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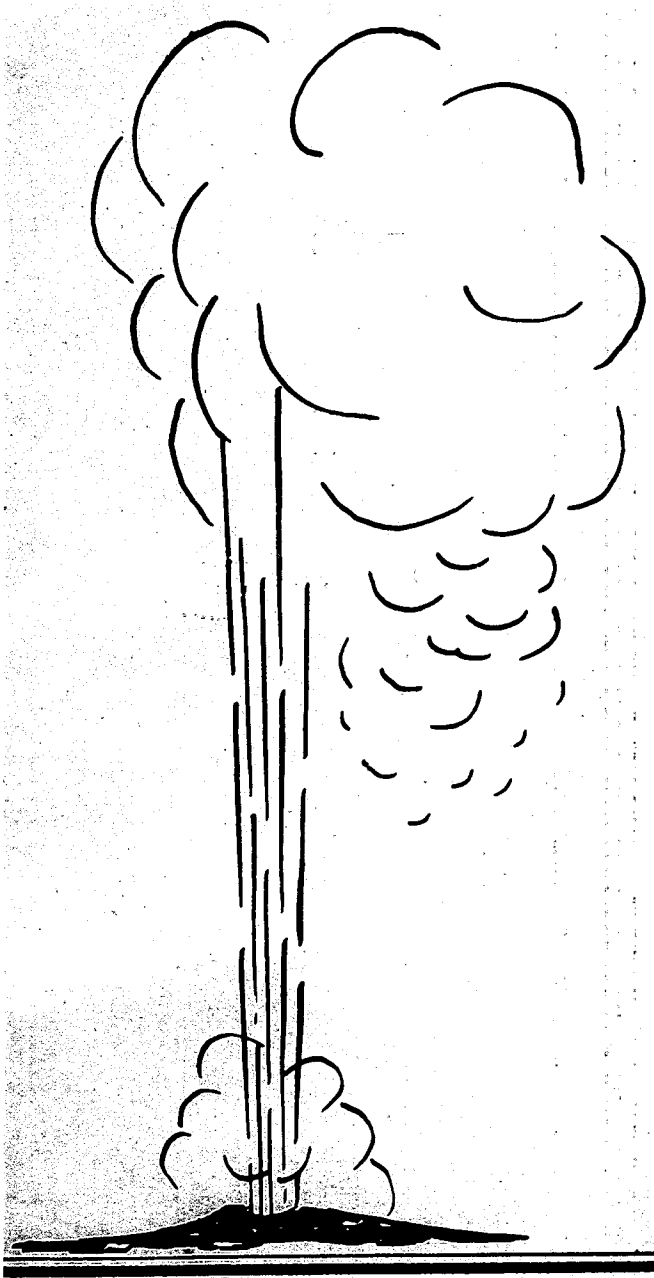

DIRECT USE GEOTHERMAL PON AND PRDA PROJECTS UNDER DOE-ID ADMINISTRATION

Annual Report Fiscal Year 1982

October 1, 1981 - September 30, 1982

Prepared by
EG&G Idaho, Inc.
Idaho Falls, Idaho

For the
U.S. Department of Energy
Idaho Operations Office
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DIRECT-USE GEOTHERMAL PON AND PRDA PROJECTS UNDER DOE-ID ADMINISTRATION ANNUAL REPORT FY 1982

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ABSTRACT

EG&G Idaho, Inc. provides technical assistance and project coordination to DOE for the Geothermal Program Research and Development Announcement (PRDA) Program and Program Opportunity Notice (PON) Programs. Both programs were instituted and funded by the U.S. Deparment of Energy, Division of Geothermal and Hydropower Technologies (DOE/DGHT) to assist in the development of the direct application of geothermal energy. The projects were then administered by DOE Field Offices in Idaho, San Francisco and Nevada. The PRDA Program consists of a series of studies designed to investigate the engineering and economic feasibility of geothermal direct heat applications. The PON Program consists of 23 demonstration projects in which project costs are shared between DOE and the private companies, municipalities, or organizations.

During this reporting period, fiscal year 1982, EG&G Idaho provided program coordination and technical support for 12 demonstration projects and five engineering and economic studies administered by the DOE Idaho Operations Office (DOE-ID).

