DOE/ID/13040--T30

FEDERAL ASSISTANCE PROGRAM

QUARTERLY PROJECT PROGRESS REPORT

GEOTHERMAL DIRECT-HEAT UTILIZATION ASSISTANCE

GRANT NO. DE-FG07-90ID 13040

REPORTING PERIOD: OCTOBER - DECEMBER 1995

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KLAMATH FALLS, OR 97601

ABSTRACT

The report summarizes geothermal technical assistance, R&D and technology transfer activities of the Geo-Heat Center at Oregon Institute of Technology for the first quarter of FY-96. It describes 90 contacts with parties during this period related to technical assistance with geothermal direct heat projects. Areas dealt with include geothermal heat pumps, space heating, greenhouses, aquaculture, equipment and resources. Research activities are summarized on low-temperature resource assessment, geothermal district heating system cost evaluation and silica waste utilization project. Outreach activities include the publication of a geothermal direct use Bulletin, dissemination of information, geothermal library, technical papers and seminars, development of a webpage, and progress monitor reports on geothermal resources and utilization.

1.0 Project Summary: October 1 - December 31, 1995

1.1 Technical Assistance. GHC staff provided assistance to 91 requests during the reporting period from 23 states, and 1 from France and 1 from Germany. A breakdown of the number of requests relative to applications are: geothermal heat pumps (23), space heating (13), greenhouses (7), aquaculture (6), equipment (13), resources/wells and other (29).

1.2 R & D Activities. Progress is reported on: (1) Final Report of Low-Temperature Assessment Program, (2) Geothermal District Heating System Cost Evaluation and (3) Silica Waste Utilization Project.

1.3 Technology Transfer. GHC Quarterly Bulletin, Vol. 17, No. 1, is in preparation. Two presentations and three tours were conducted and a GHP teleconference was held at OIT. A webpage (http://www.oit.osshe.edu/~geoheat) was developed on geothermal direct-use. A total of 446 publications were distributed on direct use. Geothermal progress monitor (GPM) reports include: (1) Idaho Injection Well Permit Required for Water-Return Heat Pump Systems, (2) Idaho Fish Farmer Eaten by Gators, and (3) Newberry Geothermal Pilot Project.

1.4 GHC staff that worked on the project included: P. Lienau (76%), K. Rafferty (85%), T. Boyd (49%), and D. Gibson (76%).

2.0 Technical Assistance

The Geo-Heat Center provides technical assistance on geothermal direct heat applications to developers, consultants and the public on data and information on low-temperature (< 150°C) resources, space and district heating, geothermal heat pumps, greenhouses, aquaculture, industrial processes and other technologies. This assistance could include preliminary engineering feasibility studies, review of direct-use project plans, assistance in project material and equipment selection, analysis and solutions of project operating problems, and information on resources and utilization. The following are brief descriptions of technical assistance provided during the third quarter of the program:

	Name	Nature
2.1	Charles Edson 528 Pacific Terrace Klamath Falls, OR 97601 97601	Space Heating. Two wells with DHEs installed are used, the first for space heating and the second for domestic hot water. The DHW well temperature dropped 20°F. By using valves, it was possible to bypass the second well and use the first for both space and DHW heating (10-2-95).
2.2	Shelly Smith Belknap Hot Springs, OR 97413	Greenhouse. Conceptual scheme developed for greenhouse heating using a combination unit heater and floor tube system. A plate heat exchanger transfers heat to the closed loop for the two heating systems (10-5-95).
2.3	Ed Little 408 S. Rock Boulevard Sparks, NV 89431	General. Requested information on U.S. direct use projects and subscription to the GHC Bulletin (10-6-95).
2.4	Gene Beeland 7864 Waverly Mill Ct. Gainsville, VA 22065	General. Requested photos of OIT campus and geothermal heated wheelchair ramp (1-6-95).

