RESEARCH INFRASTRUCTURE IMPROVEMENT (RII 4)
PROPOSAL DEVELOPMENT PROCESS

EDUCATION & OUTREACH WHITE PAPER

FOR DISCUSSION
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TITLE: REU GEOTHERMAL OUTREACH ACTIVITY: GEOTHERMAL EXPLORATION ON THE NAVAJO NATION AND GREATER NEW MEXICO

LEAD AUTHORS: MARK PERSON (NMT), SHARI KELLY (NMT), GLENN SPINELLI (NMT), MIKE PULLIN (NMT)

CONTRIBUTING AUTHORS: N/A

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Title: REU Geothermal Outreach Activity: Geothermal Exploration on the Navajo Nation & Greater New Mexico

Authors: Mark Person, Shari Kelly, Glenn Spinelli, and Mike Pullin

Description of Activity: We propose to provide undergraduate research experiences for native American students at the Dine Community College and from other institutions across the country introducing them to concepts associated geothermal exploration. Activities would include drilling a series of shallow temperature gradient holes, well site geology, surface gravity and resisitivity measurements, heat flow measurement, hydrogeologic aquifer tests, and collection of hydrochemistry samples. We propose to contract with Rodgers and Company, an Albuquerque based well driller to complete up to 15 shallow (< 350 feet), 2" diameter wells to collect rock samples for thermal conductivity measurements, water samples to estimate deep fluids temperatures using geochemical geothermometers, aquifer test analysis, vertical hydraulic gradients, temperature logging, and surface geophysical measurements (resistivity). Prior to drilling, we would conduct a series of surface geophysical measurements and collection of spring water samples to assess a wells site potential for high heat flow. We would propose to drill these wells on or near the Navajo Nation in Northwestern New Mexico in areas of know high background heat flow with the students from Dine College. For students other colleges and universities, we would propose to drill these wells at select locations within the Socorro and Albuquerque Basins of the Rio Grande Rift. The REU would take advantage of surface geophysical equipment acquired as part of this grant.

Prior to drilling new wells, students would be trained to make many of these hydrologic, geothermal, geophysical and geochemical measurements in a week long training activity at NM Tech (Fig. 1). Training activities developed as part of this REU will take advantage of our local geothermal resources and a recently completed 1102 foot deep geothermal test well located 2.2 miles west of the NM Tech Campus at Woods Tunnel. The well was drilled at the center of a heat flow high within the Socorro Geothermal Resource Area. Warm groundwater (up to 41 ^{o}C) ascends from about 1 km depths along a gap in a confining unit (playa deposit). We will use this well for two laboratory exercises. We propose to install a pump (1000 gallons per minute) and 1101 of well casing with a 560 well screen in the open hole portion of the well to allow students in the class to conduct pumping tests to measure the permeability and specific capacity, and temperature gradients of the geothermal reservoir. These are the two most important parameters to measure in a geothermal reservoir assessment. However, we would need to install a pump and well casing in order to complete these activities. We have received a bid from L&C Drilling, a local well driller that Person has worked with before. The cost of installing the well screen and pump is $46,254. Students would learn how to collect temperature-depth profiles using In-Situ pressure transducers-temperature probe as well as a state-of-the-art distributed temperature system (DTS) acquired on a previous EPSCOR grant to John Wilson. The DTS fiber optic-laser system permits students to see, in real time, changes to temperature-profiles at one-minute intervals (Taylor, 2007). Varying the flow rate using the high capacity pump also allows students to determine which fracture intervals in the formation are productive (Fig. 2).

We would conduct a field trip to NMSU to visit the geothermally heated bio-diesel facility and geothermal greenhouses at Radium Springs.

Relevance to Energy-Water-Environment Nexus: Geothermal Energy represents an attractive alternative to coal fired power plants. A typical 10 MWe binary geothermal power plant uses about consumes between about 1500-5000 acre-feet per year (Clark et al. 2011). Most of the produced water would be reinjected with estimated water losses between 60-230 acre-feet per year. A geothermal

power plant uses far less water than conventional power plants. A typical coal-power plant uses about 0.85 gal/kWh. A binary geothermal power plant uses only 0.2 gal/kWh (four time less water; Clark et al. 2011). Thus, our proposed geothermal power plant could offset water use in other regions of the state.

Target Audience: Undergrad/Grad

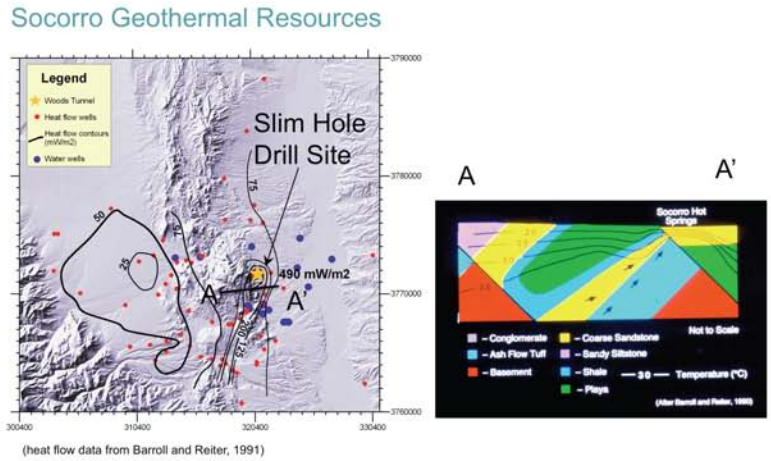

Figure 1. Location of heat flow anomalies in the Socorro area. High values of heat flow (> 100 mW/m2) is an indiactor of hot subsurface conditions (after Barroll and Reiter, 1991 and Mailloux et al. 1999).

Figure 2. (A) Deployment of distributed temperature sensor system at Woods geothermal well, Socorro NM. (B) Calibration of DTS system using constant ter reservoirs (in coolers).