ACKNOWLEDGEMENTS

Division of Geothermal and Hydropower Technologies, Washington D.C., program direction was provided by Eric A. Peterson and currently by Jacob Kaminsky. Project administration was provided by the DOE Idaho Operations Office, Idaho Falls, Idaho, under the direction of Michael K. Tucker and currently by Dr. Michael J. McLatchy.

Although too numerous to mention individually, EG&G Idaho, Inc. also wishes to thank the principal investigators and project teams from each project for their cooperation with EG&G Idaho, Inc. and DOE in the implimentation of these projects.

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DIRECT USE GEOTHERMAL PON AND PRDA PROJECTS UNDER DOE-ID ADMINSTRATION

INTRODUCTION

This report presents the status of Geothermal PRDA and PON projects administered by the DOE-ID as of the end of FY-1982. Both programs were instituted to assist the development of the direct application of geothermal energy. The PRDA Program consists of a series of studies designed to investigate the engineering and economic feasibility of geothermal direct applications. The PON Program consists of demonstration projects in which project costs are shared between DOE and the private companies, municipalities, or organizations. During this reporting period, fiscal year 1982, EG&G Idaho provided program management and technical support for 12 demonstration projects and five engineering and economic studies. Each project is summarized below.

PROJECT ACTIVITIES

PON Projects

Ore-Ida Foods, Inc., Ontario, Oregon

The objective of the Ore-Ida Foods project was to provide 97,200 MWh/yr (33.2×10^{10} Btu/yr) of geothermal energy for potato processing, space heating and potable water heating. About 50 L/s (800 gpm) of 160°C (320°F) fluid was required to meet this objective. At the estimated cost of drilling, it was calculated that this volume of geothermal fluid must be produced from no more than two geothermal production wells.

In FY-1980, an exploratory well was drilled which produced only 0.82 L/s (13 gpm) of 182°C (360°F) fluid. The drilling cost was about only 8% more than budgeted, but that was enough to use up nearly all of DOE's contribution to the project which was concentrated in drilling the

high-risk first well. Ore-Ida declined to continue the project on its own funds since drilling the first well did not reduce the development risk.

The state of Oregon requires that deep wells be plugged when they are abandoned. Ore-Ida said they would prefer to accept well ownership and liability for eventualy plugging the well if DOE would provide the funds for the plugging operation. In FY-1981, tests proved that a low-cost plugging operation was feasible. A price estimate was obtained for plugging the well by pumping cement into the well through the wellhead (no workover rig required).

During the current fiscal year, Ore-Ida Foods accepted ownership of the well and retained funds for eventually plugging the well. The project was closed out following publication of the final report in July 1982.

Monroe, Utah

The objective of the project was to install a core district heating system that could later be expanded to include the major areas of Monroe.

Prior fiscal years work resulted in a production well which produced 75°C (167°F) at 38 L/s (600 gpm), but this was only 43% of its expected capability. In addition, at the preliminary design stage, a 100% project cost overrun and inadequate operating revenues were predicted. DOE suspended the planned project activity and requested that the city find an economic alternative for the resources.

During the current fiscal year, publication of the final report was requested since the city had not been able to suitably restructure the project after about a year and a half. Terra Tek, Inc., had nearly completed the draft final report at the end of the fiscal year.

Haakon School District, Philip, South Dakota

The initial objective of the project was to provide space heating to a five building school complex. The well which was drilled produced a peak artesian flow of 18.93 L/s (300 gpm) at a temperature of 69.4°C (157°F).

The discharge temperature from the complex was determined to be high enough to allow cascaded use. The project was expanded to include eight business buildings on the discharge line route plus heating domestic hot water at the school complex.

The radioactivity level of the geothermal fluid was too high for direct surface discharge. The Environmental Protection Agency required that the Ra-226 levels in the well water be reduced to 10 picocuries/liter, prior to discharge to the Bad River. This was accomplished by the injection of a barium chloride solution which caused the Ra-226 to precipitate out in a settling pond. The school system came on-line early in the 1980-81 heating season, and system monitoring was started.

During the current fiscal year, the eight businesses in the business district were added, system monitoring was completed and several modifications were made to the Ra-226 removal system to reduce maintenance. After these modifications, an open-baffled trough was installed and the injection port for the barium chloride solution was moved to the end of the pipe just upstream of the open-baffled trough. This configuration minimized adherence of the precipitate to the system hardware and still resulted in adequate precipitation of the Ra-226 from the fluid. The final report was in preparation at the end of the current fiscal year.

