

A Demonstration Project for Capturing Geothermal Energy from Mine Waters beneath Butte, MT

May 19, 2010

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of Montana

Ground Source Heat Pumps
Demonstration Projects

Timeline (5 years total, 0% complete)

Phase 1: Feasibility study-12 months from funding award (just began)

Go / no go decision point

Phase 2: Construction- 18 months (beginning in month 13 from funding award) (0% complete)

Phase 3: Operation, Data Collection, Marketing-4 years (beginning in month 13 from award funding)

Budget	DOE cost	Matching cost	Total	FY10 funding
Phase 1	\$72,744	\$73,399	\$146,083	\$72,744
Phase 2	\$1,000,000	\$0	\$1,000,000	0
Phase 3	\$0	\$1,009,414	\$1,009,414	0
Total	\$1,072,744	\$1,082,831	\$2,155,557	\$72,744

Barriers

Partners: None

OBJECTIVE: Demonstrate performance of heat pumps in a large HVAC system in a heating-dominated climate

- A hybrid geothermal system will be installed using off-the-shelf technology to (a) reduce operating costs of Montana Tech's new Natural Resources Building, and (b) provide comparative cost/performance data for using heat pumps vs conventional (natural gas/electricity) resources.
- System will demonstrate use of warm mine waters as the heat source/sink.
- Provide data and information for research, education, and outreach effort to promote ground-source heat pump applications.

Phase 1: Feasibility Study- Analyze current system performance over various heating seasons and run simulations of building heating and cooling loads to:

- Understand heat pump simulations and document simulation procedures
- Optimize size vs cost of the heat pump system
- Produce schematic flow diagrams and sequence of operation for the system
- Complete field investigations of mine access necessary for Phase 2

Go/no go decision point prior to Phase 2

Phase 2: Construction

- Prepare construction bid documents for completing the hybrid system
- Complete additional access to the mine workings as necessary/feasible
- Install and commission heat pumps

Phase 3: Data collection and reporting

- Optimize operation of the hybrid system
- Compare with operational and simulation data
- Compare costs of heat pump vs conventional steam operation
- Education and outreach

- Funding for Phase 1 was awarded April 5, 2010; the project is just getting underway.
- The system to be used is modern and highly instrumented, enabling collection of detailed performance data to be used throughout the project.
- System performance has been monitored since initial building occupancy (January 2010); by September, 2010 data will have been collected over winter, spring, and summer heating/cooling seasons and simulations will begin.
- Approval has been granted from the State for the technical team to proceed.

Phase 1: Data are being collected remotely by the engineer who will perform the system simulations. Site visits will be made as necessary to consult with Montana Tech's physical facilities staff, inspect the mechanical system for conversion to a hybrid system, and coordinate with Montana's Architecture and Engineering Division (A&E).

Phase 2: Will be coordinated with A&E, the agency having oversight for all major construction projects on State properties.

Phase 3: Faculty of both Montana Tech's College of Engineering and College of Technology will conduct research, including data collection, analysis, simulations, and will involve both undergraduate and graduate students in hands-on experience with the system.

The Association of American State Geologists (AASG) is PI for a DOE grant to populate the National Geothermal Data System with data from all states, and also to help develop the data protocols. The Montana Bureau of Mines and Geology (a state agency and department of Montana Tech) is a partner in that grant and will have experience and responsibility for oversight of providing data to the National Geothermal Data System.

- Data collection and simulations as described for Phase 1 must be completed prior to the go/no go decision for Phase 2. This is expected to take up to 12 months.
- **Go/no go will be based on both economic feasibility and research benefits.**
- Technology for Phase 2 is off-the-shelf and no major problems are expected in implementing the project.
- Partnerships, either for leveraging funding or for research, will be established as feasible.
- Simulations from Phase 1 will have immediate application in heat pump studies. If carried through to full completion, this project will be a model for other geographic sites and applications.