2.5	URS Consultants 1090 18th Street, Suite 700 Denver, CO 80202	Resource. Requested hydrologic information on Klamath Basin. Sent USGS report on the basin (10-10-95).
2.6	Rick McDougal Belknap Lodge P.O. Box 2001 McKenzie Bridge, OR 97413	Space Heating. Calculated heating loads on five pools, the lodge and domestic hot water for the lodge--2.1 million Btu/hr. Due to limited flow rate (35 gpm) of 190°F geothermal fluid, a sequence approach was designed for meeting the heating requirements. Pipe dimensions and elevation difference for gravity-flow pipeline were also provided (10-11-95).
2.7	Jim Lewis 2601 Old Spanish Trail Slidell, LA 70401	Aquaculture. An agreement has been established to develop an aquaculture/greenhouse facility on a resource site in Lakeview, OR. The design consists of circular tanks raising tilapia and a closed-circulation system with gravel filter beds in which plants are grown. Heat loss for the tanks in 70°F air at 90% relative humidity for both open and covered situationswas calculated. Annual propane consumption was also calculated for comparison purposes with geothermal energy (10-12-95).
2.8	Bob Ice ODOE Salem, OR	Space Heat. Ran several cost evaluations for space heating the Klamath Armory. The first approach was to assume the facility develops its own stand-alone system with 1 production and 1 injection well at depths of 1500 ft and 1000 ft. The results indicated a unit cost of geothermal energy is 4 times that of current fuel oil. The second case assumes only an injection well, with better results; but, the cost of geothermal still exceeds that of fuel oil by 2:1. If the Armory could buy geothermal water from another property owner (avoid) the cost of wells, it is possible a system could be implemented (10-12-95).
2.9	Kyle Hoftiezer ECONAR 19230 Evans Street Elk River, MN 55330	GSHP. Discussed information and type of data that was collected for the case study report. A copy of the report was sent (10-13-95).
2.10	David Shaw P.O. Box 1334 Friday Harbor, WA 98250	GSHP. A contractor interested in GSHP technology. Suggested he become certified for GSHP installations through the International Ground Source Heat Pump Association in Stillwater, OK. Sent a package of information on GSHPs (10-13-95).
2.11	Eric Norland Norland Insurance Klamath Falls, OR 97601	Equipment. Assisted in specifying a brazed plate heat exchanger for geothermal space heating with Flow Components, Inc., Vancouver, WA (10-13-95).
2.12	Tom Greenwood 1050 Leigh Street Eugene, OR 97401	GSHP. Discussed using a water-loop heat pump system for motel units. Sent literature on fan-coil units (10-16-95).
2.13	Jay Guettler CEC Sacramento, CA	GSHP. Discussed why the California Heat Pump Consortium was considering eliminating groundwater systems. Told him that it would be a step backwards rather than forward. Concern is that the systems could be used to dispose of hazardous waste--no one could site an example. Sent him the report on capital cost comparisons on commercial GSHP systems (10-16-95).
2.14	Eliot Allen Criterion Engineers Portland, OR	GSHP. Discussed Geothermal Heat Pump Consortium mission and sent information on the consortium (10-17-95).