St. Mary's Hospital, Pierre, South Dakota

This project demonstrates the feasibility of using very low-temperature water from the Madison Aquifer for a physically-localized space and domestic hot water heating load.

During prior fiscal years, a well was drilled which had a maximum artesian flow rate of 23.7 L/s (375 gpm) with a temperature of 41°C (106°F). Based on the 41°C (106°F) resource,the heating system was constructed and began operation in the fall of 1980.

In addition to providing heat to the 7432 m^2 (80,000 ft^2) existing building, the geothermal system, with a heat pump, also provides heat to a new 6503 m^2 (70,000 ft^2) hospital building. The geothermal system

provides all space heating down to -12.2°C (10°F) and domestic hot water and boiler water preheat up to 37.8°C (100°F).

In September 1981, a pinhole leak was found in a 0.91 m (3 ft) long piece of 15.24 cm (6 in.) diameter black iron pipe which was installed between the wellhead and the pressure-reducing valve. The horizontal pipe was replaced and was found to have severe internal corrosion.

Early in the current fiscal year, about 37 m (120 ft) of 15.24 cm (6 in.) diameter black iron pipe, downstream of the wellhead pressure-reducing valve, corroded through with two pinhole leaks after about a year of service. As a precautionary measure, the geothermal system was shutdown in December 1981. The hospital's old heating system was used from December 1981 to April 1982 until the black iron pipe was replaced with fiberglass reinforced plastic pipe. The hospital, the engineering firm, and the construction contractor shared the replacement cost since the design called out PVC plastic pipe which would not have corroded. Given the pinhole leak warnings, it was estimated that the down time for pipe replacement could have been held to 1-2 weeks if the replacement pipe had been available.

Because the second building was incomplete during the 1980-81 heating season, and the 1981-82 heating season was interrupted by the pipe replacement, the 1982-83 heating season will be monitored and included in the final report. The project should be completed in FY-1983.

Diamond Ring Ranch, Haakon County, South Dakota

During previous fiscal years, a system was designed and installed for grain drying and space heating on the Diamond Ring Ranch near Midland, South Dakota. It uses geothermal water from an existing artesian well which flows at 10.73 L/s (170 gpm) and 66.7°C (152°F). After flowing through the central heat exchanger, the geothermal fluid is used to water stock and is then discharged into a reservoir system used for both geothermal fluid and surface water runoff catchment.

The system provided heat, as designed, during the 1980-81 heating season. Some freezing occurred in the recirculating loops during power outages. This caused some tubing leaks in a mobile home heat exchanger which were repaired during the summer of 1981.

During the current fiscal year, in the fall of 1981, the recirculating loops, which previously contained fresh water, were charged with a total of 2460 L (650 gal) of antifreeze because of the problem of freezing during electrical outages in the remote area. Btu meters were cleaned and strainers were installed. During the 1981-82 heating season, only the lower recirculating loop was operated, because the two mobile homes on the upper loop were vacant. This was due to limited ranch operation during an ownership change. The final report was in preparation at the end of the current fiscal year.

Elko, Nevada

The Elko Geothermal Project will use hydrothermal fluids for space heating and for process heat and water in a commercial laundry, for space and domestic water heating in a motor hotel and for space heating in a bank building.

In prior fiscal years, the project went through an extensive resource assessment followed by site selection, drilling and testing of the production well, EHC GP-1. The geothermal production well was drilled to 260 m (825 ft) and 24-hour artesian and pump flow tests performed. The pump test was used to predict a 5-yr continuous-flow drawdown of 42.1 m (138 ft) at 49.53 L/s (785 gpm). The water temperature was 82.2°C (180°F).

During the current fiscal year, a longer artesian flow test was conducted. During the test, the temperature of the geothermal fluid began to decline. A spinner log of the well was run by EG&G Idaho. It confirmed communication between the geothermal resource and a shallow, cold aquifer through a leak where the well casing changed diameter. The logging confirmed another problem. The open hole was bridged at the 168 m (550 ft) level.

In June, a workover rig was brought in and the well was repaired. The repair consisted of cleaning out and deepening the hole to 263 m (862 ft), cementing the casing transition section overlap, and running a 16.82 cm (6 5/8 in.) diameter liner from 74 m (242 ft) to 250 m (820 ft).

