regional AAPG	Subtask 2.4, 2.5	9/2013	Two abstracts on Cane Creek accepted to AAPG-RMS in Salt Lake City (Sept 2013)
Milestone 13	BP 1 decision point	Task 1	9/30/2013	

ACCOMPLISHMENTS

- Technology Status Assessment completed
- Project Summary completed
- Presented project overview at several events including: UGS board meeting, Utah Governors Energy Development Summit, the quarterly Uinta Basin Oil and Gas Collaborative Group meeting, and to DOE/NETL representatives during a kickoff meeting
- The PI traveled to Denver and met with several companies and described five Green River Formation cores
- Project team members described one Cane Creek shale core and collected high-resolution XRF analyses
- Completed a preliminary bibliography and well database

PROBLEMS OR DELAYS

A contract has been set up with the Energy and Geoscience Institute (EGI), University of Utah, but research will not begin until a new PhD student is found, tentatively scheduled for summer 2013. As a result, the overall project will be under-billed until research begins at EGI.

PRODUCTS AND TECHNOLOGY TRANSFER ACTIVITIES

- Project website
 - The project website has been updated with new reports and abstracts
 - http://geology.utah.gov/emp/shale_oil
- Technology Status Assessment
 - Completed early January and is available on the project website
- Project Summary
 - Completed early January and is available on the project website
- Quarterly Report – October to December 2012
 - Completed late January and is available on the project website.
- Created project exhibit booth panel
 - The exhibit booth panel is a roughly 2' x 4' poster detailing the project's goals, objectives, and early results. This panel is displayed as part of the UGS exhibit booth at national and regional conferences.
- Presentation at the Utah Governor's Annual Energy Development Summit – January 10-11, 2013
 - Tom Chidsey, UGS Petroleum Section chief and project participant, delivered a presentation about Utah shale gas and oil potential, including an overview of this project's goals and objectives. The summit was attended by over 1400 people from Utah and other states and countries.
 - The summit also included a trip for interested participants to the Utah Core Research Center where several cores were on display including a Uteland Butte core and the project exhibit booth panel.
- Presentation to the Uinta Basin Oil and Gas Collaborative Group (UBOGCG) quarterly meeting – January 17, 2013
 - The PI presented an overview of the project at the UBOGCG meeting in Vernal, UT.
- Presentation to the UGS board – January 24, 2013
 - The PI presented an overview of the project to the UGS board.
- The PI traveled to Denver in February and met with geologists at Anadarko, Berry/Lynn Energy, Bill Barrett, Newfield, and QEP Resources to discuss the project and look at Uteland Butte and upper GRF core.
- DOE-NETL Kickoff meeting – March 11, 2013
 - Via teleconference, the PI presented the goals and objectives of the project to representatives from DOE-NETL.
- The project team completed a preliminary select bibliography and a preliminary well database for both the Uinta and Paradox Basins
 - These files will soon be available on the UGS project website.

National Energy Technology Laboratory

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880

One West Third Street, Suite 1400
Tulsa, OK 74103-3519

1450 Queen Avenue SW
Albany, OR 97321-2198

2175 University Ave. South
Suite 201
Fairbanks, AK 99709

Visit the NETL website at:
www.netl.doe.gov

Customer Service:
1-800-553-7681

