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DE85 000637

DIRECT UTILIZATION OF GEOTHERMAL
HEAT IN CASCADE APPLICATION
TO AQUACULTURE AND GREENHOUSE SYSTEMS
AT NAVARRO COLLEGE

MASTER

Annual Report
for the Period
March 1, 1979 - December 31, 1979

Prepared by
Kenan Smith - Director
Environmental Aquaculture Services

Work Performed Under Contract

DE-FC08-79ET27058

NAVARRO COLLEGE
Corsicana, Texas

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U.S. Department of Energy
CONTRACT MANAGEMENT ANNUAL PROJECT REPORT

1979

TITLE: DIRECT UTILIZATION OF GEOTHERMAL HEAT IN CASCADE APPLICATION
TO AQUACULTURE AND GREENHOUSE SYSTEMS, AT NAVARRO COLLEGE

AGREEMENT:

Number: DE-FC08-79ET27058
Start Date: March 1, 1979
Completion Date: September 30, 1984
Participant: Navarro College
Highway 31 West
P.O. Box 1170
Corsicana, Texas 75110

1979:

MARCH

An agreement between the U.S. Department of Energy (DOE) and Navarro College was signed to demonstrate direct use of Geothermal Resources.

The production well pump was ordered.

A public awareness program was initiated with release of news articles and installation of site signs.

Initial work on the cost plan commenced.

APRIL

An environmental report was being prepared for delivery to DOE on May 1, 1979.

An initial project schedule was submitted on April 16, 1979.

The production pump was installed and work was being done on installation of controls.

MAY

The environmental report was submitted on May 1, 1979.

The production well electrical control equipment was installed.

Injection well plans were discussed to see if a greater depth could be reached for a possibly better reservoir.

JUNE

Location of the injection well on campus property was established.

Flow testing of the production well was performed; Flow: 290 GPM, Temperature: 125° F.

JULY - AUGUST

A proposal was submitted to DOE for additional funds to drill the #2 (disposal) well to a greater depth in the Travis Peak Formation, in hopes of hitting a better geothermal resource.

SEPTEMBER

Tentative approval was received from DOE for additional funds to drill the #2 well to a greater depth in hopes of finding a better geothermal resource.

OCTOBER

Drilling costs and a contract were sent to DOE for their approval in drilling the #2 geothermal well.

Preliminary planning and engineering for space heating applications to building structures had begun.

NOVEMBER

Approval to contract the drilling of the #2 geothermal well was received and work was scheduled to begin in December 1979.

DECEMBER

Drilling of the disposal well began on December 7, 1979, and was completed to a total depth of 4760 feet on December 20, 1979. Well logging and formation testing showed the production zone at 4500 feet to be too tight to yield any significant flows and the hole was plugged back, and cased at 4150 feet.

Plans were being developed to test another producing zone at 3900 feet.

For more explicit details and information see monthly and special reports submitted to the U.S. Department of Energy, Nevada Operations.

Dr. Lary Reed, Project Director
Navarro College

Kenan C. Smith, Project Coordinator
Navarro College

13 April 1979

Page - 2 -

Task 6.	<u>Economic Analysis</u>	Uninitiated
Task 7.	<u>College/Hospital Heating System</u>	Uninitiated
Task 8.	<u>Fluid Distribution System</u>	Uninitiated
Task 9.	<u>O & M Manual</u>	Uninitiated
Task 10.	<u>Public Awareness Program</u> - Prior to agreement signoff ceremonies on 24 March 1979, news releases were delivered to national, state, and local media. Four signs were erected at the site for use in directing the public to the project location and describing the project.	
Task 11.	<u>Institutional Factors</u>	Initiated
Task 12.	<u>Information Transfer</u>	Uninitiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

No change

4.0 VARIANCES/PROBLEMS

4.1 Cost Variances - A Cost Plan is being prepared for FFY 1979 for inclusion in next month's project status report.

4.2 Schedule Variances - A baseline schedule is to be submitted with the Cost Plan. No variance in the schedule is expected at this time.

5.0 OPEN ITEMS

None

6.0 RECENT AND PLANNED ACHIEVEMENTS

The production well submersible pump has been ordered. The cooperative agreement was signed off by Navarro College 29 March 1979.

