Black Warrior: Sub-soil gas and fluid inclusion exploration and slim well drilling

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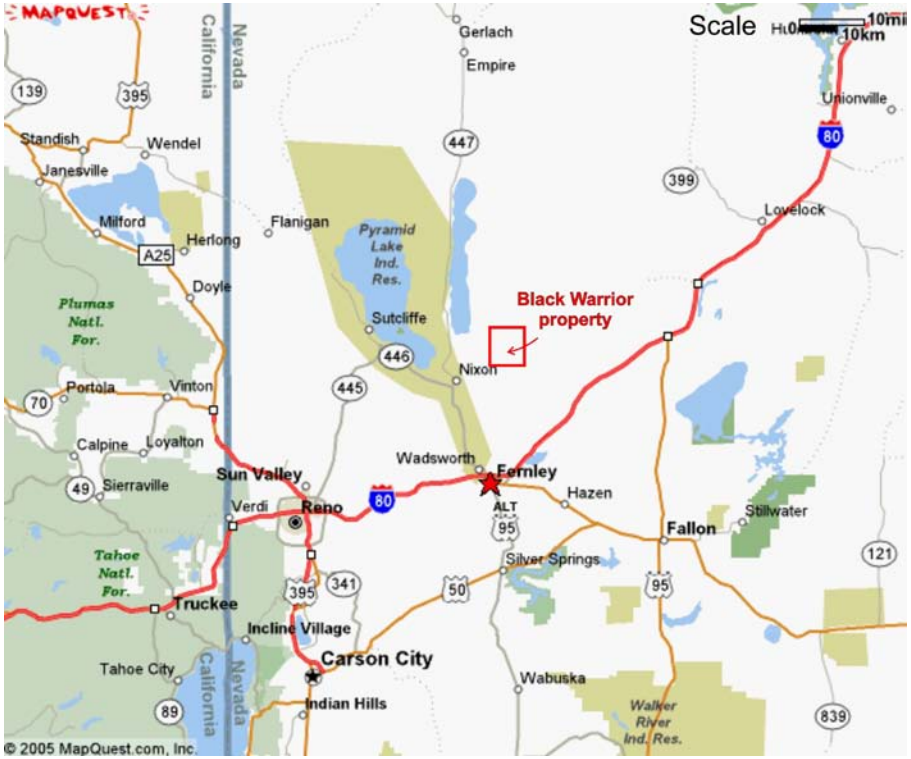
Validation of Innovative Exploration Technologies

Overview

- Timeline:
  - Start: **Spring 2010**
  - Projected End Date: **January 2012**
  - Percent Complete: **0%**
- Budget:
  - Total Project Funding: **$3,195,692**
  - DOE Share: **$1,597,846**
  - Awardee Share: **$1,597,846**
  - FY09: **$0.00**
  - FY10: **$602,692**
- Barriers:
  - Transmission Line
  - Complicated Property Issues (Intermixed BLM & Private, adjacent Tribal Lands)
- Partners:
  - **University of Utah (EGI)**
  - **Gore Technologies**



Relevance/Impact of Research

- Project Objectives:
  - Discover a blind, low-moderate temperature resource.
  - Apply a combination of detailed sub-soil gas, hydrocarbon, and isotope data to define possible upflow areas.
  - Calibrate the sub-soil chemistry with down-hole fluid inclusion stratigraphy and fluid analyses to define a follow-up exploration drilling target.
  - Create short term jobs and long term employment through resource exploration, development and power plant operation.
  - Extend and adapt the DOE sub-soil 2 meter probe technology to gas sampling.
    - Validate the 2 meter probe technology as a low-cost exploration tool in rough/varried terrain and its utility for gas sampling – and extend the technology to other blind geothermal targets along trend.

Scientific/Technical Approach

- Technical Approach:
  - Collect samples for gas chromatography and helium isotope analysis with 2m probe equipment.
  - Statistical and process model methodology to define possible zones of shallow gas upflow. Develop reservoir model and target slim-hole.
  - Drill deep slim-hole and collect fluid sample
    - Geothermometery from fluids.
  - Analyze cuttings and core for fluid inclusion stratigraphy.
  - Develop and expand the reservoir model, and target second slim-hole.
  - Slim-hole data will characterize the resource and calibrate the sub-soil gas results.

Scientific/Technical Approach

- Major Milestones:
  - Deployment of sub-soil gas adsorbers and collection of gasses.
    - 2m probe equipment designed, but not constructed. Pending final DOE approval.
  - Analysis of results, reservoir model development and slim-hole targeting.
  - Drilling of slim-hole #1.
  - Expansion of reservoir model with slim-hole results.
  - **Go/No Go Decision Point** – evaluate success, and likelihood that slim-hole #2 will be successful.
  - Drilling of slim-hole #2.
  - Final reservoir model, validation of 2m probe sub-soil gas methodology combined with fluid inclusion studies.

Accomplishments, Expected Outcomes and Progress

- Accomplishments:
  - Design for 2m probe equipment established.
  - Awaiting final authorization from DOE to proceed with construction.

- Expected Outcomes:
  - Sub-soil gas sampling is expected to define zones of upflowing shallow gas, which will be used to target slim-holes.
  - May revise initial conceptual models of gas evolution in hydrothermal systems.
  - Fluid inclusion stratigraphy from core and cuttings will provide downhole history of gasses.
  - Two techniques combined should reduce ambiguity associated with a variety of organic sources and processes in and above the reservoir.

Project Management/Coordination

- Project Management Plan: Nevada Geothermal Power
  - Resources: Using internal resources to manage and meet project timeline goals efficiently.
    - Experienced management and staff.
    - Using in-house resources, materials and supplies wherever possible.
    - Utilizing U of Utah and Gore Technologies for technical expertise for data analysis and scientific approach.
  - Timelines: Will be continuously updated as the project progresses.
  - Budgeting: Detailed budgets and spending plans have been developed.
  - Funds: Expenditures carefully monitored and recorded and we are requesting reimbursements from DOE on a monthly basis.

Project Management/Coordination

- Project Management Plan: General Schedule
  - **Spring 2010**: Design and build 2m probe equipment.
  - **Spring/Summer 2010**: Carry out sub-soil gas survey.
  - **Summer 2010**: Lab analysis, develop reservoir model, and target slim-hole.
  - **Fall/Winter 2010/2011**: Drill and test slim-hole #1.
  - **Winter/Spring 2011**: Fluid inclusion stratigraphy analysis and data integration. Reservoir model development. Target slim-hole #2.
  - **Summer 2011**: Drill slim-hole #2.
  - **Summer/Fall 2011**: Fluid inclusion stratigraphy and data integration. Reservoir model development.
  - **Fall/Winter 2011/2012**: Final analysis and reporting.

Future Directions

- Short Term:
  - Obtain final DOE approval.
  - Modify the ATV for the 2m probe sub-soil gas survey.
  - Perform the survey and start the lab analysis.
  - Develop an integrated reservoir model.

- Long Term:
  - Go/No Go Decision – Fully evaluate the datasets and determine the chance for a successful slim-hole.
  - Target, permit and drill the first slim-hole.
  - Obtain fluid inclusion stratigraphy and develop the reservoir model.
  - Target, permit and drill the second slim-hole.

Summary

- Black Warrior; Northwestern Nevada
  - "Blind", undeveloped geothermal prospect
  - Large anomaly (~10 square miles)
  - 2m sub-soil gas survey
  - Drill 2 slim-holes
  - Fluid inclusion studies.
  - Total Project Funding: $3,195,692
  - Start: Spring 2010
  - End: Winter 2011/2012
  - Awaiting final DOE authorization