FINAL SCIENTIFIC/TECHNICAL REPORT
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PYRAMID LAKE PAIUTE TRIBE
WATER RESOURCE DEPARTMENT
RENEWABLE ENERGY PARK ENERGY PROJECT
GEOTHERMAL EXPLORATION

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No protected data or patentable material is included in this report.

EXECUTIVE SUMMARY

How the research adds to the understanding of the area investigated?

The Pyramid Lake Paiute Tribe is a federally recognized tribe residing on the Pyramid Lake Reservation in western Nevada. Known geothermal resources are found through out the state of Nevada including on the Pyramid Lake Reservation. The Paiute people consider geothermal surface water sites spiritual and use them for cultural activities. Previous investigations have centered on areas with geothermal surface expressions but these sites are not available for development. The funding for this investigation was used to identify blind geothermal systems disconnected from the geothermal sacred sites and develop a tribal energy corporation for evaluating potential energy projects. To achieve this goal, a database was compiled which included well and spring water testing, geologic mapping, and geophysical surveys. Drilling target areas were identified from this data for exploration gradient holes. Seven gradient holes were drilled in two separate target areas on the northern end of the reservation. Information gained from the gradient holes was used to derive a geologic model of the Astor Pass geothermal area and locate a slim hole. An 1800 foot slim hole was drilled in the Astor Pass geothermal site to further develop the geologic model. The geothermal exploration project identified several geothermal systems through out the reservation and target areas that have the potential for geothermal development without impacting cultural resources. The data gives the tribe a better understanding of the geothermal resources through out the reservation and identified several areas that can be studied for a variety of geothermal applications. All the information can be reviewed by the energy corporation to determine the best economic opportunities for the tribe.

The technical effectiveness and economic feasibility of the methods or techniques investigated or demonstrated
How the project is otherwise of benefit to the public/tribe

The geothermal exploration on the Pyramid Lake Reservation was very effective in identifying potential tribal geothermal resources. By utilizing known geothermal exploration technology, a blind geothermal system was located that may be an economically feasible geothermal production site. Other areas were also identified with the potential for direct heating and other geothermal uses within tribal communities. Further exploration is still required to characterize the geothermal potential of these sites by identifying the geothermal reservoir parameters of each geothermal system. The Tribal corporation development was an essential part of economic development planning as it provides stability and direction for geothermal exploration activities. The corporation will determine the feasibility of projects and be the decision making entity that operates in the best interest of the tribe. The benefits to the tribe and the general public will ultimately be a source of green energy, economic development, jobs, reduced utility costs, and possibly economic stability. The immediate tribal benefit is to give the tribe a better understanding of their resources so the tribal council can make informed decisions about future economic opportunities regarding geothermal development.

ACCOMPLISHMENTS

Compare the actual accomplishments with the project goals and objectives

Project Goal
The project goal was to determine the best resource potential on tribal lands for the initial geothermal development. Using congressionally earmarked funds, the tribe planned on characterizing the geothermal resource and determining the potential for geothermal electrical production of at least one medium size geothermal facility on tribal lands. This original goal was only partially achieved by locating a resource with the potential for development and collecting some drilling data on the area. The geothermal assessment data however, was not complete enough to determine the potential for electrical production.

Geothermal Resource Assessment

The objectives used to achieve the goal are included in a Geothermal Resource Assessment. The assessment was to be conducted according to the methodology in the following tasks.

Task 1 – Surface Exploration

The objective of surface exploration was to perform sufficient exploratory work to select an optimal target location for slim hole (s) to be drilled under Task 3. All the objectives of this task were accomplished. Under this task, the tribe retrieved existing data and generated additional data that included geologic mapping, geochemical well data, and geophysical surveys. The data was complied in an electronic database. From existing data two target areas were identified where the geophysical surveys were conducted. Detailed Magnetic and Gravity Surveys were performed at Astor Pass and Bonham Ranch on tribal lands that were used to target potential drill sites. Geologic mapping at these sites were extensive to facilitate locating drill sites. There were no seismic surveys conducted due to the lack of money and the limited data they provide for the area. Additional gravity surveys and geologic mapping were conducted, using a larger grid pattern, through out the reservation to ensure the areas with the best potential for development were identified.

Task 2 – Compliance Documents and Permitting

Under this task, the tribe will develop compliance and other documents including:

- Preparation and processing of Indian Minerals Development Act compliance documents for geothermal exploration on the reservation.
- Development of compliance and permitting documents, such as, rights-of-way agreements, leases, permits, licenses, certifications, intergovernmental agreements and other approvals needed for project development or financing.

The objective of this task was accomplished by the tribe in securing a drilling permit from the Bureau of Indian Affairs. The permit included an archeological survey of the drill sites and a general cultural clearance of the target areas by the tribal NAGPRA committee. Health and safety inspections/meetings were held at the drill sites and conducted by the drillers and drilling engineer. For geothermal development to occur on the reservation, the tribe developed the necessary by laws and framework for a tribal corporation. Although the Tribal Council will still govern the project, the corporation will handle the financial interests of the tribe. The corporate structure was developed as a tribal entity with major modifications required if outside interests are involved in energy development on the reservation.