C. P. Green, Project Director
Navarro College

Task 10.	<u>Public Awareness Program</u>	Initiated
Task 11.	<u>Institutional Factors</u>	Initiated
Task 12.	<u>Information Transfer</u>	Uninitiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

No change.

4.0 VARIANCES/PROBLEMS

4.1 Cost Variances - A Cost Plan dated 7 May 1979 is submitted with this report.

4.2 Schedule Variances - A project schedule dated 16 April 1979 is submitted with this report. No variance in the schedule is expected at this time.

5.0 OPEN ITEMS

None

6.0 RECENT AND PLANNED ACHIEVEMENTS

The production well submersible pump has been installed. Installation of pump electrical control equipment is underway. Materials for the injection well have been ordered.

C. P. Green, Project Director
Navarro College

Task 10.	<u>Public Awareness Program</u>	Initiated
Task 11.	<u>Institutional Factors</u>	Initiated
Task 12.	<u>Information Transfer</u>	Uninitiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

Conservation analysis at Navarro County Memorial Hospital will not be performed this fiscal year as shown on the schedule dated April 16, 1979, but rather next year. A new schedule will be submitted next month that reflects this change.

4.0 VARIANCES/PROBLEMS

- 4.1 Cost Variances - A positive cost variance is shown on the Contract Management Summary Report due to delays in preparation and submittal of invoices for injection well materials.
- 4.2 Schedule Variances - Other than Item 3.0 above, no variance in the schedule is expected at this time.

5.0 OPEN ITEMS

DOE EIS Negative Declaration

6.0 RECENT AND PLANNED ACHIEVEMENTS

The production well electrical control equipment has been installed. Instruments attached to the installed downhole pump indicate a reservoir fluid temperature of 133°F. Production well testing is being planned to confirm temperature and determine maximum flow rate. An injection well additional proposal to reach the Travis Peak is now in preparation. Hotter water and lesser drawdown may be achieved.

C. P. Green, Project Director
Navarro College

Task 7.	<u>College/Hospital Heating System</u>	Uninitiated
Task 8.	<u>Fluid Distribution System</u>	Uninitiated
Task 9.	<u>O & M Manual</u>	Uninitiated
Task 10.	<u>Public Awareness Program</u>	Initiated
Task 11.	<u>Institutional Factors</u>	Initiated
Task 12.	<u>Information Transfer</u>	Uninitiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

As stated in the Technical Status Report for May 1979, the energy conservation analysis for the Hospital will be performed next fiscal year rather than this fiscal year. A new schedule implementing this change will be submitted 1 October 1979.

4.0 VARIANCES/PROBLEMS

4.1 Cost Variances - A positive current and cumulative cost variance is shown in the Contract Management Summary Report, due to delays in preparation and submittal of invoices for production/injection well materials and services.

4.2 Other than Item 3.0 above, no variance in the schedule is expected at this time.

5.0 OPEN ITEMS

None

6.0 RECENT AND PLANNED ACHIEVEMENTS

Preliminary flow testing of the production well has been performed. Surface discharge was measured at approximately 290 gpm. Temperature of the produced fluid was measured at 125°F. It had been anticipated that the pump, as ordered, would produce 400 gpm and 135°F fluid. Instrument packages on the downhole submersible pump indicated a fluid temperature of approximately 133°F while heat loss calculations yielded a reservoir fluid temperature of around 124°F. Due to these discrepancies with pump production rate and indicated reservoir fluid temperature, the pump and tubing were pulled and the pump returned to the vendor for inspection and testing. Testing of the pump is to be performed during the next reporting period.

12 July 1979
Page - 3 -

Final preparations of the additional well proposal to reach the Travis Peak are underway.

A handwritten signature in cursive script, appearing to read "C. P. Green", written over a horizontal line.

C. P. Green, Project Director
Navarro College

CPG:alc

13 August 1979

Page - 2 -

Task 11. Institutional Factors

Initiated

Task 12. Information Transfer

Uninitiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

As stated in previous Technical Status Reports, the energy conservation analysis for the Hospital will be performed next fiscal year rather than this fiscal year. A new schedule implementing this change will be submitted 1 October 1979.