2.15	Philip Ferguson 5556 S. Main Street Waynesville, NC 28786	Electric Power. Hot springs (100°F) on property--wants to generate electric power. Explaind limitations--temperature, flow, and depths in eastern U.S. Gave examples of U.S. power plants. Cautioned about possible interference with existing hot springs for any type of development (10-17-95).
2.16	Louie Templeton Public Works Susanville, CA	Space Heating. High school is going to apply to "Bright Schools" program for energy audit. This should eliminate the need for the GHC to do an energy balance on the buildings to verify geothermal billing (10-17-95).
2.17	Steve Kavanaugh University of Alabama Tuscaloosa, AL	GSHP. Reviewed handbook--pumping for combination ground loop and cooling tower (10-19-95).
2.18	Harvey Sachs GHPC Washington, DC	GSHP. Comments on Notice of Opportunity are: 1) verify contractor HVAC sizing to avoid over-sizing of systems, 2) identify units ARI rating, and 3) on commercial systems separately monitor the circulating pump energy which could consume 30% to 40% of the total system energy (10-19-95).
2.19	David Drew Klamath Falls, OR	Equipment. Homeowner has a geothermal system using a radiant concrete slab that has begun to leak. Suggested he talk to county school maintenance director who has dealt with similar problems. Recommended several plumbing contractors who have had geothermal experience (10-19-95).
2.20	Kim Davies Diamond D Engineering 6 West Center Moose, ID 83255 208-554-2591	GSHP. Requested design and installation information on GSHPs. Sent order form for "Ground Water Source Heat Pumps" handbook and referred to IGSHPA training program (10-20-95).
2.21	Dave Jaramillo P.O. Box 11352 Yuma, AZ 85366 619-572-0213	Resource. Discussed geothermal resource potential and applications for the Ft. Yuma Reservation. There are 7 wells ranging in temperature from 98 to 126°F at a typical depth of 300 ft. Potential applications include: resort/spa, aquaculture, and greenhouses (10-25-95).
2.22	Gerald Black DOGAMI Portland, OR	Resource. Discussed 500 ft drill holes at Hines for space heating building for SMC Corp. Will check records for flows at deeper settings (10-25-95).
2.23	Mark Dellinger Geothermal Coordinator 255 N. Forbes Street Lakeport, CA 95453	Equipment. Discussed thrust blocks. Advised on size of block as a function of pressure in pipe and soil capabilities. If pressure is lower and/or soil better, can reduce block size accordingly. Sent Klamath Falls GDH and Bondstrand thrust block information (10-25-95).
2.24	Glen Hanson ODOE Salem, OR 503-373-7562	Equipment. Discussed the possibility of installing a variable-speed drive (VSD) on the vertical turbine well pump at Mazama High School. The pumps currently operate 24 hr/day from Sept.-June. Suggested he tell the school district to shut the pump off during low-load hours, like a boiler. Klamath Falls area usually has 1500 - 2000 heating hours per year and any operation above that would be savings. Cheaper to implement than VSD and possibly look at VSD down the line (10-27-95).
2.25	Jerry McDougal 92422 Paradise Point Rd. Port Orford, OR 97465	General. Requested back issues of the GHC Bulletin, publications list and description of the GHC services, which were sent (10-30-95).

2.26 Dan Lowery
Dames & Moore
633 17th Street
Denver, CO 80202

GSHP. Requested information on ground-source heat pumps. Sent the case study report and an information packet (10-30-95).

2.27 Nataline Murray
2136 Eberlien
Klamath Falls, OR
97601

General. Requested printout of earthquakes >2.0 M since Sept. 20, 1993, recorded in the Klamath Basin. Also sent USGS weekly report (10-31-95).

2.28 Bob Creed
DOE
Idaho Field Office
785 DOE Place
Idaho Falls, ID 83401

GSHP. Requested handouts on ground-source heat pumps for a teleconference downsite. Sent handouts from teleconference held at OIT and reports on case studies and capital cost comparison of commercial GSHP systems (10-31-95).

2.29 Jim Drew
Bend, OR
541-389-9036

Space Heating. Discussed geothermal heating system for the old Medo-Bel Creamery in Klamath Falls. Making an offer on the building and wanted a structural evaluation--referred to Civil Engineer at OIT (10-31-95).

2.30 Gerry Reid
Salem Economic
Development Corp.
Salem, OR

Resource. Discussed geothermal resource possibilities for Idanha, a small town east of Salem. Considering greenhouse or other industrial development for an economically depressed area (10-31-95).

2.31 Sal Pantano
Canby, CA
916-233-5761

Equipment. Discussed control valve for aquaculture pond slide gate (10-31-95).

2.32 Jim Leshuk
Salem, OR

Electric Power. Discussed binary power generation and provided phone/fax numbers for ORMAT and Barber Nichols (11-1-95).

2.33 Jack Noel
Truth or Consequences,
NM
505-894-7154

Space Heating. Discussed space heating and cooling for a motel near two wells with temperatures ranges of 108 to 111°F. Electric bills run about $1200/mo

2.34 Adam Capages
Office of Energy
Conservation
1675 Broadway
Denver, CO 80202

General. Responded to an article, "A Renewable Energy Primer" in Energy Talk, a newsletter. Since there was no mention of geothermal energy in the article, it was pointed out that in Colorado uses include space and district heating, aquaculture, greenhouses, and resorts. Information also was provided on 167 geothermal sites and 93 geothermal areas in the state (11-2-95).

