DOE/ET/27058-5-5

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DE85 000640

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

**Annual Report
for the Period
January 1982 - December 1982**

**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

1982

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

1982

JANUARY - MARCH

A supplement to the original proposal was being reviewed by DOE. This proposal was approved in March, 1982, and a preliminary design of the project was requested by DOE.

APRIL - JUNE

Navarro College prepared a preliminary design report on cascading the geothermal energy through two enclosed aquaculture ponds, a greenhouse heating system, and into a collection catfish reservoir.

Also submitted was a revised Optional Form 60 on project funding for DOE review and approval.

JULY

On July 2, 1982, the reviewed Optional Form 60 and the preliminary designs were approved by DOE.

Also during July, 1982, a DOE approved contract was established to retain Kenan C. Smith of Environmental Aquaculture Services as Project Coordinator during the period of the contract.

Selection of an A/E Firm to prepare final designs for the project was initiated.

AUGUST

Final selection of the A/E Firm was submitted to DOE for acceptance. Two attempts had been made to locate a freshwater well for project requirements, but both were deemed "dry holes".

Alternatives for freshwater sources were available as city water, but a third attempt for a freshwater source would be conducted.

SEPTEMBER

DOE concurrence of the A/E Firm was received. The firm was notified to begin production of the final design report.

OCTOBER

Work continued on developing the final design report by the project A/E Firm. An attempt was made to drill a producing freshwater well near the project site, but resulted in another "dry hole". Use of city water and necessary filtration was incorporated in the final design report.

NOVEMBER

Final designs were completed and submitted to DOE for review and acceptance. Public Awareness of this project was being satisfied through numerous radio, television, and newspaper releases.

DECEMBER

Approval of final designs and the bid package was received from DOE and the Navarro College Board of Trustees. This resulted in the release for statements of bids. The bids were to be opened on January 27, 1983, at a Navarro College Board meeting.

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

Dr. Lary Reed, Project Director
Navarro College

Kenan C. Smith, Project Coordinator
Navarro College

3.0

TECHNICAL APPROACH OR WORK PLAN CHANGES

See "Direct Utilization of Geothermal Energy: A Project Oriented Toward Cascade Usage" (Supplement to Original Proposal)

4.0

VARIANCES/PROBLEMS

Supplement to Original Proposal submitted to Dept. of Energy

5.0

OPEN ITEMS

None

6.0

RECENT AND PLANNED ACHIEVEMENTS

During the week of December 28, 1981, a document entitled "Direct Utilization of Geothermal Energy: A Project Oriented Toward Cascade Usage" (Supplement to Original Proposal) was submitted to the Department of Energy for consideration. Also submitted was a document which recommended a change in the method of utilizing geothermal heat for space heating.

Navarro College is recommending that, based on the limited injectability of Well #2, that geothermal water be pumped from Well #1 at 50 gpm, cycled through a heat exchanger, and injected into the upper Woodbine at the same rate. A fresh water well would supply water to be pumped through the heat exchanger and then utilized for growing shrimp and tropical fish in two - $\frac{1}{4}$ acre ponds; for growing produce and landscape plants in a greenhouse which is heated and cooled utilizing geothermal heat and solar collectors; for growing fish in a one acre pond; and for irrigating a 20 acre hay field for the production of hay for feeding cattle on the College Farm.

At the time this report is being submitted, the revised project is being considered by the Department of Energy.

Dr. Lary L. Reed
Project Director
Navarro College

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

See Attachment

4.0 VARIANCES/PROBLEMS

Problems have arisen concerning the rate at which well number two (injection well) will receive the cooled water.

5.0 OPEN ITEMS

None

6.0 RECENT AND PLANNED ACHIEVEMENTS

As a result of the October 19-24 well testing where water was pumped from well number one and injected into well number two, specific recommendations will be made to the Department of Energy during the very near future. It is anticipated various project adjustments will be requested to assure a successful demonstration.

Dr. Larry L. Reed
Project Director
Navarro College

Task 9.	Resolve Problems	Initiated
Task 10.	Information Dissemination	Initiated
Task 11.	Submit Reports	Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

Due to restrictions of flow at the injection well, a negotiation for a revised project was initiated with the Department of Energy in November of 1981. A revised supplement was submitted in December of 1981 for DOE acceptance and concurrence which was granted in March 1982. A preliminary design report and revised optional form 60 were submitted for DOE approval in June 1982. A unique and innovative design concept on resource application to a cascading system was presented for their acceptance.