4.0 VARIANCES/PROBLEMS

4.1 Cost Variances - A positive current and cumulative cost variance is shown in the Contract Management Summary Report, due to delays in preparation and submittal of invoices for production/injection well materials and services.

4.2 Other than Item 3.0 above, no variance in the schedule is expected at this time.

5.0 OPEN ITEMS

None

6.0 RECENT AND PLANNED ACHIEVEMENTS

Testing of the production well pump was performed at the vendor's factory to investigate the variance between expected and actual pump performance. The pump was expected to produce 400 gpm, but in service produced 315 gpm. Although the pump and motor were not tested as a unit, tests indicated that the pump was operating within specifications. Discussions were held to determine if another pump would be more suitable, but it was concluded that the pump was the most appropriate one for the job. The pump was returned to the vendor, to be held in storage for Navarro College until a decision on the additional well proposal is made.

The proposal for additional funds to drill a deeper production well in the Travis Peak was submitted to DOE. This proposal is now being revised, including DOE's comments and some revisions in the costs for the various options considered.

C. P. Green, Project Director
Navarro College

cc: Morris Skalka
Roland Marchand
S.M. Hansen
Judith A. Florance

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

As stated in previous Technical Status Reports, the energy conservation analysis for the Hospital is to be performed in fiscal year 1980 rather than fiscal year 1979. A new schedule implementing this change and any other necessary schedule changes is in preparation.

4.0 VARIANCES/PROBLEMS

4.1 Cost Variances - A negative current cost variance is shown in the Contract Management Summary Report. However, a positive cumulative cost variance still exists due primarily to delays in preparation and submittal of invoices for production/injection well materials and services as well as delays in drilling well No. 2 itself.

4.2 Schedule Variances - Other than Item 3.0 above, no variance in the schedule is expected at this time.

5.0 OPEN ITEMS

Well No. 2 (proposed injection well) has yet to be drilled, pending DOE approval to drill well No. 2 to greater depths (4700') in order to produce hotter fluid or fluid with more desirable composition.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Tentative approval of the proposal for additional funds to drill well No. 2 to the Travis Peak as a deeper production well has been received from DOE. However, no drilling activity will be performed until the Cooperative Agreement between Navarro College and DOE has been amended to include funds for this project addition. Efforts are presently underway to firm up the costs for drilling and completing the deeper No. 2 well as included in the deeper well proposal. At this time the drilling rig is anticipated to move on site November 15, 1979. Drilling and completion activities are expected to take less than one month to complete.

Preparation for corrosion testing of various materials to be considered in system design is underway. On site testing using production fluid will be performed after decision whether well No. 1 or well No. 2 will be used as the production well. Preliminary design efforts are to be begun soon.

A revised Cost Plan for FFY 1980 is in preparation.

Morris Shalka-4 copies
S.M. Hansen- 1 copy
Judith A. Florance-1 copy
Roland L. Marchand-1 copy

C. P. Green, Director
Navarro College

NAVARRO COLLEGE

Highway 31 West
Corsicana, Texas 75110

Phone 214-874-6501

TECHNICAL STATUS REPORT

Date: 28 November 1979
Period: October 1979
B & R Number: AE-1003-03-0
Report Number: DCN-79-212-308

Title: Water and Space Heating for a College and Hospital by
Utilizing Geothermal Energy

Agreement:

Number: DE-FC08-79ET27058
Start Date: 3/1/79
Completion Date: 6/30/82
Participant: Navarro College
Highway 31 West
P. O. Box 1170
Corsicana, Texas 75110

1.0 CONTRACT OBJECTIVE

The objective of this project is to demonstrate the economic and technical feasibility of direct utilization of geothermal energy. To meet this objective, this project is designed to decrease Navarro College's and Navarro County Memorial Hospital's dependence on fossil fuel by making maximum use of the low temperature geothermal resource for water and space heating.