2.35 Thomas J. Lupero
241 Orienta Avenue
Mamaoneck, NJ 10543
914-698-3437

General. Researching geothermal energy applications as part of a graduate thesis. Discussed history of the Geysers, locations in CA and NY--Auburn school, residential and commercial energy savings, and geothermal as a renewable (11-2-95).

2.36 Rod Franklin
NREL
1617 Cole Boulevard
Golden, CO 80401
303-275-3826

General. Discussed possible article for the new Caddet Renewable Energy Newsletter, included were: groundwater heat pump systems, new vegetable dehydration plant in NV greenhouse development in Utah and heap leaching of gold (11-3-95).

2.37 Warren Cook
Clark Public Utility
P.O. Box 8900
Vancouver, WA 98668
360-992-3223

Space Heating. Requested information on Klamath Falls geothermal development and especially the district heating system (11-3-95).

2.38 Tim Holt
290 Galena Pines Road
Reno, NV 89511

Greenhouses. Discussed greenhouse geothermal heating system design. He plans to visit the GHC and discuss a project near Reno. Sent package of info on greenhouses (11-3-95).

2.39 Beverly Williams
9461 Bullion Way
Orangevale, CA 95662

Resource. Requested information on resource exploration and R&D for a geothermal field. Sent info and described Klamath Falls and Boise systems (11-6-95).

2.40 Bill Richardson
Watt Homes
3653 W. 1987 S. Bldg. 7
Salt Lake City, UT
84104
801-972-8455

Space Heating. Developing a subdivision of single-family residences near Saratoga Hot Springs, Utah. Currently, they are drilling along a fault on the NW corner of Utah Lake. The developer is concerned about the cost of distribution system and corrosion. Discussed GHC R&D task of reducing the cost of distribution for low-heating load density systems. Indicated that the GHC would be willing to work with the builder on the preliminary design of the distribution system (11-7-95).

2.41 Tom Nylan
14 Greenwood Place
Menlo Park, CA 94025
415-325-8018

GSHP. Requested information on ground-source heat pumps for graduate paper. Sent packet on several reports (11-7-95).

2.42 Debra Page
Geothermal Ed. Office
Tiburon, CA

GSHP. Discussed ground-source heat pumps for student workbook. Sent info packet on GSHPs and referred to IGSHPA (11-7-95).

2.43 Jim Lewis
New Orleans, LA

Aquaculture/Greenhouse. Discussed development of a closed system combined aquaculture and greenhouse project. The project consists of circular tanks raising tilapia from which water is circulated through filter beds of gravel in which plants are grown. Both are enclosed in a 72 ft x 96 ft greenhouse. Visited Liskey Farms, 15 mile south of Klamath Falls, where 90°C water is available at a lease site for ten facilities. Also visited Lakeview, Oregon, to investigate another resource site (11-7-95).

2.44 Dave Anderson
GRC
Davis, CA
916-758-2360

GSHP. Discussed groundwater heat pump systems as an option along with ground-coupled or hybrid systems. Developed an example of capital costs for a 200-ton system: groundwater - $80,000, hybrid - $140,000 and ground-coupled - $200,000. The groundwater system reduces the first cost, which is a main concern of the industry. Concern was expressed about aquifer problems. The answer is, properly designed systems coupled with good resource management is the strategy to promote. The goal is to get more energy efficient systems online. Eliminating options (groundwater) compromises our ability to do this (11-9-95).

2.45 Norma Dart
2700 Brandon Road
Star, ID 83669
208-286-9561

General. Discussed and sent information on the use of geothermal energy for greenhouses, aquaculture and binary power generation. Explained technical assistance program and other services the GHC offers (11-13-95).

2.46 Mike Nielson
Union County Economic
Development Coop.
P.O. Box 1208
LaGrande, OR 97850

Resource. Discussed resource information in the GHC database on Union County. Also, considered was a strategy to use Sifford Energy Services to identify a target application and the GHC to determine the practical requirements (11-13-95).