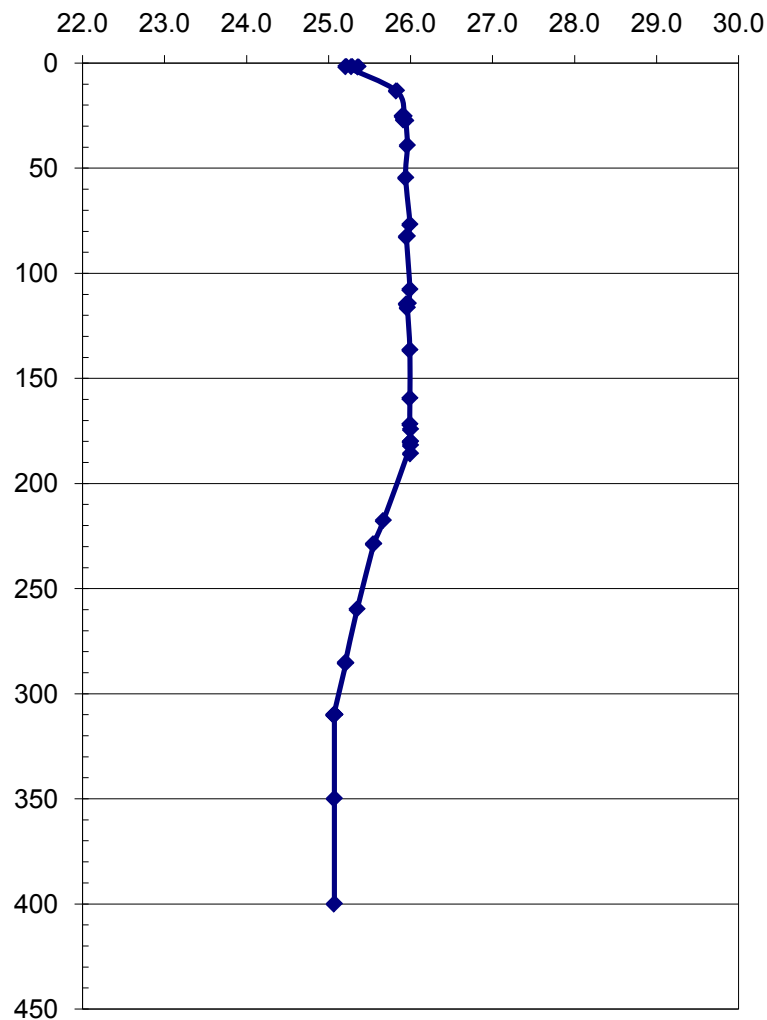
This project will provide:

- Documented simulations of a large hybrid heat pump system.
- Comparative data for simulations vs actual operation, and operational costs of heat pumps vs conventional steam.
- Broad and immediate application in many other uses and geographic locations.

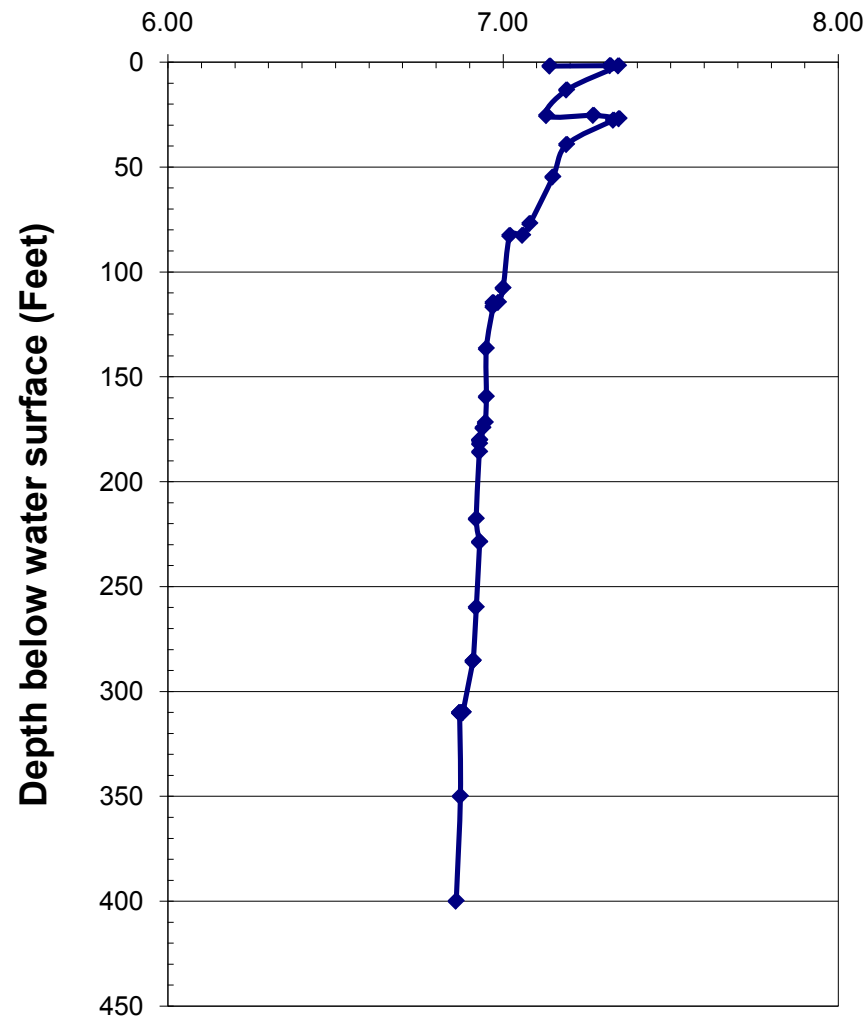
Montana Tech is favorably situated to conduct this study because it has:

- A new building with a highly instrumented system ideal for conversion to a hybrid system that will enable collection of comparative data.
- Access to mine workings filled with warm water that can be used as a heat source/sink.
- Faculty and students (Colleges of Engineering and Technology) eager to conduct research using the system.

