Project Updates for:

1) ***Proppant Project:*** ***Investigation of Improved Conductivity and Proppant Applications in the Bakken Formation***
2) ***Gas-to-Rigs Project:*** ***Demonstration of Gas-Powered Drilling Operations for Economically Challenged Wellhead Gas and Evaluation of Complementary Platforms***

Oil and Gas Research Council
Bismarck, North Dakota
January 24, 2012

Darren D. Schmidt, P.E.
Senior Research Advisor

UND University of North Dakota Grand Forks

Proppant Project – Grant Details

CAN WE PROP FRACS BETTER?

Description: Use laboratory methods to determine loss of conductivity relative to potential proppant or formation face collapse and suggest means to maintain conductivity.

Partners:

- Insight Consulting, Mike Vincent
- Carbo Ceramics, Robert Duenckel, Director of Technical Development
- U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Joint Research Program
- North Dakota Geological Survey

OGRC Funds – $150,000, 45% of total

Total Program – $332,432

Cost Share NETL – $113,201

Cost Share Carbo – $69,231

Term: 12-month contract

May 1, 2011 – April 30, 2012

Industry Engagement

- Professional workshop provided by partner and leading hydraulic-fracturing engineer.
- 40+ attendance by invitation, including three from the North Dakota Department of Mineral Resources.

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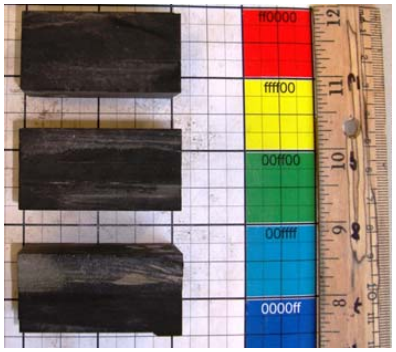
Capability to Process Core

- Activity 1 – Solved challenge regarding inability to cut friable core with blade-cutting techniques.

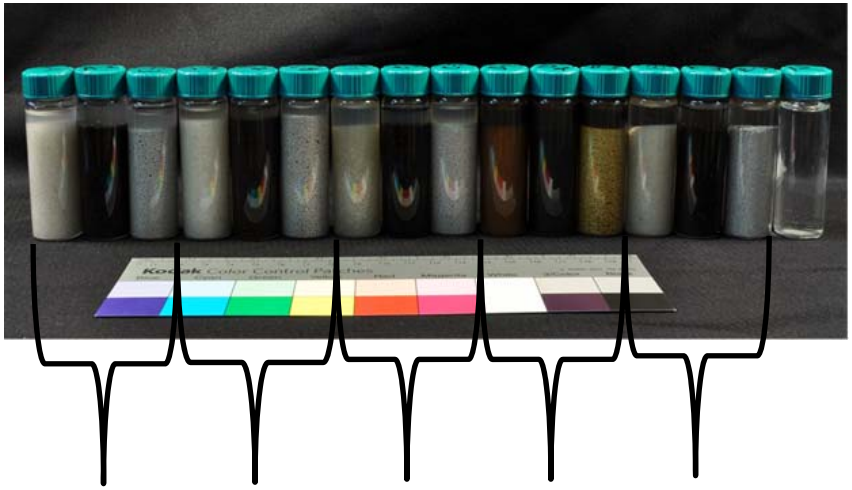


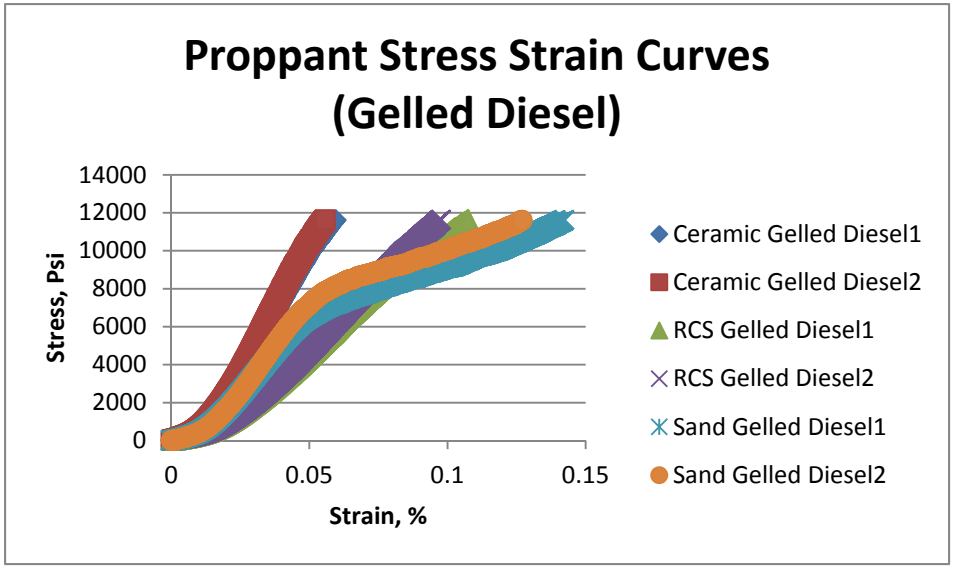
LBS

TF

MB

Current Results





- Proppant degradation – lab work complete
  - 20/40 Sand, RCS, Ceramic
- Rock work – near complete
  - Selected Brinell hardness
  - Out of reactor January 26
  - Complete by January 31
- Conductivity testing – planned
  - Milestone February 15