After evaluating disposal options it was decided to dispose of the geothermal fluid in an infiltration pond. The final design was completed in April, and the construction contract was awarded in September.

The award of the construction contract was delayed due to the Stockman Hotel owner's concern over reduced investment rate-of-return caused by increased interest rates, higher than expected retrofit cost, and the well repair cost. Additional economic analyses by the Stockman Hotel's accountants and EG&G Idaho showed that the project would still have an attractive rate of return. The owner of the Hotel, who is also the Elko Heat Company's largest stockholder, then agreed to proceed with the project.

Construction was scheduled to begin the first week of October 1982 (FY-1983) with completion expected early in calendar 1983. The 1983-84 heating season will be monitored. The project will be completed by submittal of the final report in the spring of 1984.

Warm Springs State Hospital, Montana

The objective of this project was to develop the geothermal resource at Warm Springs (on I-15 about 48.3 km (30 m) west of Butte, Montana) to provide both domestic water heating and space heating at the Warm Springs State Hospital. Water from the production well would be pumped through two plate-type heat exchangers and discharged into a waterfowl wetlands disposal area.

In previous fiscal years, flow tests showed that the well would produce 5.68 to 6.31 L/s (90 to 100 gpm). This was inadequate for both space and domestic water heating loads. Therefore, it was decided to design the system to use the 71.1°C (160°F) resource to heat 4.73 L/s (75 gpm) of domestic water from 12.8 to 60.0°C (55 to 140°F). The design

was reviewed twice by EG&G Idaho and DOE-ID, and comments were returned to the prime contractor in August and September 1981.

At the start of the current fiscal year, in October 1981, the project was rescheduled and rebudgeted for the present domestic water heating design. In January 1982, EG&G Idaho and DOE-ID made the final design review and again issued comments. The comments were not resolved until April 2, when DOE-ID approved the design and the invitation for bid for construction of the domestic hot water heating system. A construction contract was awarded on June 28 and construction began on September 1. By September 30, all underground and well head piping had been installed. The geothermal heated domestic hot water system is expected to begin operation in January 1982 with monitoring and submission of the final report to be completed in FY-1983.

Pagosa Springs, Colorado

The geothermal resource in Pagosa Springs has been in limited use since the early 1900's. Nearly 30 small, historical wells had been drilled for individual heating and recreational purposes prior to starting this project. The objective of this project was to establish a geothermal district heating system from which many of the town's public and private buildings would be heated. The consolidated system would be designed to use the resource more efficiently than the old individual systems which were always run at maximum flow with no controls.

In previous fiscal years, three wells were drilled by the project. Two were good geothermal production wells, PS-3 and PS-5. In the summer of 1980, the two wells were individually and simultaneously artesian flow tested. In the simultaneous test, well PS-3 produced 12.6 L/s (200 gpm) and PS-5 produced 44.2 L/s (700 gpm) for seven days. It was decided to use well PS-5 initially since its fluid temperature was 65°C (149°F) versus PS-3's 55°C (131°F).

In the initial flow tests of the two production wells, the reservoir capacity appeared adequate for a district heating system with a peak flow of 56.78 L/s (900 gpm). It was estimated that this was equivalent to a

continuous flow rate of about 25.2 L/s (400 gpm) during a heating season. The distribution system was designed to handle growth to twice the needed capacity. It was anticipated that, as the historical wells and user-systems corroded and were shut down, the historical well owners would join the project's system. Gradually the wasteful full-flow systems would be replaced by more efficient, load-controlled user-systems which would allow more people to be served from the same resource flow. The system could also be expanded by using more wells. Eventually, the production from the project's wells might cause interference with some of these historical wells. If so, the well owner would be compensated by service from the project or the historical water right might be purchased for the project. Construction of the project distribution system was almost completed by September 30, 1981.

Construction of the distribution system was completed early in FY-1982. The district heating system was dedicated on November 21, 1981. Later, during checkout tests, two 20.32-cm (8-in.) diameter asbestos concrete pipes broke. They were found to have been improperly bedded during installation and were replaced by the contractor. Coury & Associates, who developed the district heating system design, received the Grand Award for Engineering Excellence from the Consulting Engineers Council of Colorado.