Task 3 – Slim–Hole Drilling and Characterization

The objective of this activity is to access and characterize the geothermal reservoir at the sites by gathering and confirming the geological and geothermal characteristics of the resource. Ultimately a single slim hole was drilled at Astor Pass, to a depth of 1800 feet, to fulfill this objective. The hole was tested and surveyed to collect data on the geologic environment contacted by the well. Due to the lack of money, only a single slim hole was drilled and seven gradient holes were drilled to approximately 400 feet to help characterize the target areas. Gradient holes data included temperature and geologic logs. These were also collected in the slim hole with the addition of bore hole analysis by Haliburton that provided geologic and hydrothermal characteristics of the slim hole. The flow test and temperature surveys were completed for the slim hole during a 12 hour pumping event. From all the data collected during drilling and compiled in Task 1, a geologic model was developed from the Astor Pass Geothermal Area. This model has indicated areas of interest for locating future slim hole drill targets. All the Injectivity tests, to determine well productivity, were not completed for the slim hole, as the desired temperature for electrical production was not reached. Only the tests contributing to the Geologic Model data and information for conformation were performed on the slim hole.

Task 4 – Testing and Assessment

This final activity associated wit defining the geothermal resource, during which sufficient flow testing, sampling and logging information will be integrated with exploratory and drilling data to provide a final assessment. Since the slim hole APS #1 did not achieve the desired temperatures necessary for energy production, the final assessment activities were not completed and conformation of the geologic model has yet to be confirmed. Continued exploration drilling will be required to accomplish this task.

Task 5 – Well Site Restoration

This activity involves restoring the drill site according to tribal and federal regulations. Since the project is not completed and future drilling at the Astor Pass Geothermal Site is planned, the site remains available for the next drilling event. The site has been left in condition that does not cause any environmental degradation or pose a safety hazard to the public or tribal members.

PROJECT ACTIVITIES

Original hypotheses

The original hypothesis for the project was that there were areas on the reservation with the potential for geothermal development. Previous geothermal exploration was concentrated at sites with surface expression that were not suited for development due to cultural significance. The geothermal exploration for this project strived to compile data through out the reservation and locate potential geothermal systems appropriate for development.

Approaches used

A traditional approach was used to assess and define the geothermal resource on the Pyramid Lake Reservation. The exploration activities included geophysics, structural geology, and well data collection. Target areas were first drilled with 400 foot gradient holes followed by an eighteen foot slim hole. Down hole analysis on the slim hole was performed by Halliburton and a complete spinner temperature survey conducted.

Problems encountered and departure from planned methodology

The only deviation from the planned methodology was a reduced number of slim holes were drilled. Originally 3 slim holes were planned but the increased cost of drilling allow only enough money for one slim hole to a depth of 1800 feet.

An assessment of their impact on the project results

The increased drilling cost prevented the completion of the exploration slim hole drilling. The impact on the project results was incomplete data to confirm the geologic model. Further exploration drilling will need to be completed before the Astor Pass Geothermal system is completely characterized.

Assumptions used during the life of the project to support the conclusions

The only assumption made during the course of the exploration project was that there was a geothermal system on the reservation capable of development. This assumption was circumstantially confirmed with the discovery of 200 degree water at the Astor Pass site. From the data collected on this project, a presumptive geologic model was generated. Conclusions on the project assumptions are yet to be confirmed until the final exploratory drilling is completed.

PRODUCTS AND DELIVERABLES

Publications/Conference Papers

2 Conference Papers were written on the project and presented at the 2007 Geothermal Resource Council Conference at the Nugget Sparks Nevada

No Website or other internet sites were developed during the Pyramid Lake Energy Project.

Databases & physical collections

A Geothermal Data base was generated under the Pyramid Lake Energy Project. The database includes gravity data, magnetic data, well data, geologic mapping, structural mapping and drill data compiled in an Arc View program. A physical collection of drill samples from gradient and slim hole drilling has been maintained by the Pyramid Lake Paiute Tribe.

No new techniques or technology were developed during the Pyramid Lake Energy Project.

Networks or collaborations fostered

The Pyramid Lake Paiute Tribe was able to establish a number of informal networking activities during the project including the University of Nevada Reno Geothermal and Geology groups, Geothermal Resource Council, Nevada Department of Minerals, and Bureau of Land Management state geothermal office. No formal collaborations were fostered during the duration of the project.

No inventions/Patent Applications or licensing agreements were made during the time of this project.

No products such as audio or video, software or netware, models, educational aids or curricula, instruments or equipment were developed or purchased for this project.

This project did not involve computer modeling.

If you have any questions, please contact John Jackson at 775-574-0101 x21 or via e-mail at jjackson@plpt.nsn.us