Water Temperature (Centigrade)



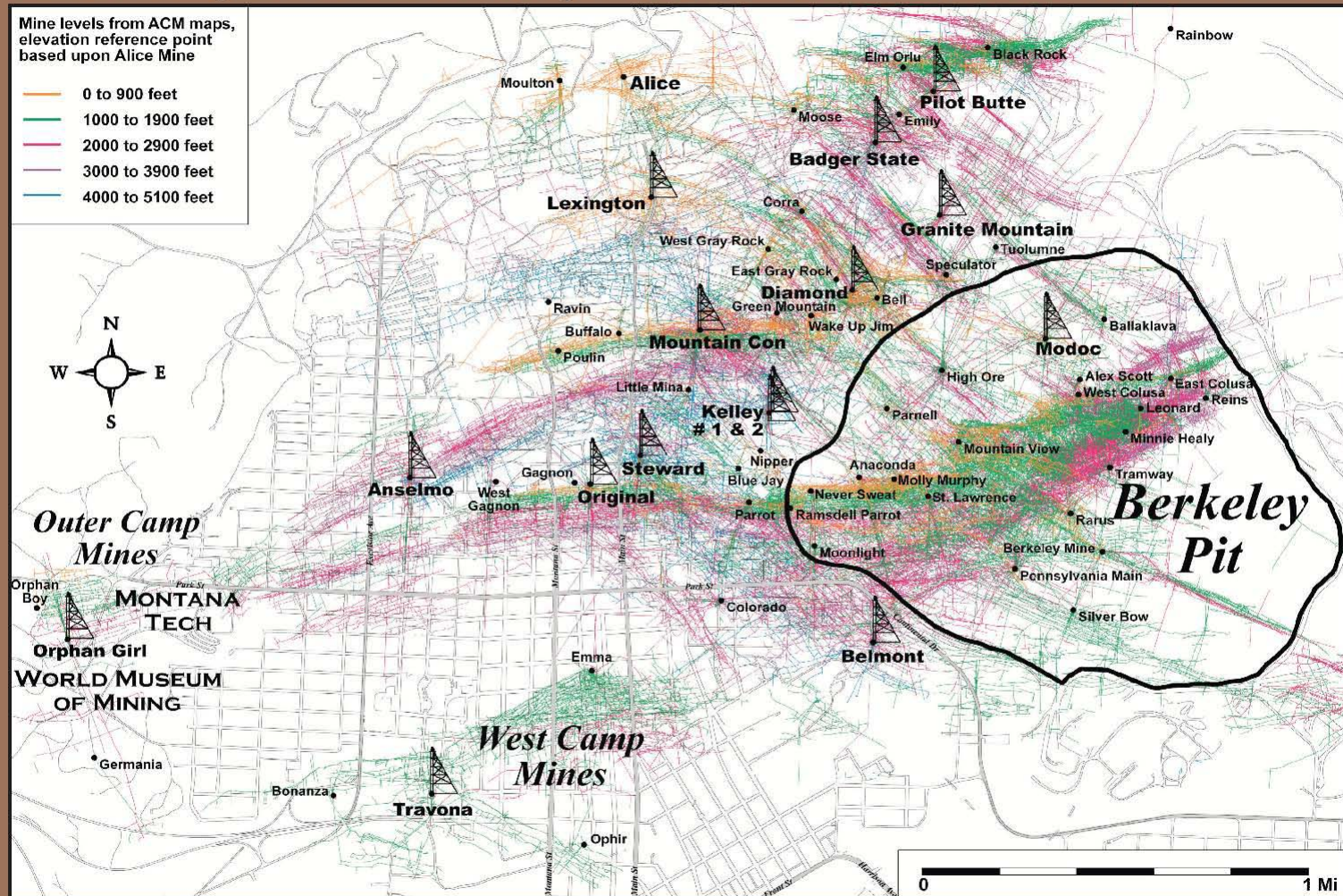
pH



Water level is 120 ft below shaft collar

Butte, MT has an abundance of underground mine voids filled with warm water

BUTTE, MONTANA, RICHEST HILL ON EARTH



MONTANA BUREAU OF MINES AND GEOLOGY



Orphan Boy Mine site

viewed from the Natural Resources Building 4-30-10



Orphan Girl Mine site

viewed from the Natural Resources Building 4-30-10

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