The completed distribution system did not operate during the 1981-82 heating season because the State of Colorado would not issue the production permit for the systems's wells unless test data were submitted that showed there would be no interference with existing wells.

Attempts to secure a production permit from the state was complicated by a new permitting procedure involving two state agencies, personnel changes for the Town of Pagosa Springs, and negotiations with about 15 existing-well owners. EG&G Idaho was instrumental in coordinating with the Colorado Department of Water Resources which must assure that existing water rights are protected prior to the Oil and Gas Commission approving the production permit. EG&G was also instrumental in getting the town to appoint a new project principal investigator and developing a detailed plan for the completion of the project.

On September 9, 1982, Pagosa Springs received verbal permission from the Colorado Department of Water Resources to do additional flow testing to demonstrate to the state that either interference with neighboring wells was not serious or that well owners would be compensated without calling on the state for water right enforcement. An 85.2-hour artesian flow test of well PS-5, with flow rates up 56.65 L/s (898 gpm), was followed by monitoring recovery for 72 hours. Some interference with neighboring wells was noted, but not enough to preclude moderate operation of the district heating system for initial demonstration purposes. Data reduction and preparation of the revised application for a tempory production permit for the 1982-83 heating season were in progress at the end of September 1982.

During FY-1983, the 1982-83 heating season data will be used to obtain a permanent production permit. It is planned to use the 1983-84 heating season for the monitoring season since the load for the 1982-83 season will be relatively light. Also, some system modifications are expected between the two seasons. The project is scheduled for completion in August 1984.

Utah State Prison, Draper, Utah

The Utah State Prison is located in Salt Lake County approximately 27 km (17 m) south of Salt Lake City. The objective of the geothermal project is to supply the minimum security section of the prison with domestic water and space heating. The resource surface expression, known as Crystal Hot Springs, is adjacent to the prison. In previous fiscal years, a commercial greenhouse and the prison project have both drilled geothermal wells, and there is some concern about interference between the two projects with a limited resource.

At the start of current fiscal year, CH2M Hill Central, Inc. completed the geothermal water disposal and preliminary design reports. The preliminary design used a shaft-driven pump in the well to avoid dissolution of carbon dioxide gas from geothermal fluid which would cause the precipitation of calcite in the system. Disposal would be by pipeline to the Jordan River if permits could be obtained.

The Utah Division of Facilities Construction and Management (DFCM) took over project management from Utah Energy Office (UEO) and pursued permitting and design tasks. In their meeting of October 29, 1981, the Utah Water Pollution Control Committee approved surface disposal of the geothermal fluid. When received by the project, the state disposal recommendation was forwarded to the EPA/Denver which was reviewing the November 1981 application for a NPDES disposal permit for the flow test scheduled for June 1982. In January 1982, supplementary data was provided per EPA's request. The NPDES permit was issued by EPA on March 8.

On April 5, Case, Lowe and Hart was selected to develop the final design for the space and domestic water heating system for the minimum security building. By August, the heat exchanger and recirculating loop designs were agreed upon. In September, two production options were still under consideration: (1) allowing natural, carbon dioxide lift to cause artesian flow followed by the removal of the calcite precipitate and (2) the original shaft-driven well pump design which would keep the carbon dioxide in solution until downstream of the flat plate heat exchanger by maintaining a pressure in excess of about 690 kPa (100 psig) on the fluid.

To determine if there was a resource interference problem, Morrison-Knudsen ran a series of pulse tests followed by a long duration test during the summer of 1982. Each test was naturally artesian with the dissolution of carbon dioxide assisting in lifting the fluid from the well. The long term test consisted of three parts: 18.93 L/s (300 gpm) for 20 days, then 37.86 L/s (600 gpm) for 14 days followed by monitored recovery (no flow) for 10 days. The 34-day flow extended from June 17 to July 19. Analysis of the data indicated that the resource is sufficient for the current prison and commercial greenhouse projects and may be sufficient for significant expansion of its use.

The prison system should be operating and monitored during the 1983-84 heating season with its final report to follow by the summer of 1984.

Madison County, Rexburg, Idaho

The objective of the Madison County Geothermal Project was to demonstrate a low-temperature geothermal resource for food processing and district space heating in Rexburg, Idaho.

