

FINAL REPORT

**U.S. Department of Energy Project No DE-EE 0003-008
Enhanced Geothermal Systems
New York Canyon Stimulation Project
June 2012**

Prepared for:

**Geothermal Technologies Program
Energy Efficiency and Renewable Energy
U.S. Department of Energy, Golden Field Office
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Project Title: New York Canyon Stimulation
Agency: US Department of Energy – Energy Efficiency and Renewable Energy (EERE)
Project Number: DE-EE0003-008
Project Officers: Lauren Boyd
Project Monitor: Grant Logsdon
Contracting Officer: Genevieve Wozniak
Principal Investigator: Bernard Raemy
Project Period: Start - October 1 2009 - Termination: April 3, 2012

Summary

The New York Canyon ("NYC") Stimulation Project was to demonstrate the commercial application of Enhanced Geothermal System ("EGS") techniques in Buena Vista Valley area of Pershing County, Nevada. From October 2009 to early 2012, Terra-Gen Power Development Company ("TGP") aggressively implemented Phase I of Pre-Stimulation and Site/Wellbore readiness. This included: geological studies; water studies and analyses and procurement of initial permits for drilling. Oversubscription of water rights and lack of water needed for implementation of EGS were identified and remained primary obstacles. Despite extended efforts to find alternative solutions, the water supply circumstances could not be overcome and led TGP to determine a "No Go" decision and initiate project termination in April 2012.

This Final Report reviews the project; the tasks completed during the project period; and the obstacles that lead to project termination.

Project Objective

The goal of the New York Canyon ("NYC") Stimulation Project was to demonstrate the commercial application of Enhanced Geothermal System ("EGS") techniques in a manner that minimizes cost and maximizes opportunities for repeat applications elsewhere. The principal advantages of the NYC site are: high temperature gradients at shallow depths; reported steam production near the center of TGP's lease position; a location on the opposite side of the Stillwater Range from Dixie Valley, suggesting a possible common heat source underneath the Stillwater Range, with potential for expanded geothermal development in the future; and a large lease position in a contiguous block along the northwestern Stillwater Range front, in an area where TGP plans to drill several full-diameter exploration wells, which could complement the EGS stimulation effort with logistical support. Project objectives were: update the geologic model of New York Canyon with the assistance of state-of-the-art geophysical logs in new full-diameter wells and sub-surface microseismic monitoring in new slim holes to be drilled in a ring around the EGS stimulation area; create an exploitable geothermal reservoir through fracturing induced by long-term injection at moderate wellhead pressures; establish a commercially viable injector-produced doublet, in which the production well is targeted with the assistance of high-resolution microseismic data; and generate commercial amounts of electricity from the project.

Phase 1 - Pre-Stimulation, Objective 1.1 Site/Wellbore Readiness:

Task 1.0 Obtain drilling permits for wells

TGP began preparation for the New York Stimulation Project in October 2009. Permitting activities for drilling of the injector well and producer well were completed. Permitting of seismic monitoring (micro-earthquake (“MEQ”)) (categorical exclusion) was also completed. The Finding of No Significant Impact (“FONSI”) and Record of Decision (“ROD”) for exploration were received in November 2010 from US Department of Interior, Bureau of Land Management (“BLM”). Additional geothermal drilling permits for individual well locations were completed in 2011. During the permitting process, TGP’s primary challenges in NYC were cultural issues which caused some schedule delays but were resolved.

Task 1.1.2 Drill water supply wells or identify water source for drilling operations

TGP executed a water supply agreement for water used during drilling in NYC. Lumos & Associates submitted a paper study to TGP in October 2010 advising on locations of water wells in Buena Vista Valley. Existing water wells were also identified. TGP retained Carson Pump to conduct water well flow tests. Carson Pump’s results confirmed adequacy of wells to provide water for drilling operations and subsequently TGP worked with BLM to implement a water monitoring plans around the drilling targets in NYC.

TGP continued to analyze water supply requirements. Lumos & Associates’ on-going water analyses identified inadequate sources of water and oversubscription of water rights, inhibiting implementation of EGS. Further investigation revealed that to achieve adequate levels prolonged efforts to secure additional water rights would be required resulting in delays of several years before engaging in drilling.

Task 1.1.3 Have water analyses performed on water-supply source.

In March 2011, Sierra Environmental completed water analyses and verified water quality for NYC.

Task 1.1.4 Review existing geologic/geophysical data and develop strategy for drilling.

Extensive surface geologic data was acquired and reviewed for NYC. Geophysical/3DMT data continued to be under review during the entire project period. In May 2011 TGP Resource staff presented to the DOE Technical Monitoring Team geophysical data for NYC and alternatives on further outlining the drilling strategy. These discussions were on-going through September 2011.

Task 1.1.5 Prepare Casing and Completion Plan

Various alternatives to base case design were prepared and reviewed by TGP for NYC. The casing and Completion Plan was completed.

Task 1.1.6 Drill exploration wells

Although wells were drilled in NYC, they were not deemed eligible for the project.

CONCLUSIONS

The NYC project encountered three primary challenges: water scarcity, EGS permitting and lack of background seismicity based on research conducted by Lawrence Berkeley National Laboratory. While the water scarcity can be attacked with increased water rights acquisition, this approach was expected to cause significant schedule delays of several years jeopardizing the project. The lack of background seismicity raised additional concern and prompted consideration of project area expansion. The expansion alternatives explored also entailed significant project delays.

PRODUCTS / DELIVERABLES

Training and Professional Development:

No training and professional development was provided to members of the project team, or anyone who was involved in the activities supported by the project during the project period.

Publications, Conference Papers, and Presentations:

DOE Presentations included:

- 2011 DOE Peer Review Meeting, June 5-7, 2011, Baltimore, Maryland
- 2010 DOE Peer Review Meeting, May 17 – 20, 2010, Arlington, Virginia

Permit Related Presentations:

Over the three years Bernard Raemy made numerous presentations regarding the EGS project to various agencies and government offices keeping parties apprised of project progress, including:

- Supervisor of Pershing County, Lovelock, Nevada,
- US Bureau of Land Management (BLM), Winnemucca and Carson City, Nevada

Patents and Intellectual Property:

No patents were applied for during this project and no patent applications are anticipated. Proprietary geological data and modeling was presented to DOE staff and Technical Monitoring Committee members between March 2011 and September 2011 over a series of meetings/conference calls.

Federally Owned Property:

Federally owned property was not used in the conduct of this project.

Other Products / Deliverables:

No other deliverables were produced.

Subcontractors and Vendors: TGP's approved vendors and subcontractors during this period were:

- AKT Consulting LLC (San Diego, CA)
- Array Information Technology (Emeryville, CA)
- Carson Pump (Carson City, NV)
- CH2MHill (Boise, ID)
- GeothermEx (Richmond, CA)
- Historical Research Associates (Missoula, MT)
- Jim Estill (Lovelock, NV)
- Lawrence Berkeley National Laboratory (Berkeley, CA)
- Lumos & Associates (Carson City, NV)
- Petroleum Geophysicists, Inc. (Carpinteria, CA)
- Premier Geophysics (Aurora, Canada)
- Prospectiuni SA (Bucharest, Romania)
- Seismic Acquisition Services, Inc. (Boulder, CO)
- Sierra Environmental Monitoring (Reno, NV)
- Stoel Rives (Portland, OR)
- TESLA (Calgary, Canada)
- Western Geco (Houston, TX)