2,47	Warren Poling 1039 Shady Fork Road Chattanooga, TN 37421	GSHP. Requested information on design and installation of ground-source heat pumps. Sent packet of info and referred to GSHP Handbook by S. Kavanaugh, Univ. of Alabama (11-13-95).
2.48	Paul M. Brown SMC Corp. 30725 Diamond Hill Rd. Harrisburg, OR 97446	Space Heating. The Snow Mountain Pine mill site near Hines, Oregon, is to be converted to a motor coach manufacturing plant. At the request of the Oregon Department of Economic Development, the GHC was asked to evaluate the prospects for geothermal space heating the 180,000 ft^2 building. Hot water wells located to the north and east of the site (one with a temp. of 172°F) suggest that a well drilled (1000 to 1500 ft) at the vicinity of the site could produce fluids of approximately 110°F. Based on natural gas consumption at a similar facility, the simple payback on geothermal energy would be in the 1 to 5 year range. Because of the risk in geothermal drilling, we advised the company retain a consulting geologist and render an opinion on the resource and the GHC could advise on the mechanical system requirements for the geothermal system (11-14-95).
2.49	Matt Freedman Public Citizen 215 Penn. Avenue SE Washington, DC 20003 202-546-4996	General. Discussed history of DOE R&D activities, special technologies and new discoveries, lessons learned, why program is important today, continuing rational for DOE involvement, explained nature of program, and any new pioneering technology. Indicated that key developments and special technologies that have played a role in geothermal direct-heat use are: DOE demonstration projects, technical assistance program, resource assessment program, and awareness that this environmentally clean and renewable resource is available (11-15-95).
2.50	Paul Barrington Big Bend, CA	Equipment. The Indian Springs School geothermal system is retrofitted to a plate heat exchanger and closed loop. Problem with air in the lines. Recommended that the lines be back flushed (11-15-95).
2.51	Kent Mathison 29296 Madison Drive Echo, OR 97826	Greenhouse. Discussed heating cost of greenhouses, etc. Wants to use waste heat from a power plant to start onion plants earlier in the season. Sent greenhouse info (11-16-95).
2.52	Jim Lewis New Orleans, LA	Equipment. Discussed sizing flow and control for 400,000 Btu/hr heat exchanger. Gave him vendor names and suggested plate (316 SS) and gasket material (Buna N)(11-16-95).
2.53	Bert McCormick Fort Peck, MT	Resource. Discussed geothermal resource on the Fort Peck Indian Reservation with temperatures of 200°F at 6000 ft, deeper wells up to 400°F. Suggested he call ESRI or GRC for high temperature info (11-16-95).
2.54	Tim Holt Reno, NV	Greenhouses. Discussed greenhouse geothermal heating systems. Sent spreadsheet for greenhouse equipment selection (11-17-95).
2.55	Gordon Bloomquist WSEO Olympia, WA	GSHP. Discussed GRC session on ground-source heat pumps. Suggested advertizing in "diffuser" and similar publications for west Washington and east Washington, Idaho and other ASHRAE chapters (11-17-95).
2.56	Brenda Gunter Walter City, TX	Aquaculture. Discussed fish farm 50 miles WNW of Houston. Facility consists of 16 indoor tanks and 8 large ponds for growing tilapia (300 - 400,000 lb/yr). Looking for warm water source to augment heat. Discussed geopressured resources. Suggest she call Bureau of Econ. Geology at University of Texas for more info (11-17-95).
2.57	Lori Phillips P.O. Box 748 Dillsboro, NC 28725	General. Requested geothermal energy info for a science project. Sent USGS book on geothermal, direct-use, heat pumps and referred to education office (11-21-95).

2.58 Carl Orio
Water & Energy Systems Corp.
100 Maple Avenue
Atkinson, NH 03811
603-362-4606

GSHP. Discussion of topics for the IGSHPA groundwater interest group. The optimum HVAC system for a given building is dictated by a host of site specific factors. The best way to maximize the number of ground-source installations is to maximize the number of ground-source choices available to the designer. Issues that concern groundwater systems include: groundwater availability, regulatory issues, water quality and pumping energy. We think it would be useful to address these issues through presentations at future IGSHPA meetings. Highlight the percentage of current heat pump production that is installed in groundwater systems. See that groundwater systems are included in IGSHPA publications. In general, we need to promote groundwater as another ground-source alternative (11-21-95).