In previous report periods, the well MCG-1 was drilled and deepened to 1202 m (3942 ft), but the water temperature never exceeded 21.7°C (71°F). A 1.9 L/s (30 gpm) downward flow ran from 731 to 853 m (2400 to 2800 ft) where the hole had sluffed in and bridged across after drilling. It was postulated that warm lower zones might be masked by the cold downward flow, particularly since the lower 143 m (470 ft) had never been logged. The hole was cleaned out and a 20 cm (5.5 in.) diameter liner was installed down to 1079 m (3540 ft). However, the casing hanger leaked and the downward flow continued. The first attempt to patch the leak at the casing hanger failed and the seal assembly was removed.

In October 1981, the start of the current fiscal year, the reworked seal assembly was installed for the second time. A well log showed an obstruction at 701 m (2300 ft). Airlift tests only produced about 8.83 L/s (140 gpm) versus 15.77 L/s (250 gpm) obtained previously. On November 11, a cable tool rig unsuccessfully attempted to push the obstruction to the bottom of the well with a 272 kg (600 lb) hammer. After waiting for a rig and heavier hammer to become economically available, the obstruction was pushed to the bottom of the well on April 5, 1982. The well was logged the next day. The patch assembly had stopped the leakage and the bottom-hole temperatures, at 1202 m (3942 ft), was 22.2°C (72°F). In a 52.5-hour airlift flow test, the flow had increased to 18.93 L/s (300 gpm) and the maximum temperature of the discharged flow was equal to the bottom-hole temperature. A temperature log five months later, on September 3, showed no increase in bottom-hole temperature.

The project is being ended due to lack of resource. The draft final report was reviewed by EG&G Idaho and DOE-ID in August. At the end of the fiscal year, comments on the draft were being incorporated by Energy Services, Inc.

Publication of the final report is expected in January 1983.

Utah Roses, Sandy, Utah

The Utah Roses greenhouse complex is located in the town of Sandy, which is approximately 17 km (10.6 m) south of Salt Lake City, Utah. The complex consists of 23,500 m^2 (6 acres) of greenhouses that produce cut roses for the national floral market. In previous fiscal years, a production well was drilled to a depth of 1525 m (5009 ft). It can produce water at a pumped flow rate of 12.6 L/s (200 gpm) and a temperature of 50°C (122°F) with a drawdown of about 366 m (1200 ft).

The geothermal water will be piped to 55 unit heaters located in the greenhouse. The spent geothermal water will then be discharged to the Jordan River via the Aaranall Ditch. Construction was nearly completed at the start of the current fiscal year.

During the current fiscal year, construction was completed and the system began operation November 4, 1981. The system operated successfully through the winter and was shut down for the summer on May 15. The NPDES permit only allows discharge from September 15 through May 15. During the winter, the geothermal system provided approximately 34% of the greenhouse heating requirement.

At the end of the current fiscal year, Energy Services Inc. was working on the draft final report for the project.

Boise, Idaho

The geothermal project in Boise, Idaho has two participants: the City of Boise and the Boise Warm Springs Water District (BWSWD) which has been in operation since its two wells were drilled in the late 1890s. The City of Boise and BWSWD established Boise Geothermal as the office through which the DOE project would be managed. Boise Geothermal should not be confused with Boise Geothermal, Ltd. which is the private, limited partnership which is developing the city-owned resource for the City of Boise system. The objective of the geothermal project is to develop geothermal district

heating systems to serve the largest possible commercial and residential market in the Boise central business district and neighboring residential areas.

In previous fiscal years, four production wells were drilled for the city system by the Boise Geothermal, Ltd., (a private, limited partnership) pipeline designs were in progress, a discharge permit for the vicinity of the Veterans' Park and a discharge permit for near the Americanna River bridge were pending. During the same period, the BWSWD had drilled one unsuccessful well, designed and bid its distribution pipeline, and opened the pipeline bids on September 30, 1981.

By the end of the current fiscal year, all of the BWSWD distribution pipeline and 70% of the City distribution system were completed. Boise State University has agreed to connect to the City system and extension of the service to the campus area was started.

The Idaho Department of Health and Welfare approved disposal of the spent geothermal fluid near the Americanna River bridge, upstream of the original discharge points. This is nearer the downtown area. As a result, the estimated cost of the disposal pipeline system was reduced. The design of the disposal system was completed and the contract is expected to be awarded in November 1982.