2.0 AGREEMENT TASKS

Task 1.	<u>Production Well (No. 1)</u>	Completed
Task 2.	<u>Environmental Report</u>	Completed
Task 3.	<u>Fluid Disposal System</u> - Following DOE approval of a proposal and the subsequent allocation of funds to drill a new deeper production well to an estimated 4700 foot depth in the Travis Peak formation, it was learned that drilling, service, and casing costs had increased dramatically from those estimated in the proposal. Consultation with drilling and service contractors and casing suppliers indicated that in order to reduce the estimated cost of the as proposed new well, a smaller diameter well bore and long string casing would be required. This effectively decreased costs for drilling footage rates,	

cementing services, and casing. Consultation with casing suppliers resulted in an arrangement where not only would the smaller diameter (8 5/8" O.D.) long string casing be supplied at what seemed to be reasonable prices, but the supplier would sell the casing that the College had previously purchased for the original as proposed injection well at no loss to the project. The drilling and completion of this new smaller diameter well is not expected to reduce the production capacity of the system and yet costs are still very nearly within the additional allocated funding. Costs for services such as logging, well testing, etc. will not be known until after such services are performed.

Task 4.	<u>Preliminary Design Report</u>	Uninitiated
Task 5.	<u>Final Design Report</u>	Uninitiated
Task 6.	<u>Economic Analysis</u>	Uninitiated
Task 7.	<u>College/Hospital Heating System</u> - Some work has been initiated on the preliminary design of the heating systems for the hospital and the student union building but this has primarily involved gathering data on the systems as they are presently installed. No detailed design is expected to be conducted until after the new deeper production well is completed, and the discharge temperature and production capacity of the well are determined. Work is in progress on the energy conservation analysis of the Hospital.	
Task 8.	<u>Fluid Distribution System</u> - Some work has been conducted on the preliminary design of the fluid distribution system, but as in Task 7 above, no detailed work concerning sizing of heat exchangers, piping systems, etc. can be done until the nature of the production fluid is determined.	
Task 9.	<u>O & M Manual</u>	Uninitiated
Task 10.	<u>Public Awareness Program</u>	Initiated
Task 11.	<u>Institutional Factors</u>	Initiated
Task 12.	<u>Information Transfer</u>	Uninitiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

As stated in Item 2.0 above, a new deeper production well is to be drilled in the near future. Although preparation for materials testing has been underway according to schedule, actual site work will not be performed until after the well is completed. At the present time, work is being performed on an energy conservation analysis of the Hospital. These changes are indicated on a revised work schedule included with this status report.

4.0 VARIANCE/PROBLEMS

4.1 Cost Variances - A positive current and cumulative variance is shown in the revised Contract Management Summary Report covering FFY 1980. These variances are due to delays in drilling well No. 2 and invoicing of services and other well materials. A revised Cost Plan dated 26 November 1979 is submitted with this project.

4.2 Schedule Variances - No variance in the attached revised schedule dated 26 November 1979 is expected at this time.

5.0 OPEN ITEMS

Well No. 2 has yet to be drilled. Materials testing has yet to be performed.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Copies of the executed drilling contract have been sent to DOE for approval. Notification of approval of this contract by DOE is required by November 27, 1979 in order to reserve the drilling rig for an approximate December 3 move-on date. Drilling is anticipated to begin during the week of December 3. The well is expected to be completed within approximately 21 days.

The casing supplier is in the process of submitting a written cost estimate for the smaller diameter long string. Recent telephone conversations have confirmed earlier discussions concerning the firm price of this casing and arrangements for selling casing previously purchased by the College. There is no problem at this time with the availability of the casing.

Modifications to the contract between the College and Radian Corporation authorizing funds for work in FFY 1980 have been made and received. Following execution by the College this will be sent to DOE. Contracts between the College and Hammer Consulting Engineers, Inc. have been drawn up, reviewed, and signed.

C. P. Green, Director
Navarro College

14 December 1979

Page 3

5.0 OPEN ITEMS

Well No. 2 has yet to be drilled. Materials testing has yet to be performed.

6.0 RECENT AND PLANNED ACHIEVEMENTS

The drilling rig moved on site December 4 and began drilling on December 7. By the afternoon of December 13, the depth drilled was around 3200 feet. T.D. of 4700 feet is expected to be reached by December 19 or 20. Consultation with formation testing service personnel is to be held during the week of December 17. News releases were sent out prior to initiation of drilling.

A handwritten signature in dark ink, appearing to read "C. P. Green", is written over a horizontal line.

C. P. Green, Director
Navarro College