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Proposed Enhanced geothermal system demonstration at the Nevada Test Site

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Proposed Enhanced Geothermal System Demonstration at the Nevada Test Site

A Joint Proposal of the Nevada Alliance for Defense, Energy, and Business, the University of Nevada Las Vegas, and Nye County

Michael D. Voegele
Enhanced Geothermal System Demonstration at the Nevada Test Site

- 25 to 50 MWe geothermal power generation facility; support the power requirements of the principal mission of the NTS
- Joint effort of the Nevada Alliance for Defense, Energy and Business, the University of Nevada Las Vegas, and Nye County.
- The NTS is likely is one of the most thoroughly studied regions in the world
- Enough is known about the NTS to allow selection of a principal candidate site
- Proposal is to finalize selection of the site and develop a Provisional Stimulation Plan, consistent with all requirements
Enhanced Geothermal Systems Could Become a Significant Part of U.S. Baseline Energy Supply

Combinations of rock temperature and energy recovery systems need to be considered.

Figure 2.7d Average temperature at 6.5 km.
Fenton Hill site, New Mexico.
Challenges

• Goal 3: Develop improved tools for the characterization and modeling of the subsurface at EGS project sites.
• Goal 5: Ability to describe accurately the physical characteristics of the created EGS reservoir.
• Goal 6: Demonstrate ability to accurately detect reservoir characteristics including fluid pathways, dynamics, residence time, etc.
Technical Approach

• Develop numerical models that directly simulate the behavior of fractures, including response to fluid flow, facture movements, fracture growth, and acoustic energy emissions.
  – Detailed mechanical model of the fractured rock mass will be constructed from field data on the in situ fracture systems
  – The modeling approach overcomes many of the past challenges of understanding the growth of hydraulically induced fractures and the development of geothermal reservoirs.

• Simulate likely rock mass behavior under geothermal loading conditions to develop a realistic reservoir model.

• Develop a catalog of likely responses of reservoir to development
Technical Approach - II

- Detailed fracture growth information collected during well drilling and testing will enable calibration and validation of a reservoir model that will guide the location and development of the production wells.
- Deep well in situ stress determinations are coupled with advanced numerical simulations which are in turn coupled with microseismic monitoring of fracture growth.
- Allows preparation of three-dimensional maps of fractures that are transmitting fluid, which in turn leads to higher precision in locating production wells.
Hydraulic fracturing development from injection well to production well

Figure is in plane of maximum and intermediate principal stresses
This approach did not work well at Fenton Hill.
Hydraulic fracturing development from injection well

Figure is in plane of maximum and minimum principal stresses
The propagating fracture releases acoustic energy that allows location of the fracture and improves the model of the reservoir.
Earthquake Density (10 meter boxes)
Vertical Section, Azimuth = 90.
Figure 3.2. U.S. Geothermal Resource Map at 3.5 km

Figure 3.3. U.S. Geothermal Resource Map at 6.5 km

Earthquake Density (10 meter boxes)
Vertical Section, Azimuth = 90.

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