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Time Line

Proposed Time Line

Work Progress Time Line

Period of Performance: May 1, 2011 – April 30, 2012

Year	2011								2012			
Month	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Activity 1 – Obtain Core Samples	M1 ♦											
Activity 2 – Embedment and Penetration Testing				M2 ♦								
Activity 3 – Proppant Degradation Studies							M3 ♦					
Activity 4 – Conductivity Testing									M4 ♦			
Activity 5 – Data Analysis, Management, and Reporting												M5 ♦

♦ = Milestone

Budget

$143,991 remaining out of $332,432

Deliverables

- Quarterly reports delivered June, September, December.
- Majority of laboratory work will be covered in the March 2012 quarterly.
- Final report, as planned, April 30, 2012.
- Presentation at Williston Basin Petroleum Conference, May 2012

- Anticipated results
  - Analysis of proppant crush data relative to fluids.
  - Analysis of rock hardness measurements relative to fluids.
  - Proppant conductivity in actual Bakken core at reservoir conditions.

Gas-to-Rigs Project – Grant Details

MOVE WILDCAT WELLHEAD GAS TO MARKET
FOCUS: DRILLING OPERATIONS

Description: 1) demonstrate a safe and robust method for powering drilling rigs with *rich* Bakken gas, including the procurement and delivery of compressed natural gas (CNG). 2) investigate the technical and economic viability of end-use technologies that utilize associated gas.

Partners:

- Continental Resources
- GTI-Altronics, Butler CAT, ECO-AFS, Industrial Equipment, Linde
- U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Joint Research Program

OGRC Funds – $750,000, 39% of total

Total Program – $1,900,000

Cost Share NETL – $400,000

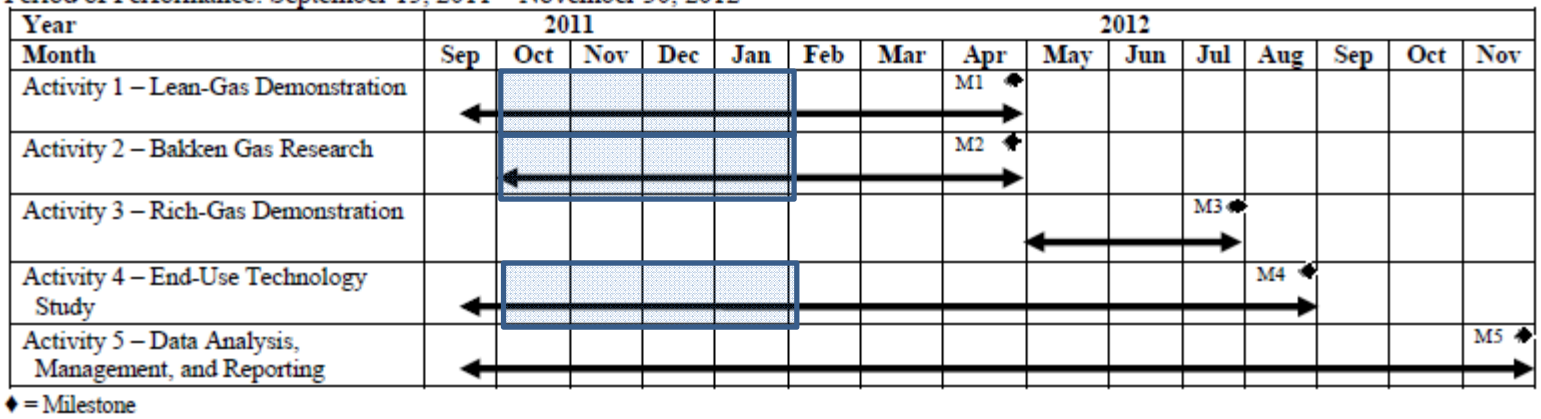
Cost Share Continental – $750,000

Term: 12-month contract

October 1, 2011 – September 30, 2012

Time Line

Period of Performance: September 15, 2011 – November 30, 2012



Work Progress Time Line

Industry Engagement

AGENDA

Monday, November 7, 2011

- North Dakota Department Mineral Resources
- North Dakota Pipeline Authority
- Bakken Express
- Enbridge Pipelines
- CHS (ammonia distribution)
- IMW Clean Energy
- Cummins Energy Business Solutions
- Cummins Npower
- Linde

Preparation for Research and Field Work

- Agreements established to accomplish engine research: GTI-Altronics, Butler CAT
- Preparations in progress to accomplish engine research: site cleared, system designed, engine prepared, putting together hardware; CAT preparing heads.
- Lean gas demo: proposal from BX to Continental, expect results this week. BX prepared to move gas from Whiting location.
- Currently modeling gas compositions and preparing to sample.

Next Steps

- Continental to select site, designate rig, and purchase equipment. Lead time likely to push April milestone.

Take Home

- **Project is timely (Public and Commercial)**
  - Prior to July 2011: little attention, pioneering work natural gas
  - Fall 2011 and after: much attention and continues, first North Dakota rig on rich gathered gas, BX started CNG to pipeline
  - Now: innovating to use nongathered gas, preparing to move CNG to rigs
- **Project is covering new ground**
  - Today: no significant practice in undeveloped areas
  - Tomorrow: look to provide CNG as a solution
  - Future: significant number of rigs firing wellhead gas, and supplied from CNG
- **Project is addressing challenges/opportunities**
  - Technical challenges of C4+ in engines (knock) (liquids)
  - Transportation and handling CNG
  - Other utilization platforms and attendant challenges, (technical/economic)

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