Boise Geothermal Ltd., a private, limited partnership, which is developing the City's resource, flow tested their no. 2 and 4 wells in April, 1982. The test indicated ample capacity to supply a 126 L/s (2000 gpm) peak system. Currently, there are sufficient committed customers to fully utilize the 126 L/s (2000 gpm). Pumps for Wells 2 and 4 were ordered and design of the wellhead piping and pumphouses was started.

The project presented a proposal to the State of Idaho to lease or buy the state's Capitol Mall wells. The project would supply the state with water and use the state wells for additional supply and/or disposal capacity. The state has agreed in principle but no formal agreement has been reached.

The large, old wellhouse which houses the two, side-by-side BWSWD wells is an officially designated National Historic Landmark. The project had the choice of refurbishing the wellhouse where it stands or moving and preserving the wellhouse plus building a new wellhouse. The latter operation would have been much more expensive.

BWSWD elected to refurbish and preserve the old National Historical Landmark pumphouse where it stands, rather than attempt to move it. The refurbishment cost is less than the BWSWD's owed share of project costs so DOE will not share in the refurbishment cost. As a result, the DOE work with BWSWD is complete. The BWSWD will do the refurbishment and preservation of the historical pumphouse on its own.

Currently, system construction is scheduled to be completed early in calendar 1983. After that time, the Boise Geothermal office, which has managed the project for the City of Boise and the BWSWD, will be closed and the city's portion of project turned over to the Boise City Public Works Department. Monitoring of the 1983-84 heating is planned with submittal of the final report by July 1974.

PRDA Projects

Engineering, Marketing, and Economic Study of a 4.5-Million-Gallon Geothermal Fuel Alcohol Plant for the Vale Geopark Site

Renewable Energy, Inc. (REI), formerly Technology International, Inc., is conducting a feasibility study and generating a preliminary design for a fuel alcohol plant. It was planned to use data from a 457 m (1500 ft) production well in the study.

Prior to this fiscal year, four shallow thermal gradient holes and much of the study design and analysis were completed. During this fiscal year, in December 1981, the Environmental Report and Second Progress Report were received and reviewed by EG&G Idaho and DOE-ID. With some interruptions, the 457 m (1500 ft) production well EV-1 was drilled from January through April 1982. Before the well could be tested as part of REI's cost share, REI ran into financial problems. During this fiscal

year, no more work was performed on either the well or the study which planned to use the well test data. REI has assured DOE that it will complete the work as soon as its financial problems are no longer a primary concern and negotiations are planned for early in the next fiscal year.

Resource, Engineering, and Economic Study for Direct Heat Applications of Geothermal Energy at the Salida (Colorado) Geothermal Project

Chaffee Geothermal, Ltd., studied the direct heat application of the Poncha Springs-Salida Geothermal Prospect to the industrial process heat requirements of CoZinCo, Inc., a manufactorer of zinc sulfate, and to other prospective energy users in Salida.

The study has been completed and concluded that the project is an attractive financial venture. Depending on the quality of the resource and the discounted cash flow, rates of return for the Producer and Distributor would be 16% to 39% and 13% to 20%, respectively.

During the previous fiscal year, a retrofit design for process and space heating at CoZinCo, Inc., was completed, and the resource information was assembled. Preparation of the draft final report was started.

In the current fiscal year, the draft final report for the study was received and reviewed by EG&G Idaho in March 1982. The draft did not include the zinc sulfate process which was being withheld by Chaffee Geothermal's subcontractor Western Energy Planners Limited (WEPL) because it was thought to be patentable. Comments on the draft were returned to Chaffee who completed the final report, except for the zinc sulfate process.

Late in September, WEPL agreed to release the zinc sulfate process to Chaffee so that they could submit the complete report and meet their obligation under the cooperative agreement. In return DOE-ID agreed to withhold distribution of the report until WEPL has had time to apply for foreign patents. Distribution of the final report is expected to be in June 1983.

Commercial Production of Ethanol in the San Luis Valley, Colorado

WESTEC Services and McCulloch Geothermal Corp., investigated the feasibility of using geothermal energy in the San Luis Valley, Colorado, to provide all or part of the total energy requirements of a 75- to 190-million L/yr (20- to 50-million gpy) ethanol production plant. The study was completed and the draft final report was in preparation at the end of the previous fiscal year.