4.0 VARIANCES/PROBLEMS

Addressed in 3.0 above

5.0 OPEN ITEMS

6.0 RECENT AND PLANNED ACHIEVEMENTS

On July 2, 1982 the Department of Energy granted its acceptance of the revised Optional Form 60 for project funding and for the preliminary design reports submitted for their approval.

Also during July of 1982 a DOE approved contract was established between Navarro College and Kenan Smith of Environmental Aquaculture Service to retain him as Project Coordinator during the period of the project.

In addition, the selection of an Architectural/Engineering firm was initiated by requesting Statements of Qualifications from interested firms. Based on their statements, the top three firms were selected to submit a fixed price bid, to participate as the project A-E firm, by August 10, 1982.

Dr. Lary Reed, Project Director
Navarro College

RECENT AND PLANNED ACHIEVEMENTS

A project presentation and status report were presented, along with all other D.O.E. funded projects on direct heat applications, at the annual programs review meeting held in Las Vegas, Nevada on August 5th and 6th of 1982. This information has been published in the Department of Energy publication entitled Geothermal Direct Heat Applications Program Summary, August 1982.

Selection of an architectural/engineering firm has progressed to the point where concurrence and acceptance by the Department of Energy is anticipated shortly. This acceptance is partially dependent upon the procedures used for A/E selection and this process has been accumulated in a documentation packet which has been submitted to the Department of Energy.

Other project progress involves the drilling of two exploratory holes to locate a freshwater well. Logs of previously drilled wells and the advice of a local geologist were used for the selection of most probable sites. These first two exploratory wells proved to have very limited capacities at less than a gallon per minute production. The first well was drilled on August 23rd, 1982 approximately 75 feet south of the geothermal injection well, while the second well was drilled to a depth of 300' and located approximately 15' east of the geothermal production well on August 24, 1982.

Problems in locating a freshwater source were anticipated in the project funding and monies have been allocated for another exploratory hole to locate a well which can produce the necessary volume of freshwater for the project. A third site has not yet been selected, but a pump test of an existing well near the administration building is planned for September 3, 1982. Results of that test will be used in determining the selection of third site.

7 October 1982

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Task 9.	Resolve Problems	Initiated
Task 10.	Information Dissemination	Initiated
Task 11.	Submit Reports	Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCES/PROBLEMS

None

5.0 OPEN ITEMS

None

6.0 RECENT AND PLANNED ACHIEVEMENTS

Investigation and location of a freshwater source for the project was continued. An existing well near the administration building was pump-tested on September 2, 1982, and results of the test were very encouraging. A documentation of the test is attached with this report. This well is a good producer but is located in a poor area for project utilization except as a last resort. Efforts continue to be directed toward establishing a third exploratory drilling site more compatible for project utilization.

A supplier of brood stock animals for the project was located in Taylor, Texas and said he would supply the project with these animals around the middle of October. In preparation for their arrival, materials have been purchased for construction of a brood stock holding tank and filter system. The tank and filter should be completed during the first week in October.

Department of Energy concurrence of the project selection of an architectural /engineering firm was conveyed through a telephone conversation on September 28, 1982. The A/E firm has been notified to begin production of the Final Design Report and associated materials.

Dr. Larry Reed, Project Director
Navarro College

Task 9.	Resolve Problems	Initiated
Task 10.	Information Dissemination	Initiated
Task 11.	Submit Reports	Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCES/PROBLEMS

None

5.0 OPEN ITEMS

None

6.0 RECENT AND PLANNED ACHIEVEMENTS

A continuation of exploration for a freshwater source and feasible alternatives were conducted during the month of October. A poorly producing well on the northeast corner of the campus was pressure injected with a freshwater supply in an effort to increase its production on October 20, 1982. Results from this injection were minimal and production remained at less than 2 gallons per minute. Solutions for providing freshwater to the project are being considered by the project engineers and should be available next month.

Also, during the month of October a small hatchery has been constructed and stocked with 15 brood stock animals. Research will be conducted to determine the best methods and procedures required in order to have successful hatchings and survival of larval prawns for the project.

Dr. Lary Reed, Project Director
Navarro College

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Task 11. Submit Reports Initiated

None

None

Dr. Lary Reed, Project Director
Navarro College