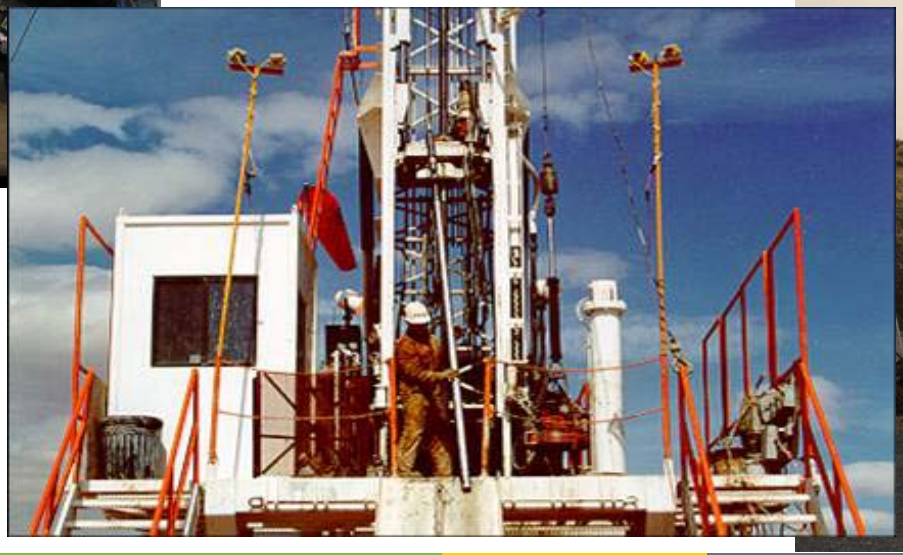

Base Technology and Tools for Super Critical Reservoir

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High Temperature Tools and Sensors,
Down-hole Pumps and Drilling

Overview

- Project Overview
  - Timeline
    - Project start date April 2010, Project end date April 2012
  - Budget
    - ARRA project Total budget $1956k (with $100k cost share)
      - FY10 $885.6k (funding received to date)
  - Barriers
    - Funding needed for completion
    - Possible funding delays
  - Partners
    - Thermochem, Inc.,

Relevance/Impact of Research

- Inline with DOE objective of advancing base technology required for developing downhole tools for supercritical reservoirs
- Designing any tool to operate in a supercritical reservoir is ambitious
  - Will require an innovative design approach
  - Advances in electronics packaging and materials are needed
    - Developed concepts will provide a foundation for applications outside this work effort
- The tools were chosen as they provide information critical to developing and maintaining an EGS supercritical reservoir

Relevance/Impact of Research

- Objective
  - Develop building blocks necessary for robust tools that can operate in supercritical environments
    - Building blocks consist of MCMs; each with specific functionality
      - Sandia-designed analog MCM and DOE (NTEL) digital MCM
  - Design and field test tools based on developed building blocks
    - Tools include:
      - 240° C Dewarless Pressure/Temperature/Collar locator (PTC) Tool
      - 450° C Dewared PTC tool
      - 450° C Fluid sampler (not currently funded)
  - Collaborate with universities and industry to help solve the technical challenges detailed in this proposal
    - Packaging reliability
    - Interconnect issues

Scientific/Technical Approach

- While keeping in mind DOE's objective, advance base technology that can be utilized in a wide variety of applications
  - Dewar development potentially will enable additional tools to be developed
  - HT valve development could be utilized in tracer work, etc.
  - MCMs are building blocks for future tools
    - Advancements in packaging and innerconnects will increase reliability in MCMs
- Demonstrate advances by fielding tools
  - Choose tools critical to developing and maintaining an EGS supercritical reservoir

Scientific/Technical Approach

- Major milestones:
  - Year 1: Dewarless 240° C PTC Tool – April 2011
  - Year 2: Flasked 450° C PTC Tool – April 2012
  - Year 3: Flasked 450° C Fluid Sampler Tool

Accomplishments, Expected Outcomes and Progress

- Project in early stages
  - Dewar contract initiated
  - HT valve companies contacted; negotiations underway
  - HT team being selected to help guide sample collection methodology
  - University contract in negotiations

Project Management/Coordination

- Schedule
  - Early stages
  - First major milestone due in 10 months
- Application of resources
  - Sandia geothermal department – hardware and electronics design
  - Scot Engineering – HT valve mechanical design
  - Sandia explosives department – pyrotechnic development
  - University of Maryland – MCM reliability study
  - Harvey Mudd College – high speed data link
- Project Integrated
  - HT tools and samplers required during the developing of EGS reservoirs. As such, this tool is aligned with DOE geothermal program objectives
- Coordination with industry
  - Working with Themochem

Future Directions

- Year 1 PTC Tool Development
  - Design, fabricate and assemble PC boards for analog MCM, RPDA, and support circuits
  - Determine if HT battery will be available; if not, use wireline to deploy
  - Assemble, test, calibrate and verify performance at 240° C
  - Determine well of opportunity and field tool
- Required subtasks performed in parallel to meet year 2 and year 3 objectives
  - Evaluate conventional Dewars;
  - Initiate pyrotechnic actuated valve design
  - Investigate HT cablehead and e-line design for 450° C
- University Collaboration
  - Initiate collaboration with the University of Maryland
    - Model behavior of MCM operating at 250° C and predict lifetime based on conventional die attach and wire-bonding techniques.

Future Directions

- Year 2 PTC Tool Development
  - Analog MCM development; convert circuit to MCM and test
  - Design, fabricate and assemble PC boards
  - Determine if HT battery will be available
  - Assemble, calibrate and verify performance of electronics
  - Determine well of opportunity and field tool
- Dewar development
  - Hold design review for prototype 450° C Dewar
    - Fabricate and evaluate up to 450° C (goal)
- Valve development
  - Hold design review for proposed pyrotechnic actuated valve
    - Fabricate and evaluate up to 450° C (goal)
- University Collaboration
  - Continue collaboration with the University of Maryland
    - Validate model by performing accelerated powered life tests of MCM

Future Directions

Year 3

Included in proposal, but not currently funded

- 450° C Fluid Sampler
  - Hold final design review; accommodate design changes
  - Assemble, calibrate and verify performance of electronics
  - Determine well of opportunity and field tool
- University Collaboration
  - Continue collaboration with the University of Maryland. Investigate improvements for longer life at 250° C and to extend the temperature to 300° C with engineered enhancements
  - Graduate student will present result of research at conference (GRC and/or HiTEC).

Summary

- Project is in the early stages
  - Dewar contract initiated
  - HT valve companies contacted; negotiations underway
  - HT team being selected to help guide sample collection methodology
  - University contract in negotiations
- Detailed work plan presented
  - Developed tools include:
    - Dewarless 240° C PTC Tool
    - Dewared/Flasked 450° C PTC Tool
    - Dewared/Flasked 450° C Fluid Sampler Tool (not currently funded)
- Project advances HT electronics and promotes the design of future HT downhole tools
  - Dewar advancement
  - HT valve designed
  - MCM development
  - MCM reliability study

Publications and Presentations

Early stages of project. As such, no publications so far.

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