Early in the current fiscal year, the draft final report was received, reviewed and comments transmitted back to WESTEC Services. The comments on the report were extensive, would require considerable work to resolve, and WESTEC had already invoiced for the full amount under the cooperative agreement.

At the end of the current fiscal year, agreement on the revisions had been reached and a modification to the cooperative agreement was being prepared to extend the report completion date to November 31, 1982.

Resource, Engineering, and Economic Study for the Great Western Malting Co. Geothermal Project

Trans Energy Systems, Inc., determined if drilling wells and constructing a heat recovery system to use geothermal energy in processing barley malt is justified.

In the previous fiscal year, the resource definition was completed and the preliminary design of an air preheat system was started. The environmental and institutional portions of the project were completed.

During the current fiscal year, the study was completed and the final report issued. The report concluded that the proposed application was financially feasible having a simple payback of 0.91 to 2.67 years, depending on the method of application and quality of the resource.

Other PON Support

Research and Development of Information on Geothermal Direct Heat Application Projects

ICF, Inc., is conducting a study of the more mature PON projects to compile, evaluate, and analyze the data for selected issues; identify and, if possible, circumvent barriers to development; and report on the project. Previously, data were gathered on five selected projects, and a report on the economic analysis of the projects was issued.

During the current fiscal year, ICF wrote and submitted a Draft Resource Report and a Draft Development and Construction Report which have been passed through review cycles. It was determined that EG&G Idaho will participate in the revisions of these reports. Meanwhile, ICF will work on the Financial and Institutional report which is their primary area of expertise.

ICF's Annual Report was received on October 13, 1981. The five economic analyses, which had been reported earlier, were updated for current economic conditions and two more projects were added. The data was presented as a paper at the 9th Energy Technology Conference and Exposition on February 18, 1982.

GRC Special Session

The special session on the DOE-sponsored Direct Heat Application Projects was held on Wednesday, October 25, 1981 at the GRC Annual Meeting in Houston, Texas. The session was chaired by Frank W. Childs, EG&G Idaho, Inc. Dr. James C. Bresee, Acting Director, DOE/DGHT, gave the opening Program Overview. The session was divided into two parts of six presentations each: (a) Systems Design and Operation, and (b) Nontechnical Considerations. PON projects presented were: City of Klamath Falls, Oregon; Boise, Idaho; Susanville, California; Pagosa Springs, Colorado; Moana, (Reno) Nevada; and T-H-S Hospital in Marlin, Texas. A status report on all active PON projects was available, and a handout was distributed

which listed information sources for the PON and other direct-use geothermal projects.

IDHA Meetings

A presentation covering ten PON projects was given at the International District Heating Association's Annual Conference on June 14, 1982. F. W. Childs, EG&G Idaho, Inc., and George S. Budney, Rockwell Energy Technology Engineering Center (ETEC), each presented five of DOE's PON projects. The latter are administered by the DOE San Francisco Operations Office. On September 28, ETEC gave the total presentation to the Western Section of IDHA in Seattle, Washington.

ASHRAE Annual Meeting

The PON project presentations for Pagosa Springs (Colorado), Utah Roses (Sandy, Utah) and Haakon School (Philip, SD) were the complete agenda for Symposium TO-82-84, Geothermal Heating Systems Operating Experiences. Each of these projects are administered by DOE-ID. The symposium was held on June 27, 1982.

The Geothermal District Heating Blue Ribbon Panel met in conjunction with the ASHRAE meetings. The principal outputs from the panel were: a report on European energy metering and billing practices in district heating, a report on district heating technical/economic relationships and input to the standard outline for the PON final reports.

PON Program Review

EG&G Idaho coordinated and reviewed nine PON project status papers for the PON review hosted by DOE/NV in Las Vegas on August 5 and 6, 1982. EG&G Idaho, DOE-ID and two representatives from each active DOE-ID administered project participated in the review.

ASTM Activities

Mr. Childs, EG&G Idaho. Inc., served as chairman of the Utilization Subcommittee (E45.20) of the ASTM Geothermal Resources and Energy Committee (E45). The committee and its subcommittee met semiannually and are in the process of developing ASTM standards for the geothermal industry.