2.59 Dave Anderson
Gordon Bloomquist
Dave McClain
GRC Conference Call
Davis, CA

General. Discussed GRC annual meeting for 1996. The GHC agreed to offer a field trip on the Klamath Falls installations, serve as chairman for the direct-use session and help promote commercial GSHP course (11-21-95).

2.60 I. Croix
17 Rue Capron
75018 Paris, France

General. Requested info on geothermal direct-use systems, handbook and Bulletins (11-22-95).

2.61 David Klinkebeil
Northern Aqua, Center
NDSU
P.O. Box 219
Carrington, ND 58421

Aquaculture. Discussed heat loss from aquaculture ponds. Provided software for calculating heat loss and accompanying documentation (11-28-95).

2.62 Norma Dart
2700 Brandon Road
Star, ID 83669
208-286-9561

GSHP. Referred to the GHC by the Geothermal Education Office to send info on ground-source heat pumps (11-28-95).

2.63 Patti Snowden
Carson H.S., WA
509-427-7777

Space Heating. Discussed geothermal resource in the Carson H.S. area for space heating a motel and mini-mineral baths. Explained the resource is associated with fault zones and recommended she contact the Washington Department of Natural Resources. Told her we could provide technical assistance on the retrofit of the motel (11-28-95).

2.64 Mike Smith
20566 S. Earle Road
Colton, OR 97017
503-824-4474

GSHP. Discussed the replacement of an old ground-source heat pump with a new system. Advised him to verify the need for 3.5-ton machine. A smaller unit would use less flow, higher efficiency and less cost. Also discussed Griswold valve, pressure regulating valves for water flow control (11-28-95).

2.65 Gale Research, Inc.
835 Penobscot Building
645 Griswold Street
Detroit, MI 48226

General. Requested the GHC submit information to Research Centers Directory (11-30-95).

2.66 Eliot Allen
Criterion Engineers
Portland, OR

District Heating. Discussed billing procedures for customers on Seattle Metro effluent line for energy. Considered cost of service, competing costs, other computing costs likely to produce higher revenue to Metro, cost of service cheaper, and easier to implement, but lower revenue (11-30-95).

2.67 Brian Martin
Attorney
1775 N. Fini Avenue
Fresno, CA 93727
200-251-7100

Space Heating. Discussed Cedarville School well and the lease arrangement and appraisal. Referred to Ward Grady (11-30-95).

2.68 Julia Bahr
53781 4th Street
LaPine, OR 97739

GSHP. Explained ground-source heat pump technology, Oregon regulations and tax credits. Sent packet on GSHP (11-30-95).

2.69 Tom Petit
7780 N.E. Todd Drive
Corvallis, OR 97330
541-715-2107

Resource. Requested geothermal resource data for oregon, Idaho and Nevada, which was supplied (11-30-95).

2.70 Mr. Zhao
16749 39th Avenue NE
Seattle, WA 98155

Greenhouse/Aquaculture. Working on geologic project for government near Tianjin, China. Joint venture with U.S. corporations. Discussed greenhouse, aquaculture, industrial applications, and injection of geothermal fluids. Sent packet of information (12-1-95).

2.71 Lisa Powers
Rt. 1, Box 462
Glenns Ferry, ID 83623

Aquaculture. A hot water well with artesian flow at 142°F is being used to heat greenhouses. Asked about what else they can do with the hot water. Suggested they look into aquaculture and drying of agricultural products. Referred to Ag Extension regarding what crops to grow (12-1-95).

2.72 Dennis Trexler
Desert Research Institute
Reno, NV

Resource. Requested coordinates for KGRAs in southern Oregon. Referred to Jack Feuer with BLM. Discussed what will happen when SO_4 contracts expire and geothermal power plant revenues go from 6¢/kWh to 2¢/kWh. Looked at externalities and their value (12-4-95).

2.73 Paul Hesse
NCI/EREC
8260 Greensboro Drive
McLean, VA 22102
800-363-3732

General. Requested data on the amount of energy being used on geothermal direct-heat projects. Told him 430 MWt and 5411 billion Btu/yr which does not include heat pumps (12-4-95).

2.74 Gerald Orthmayer
P.O. Box 459
Teeapa, CA 92389
619-852-4512

Space Heating. Wants to heat mobile home (10 ft x 50 ft) and a 14 ft x 20 ft shop with artesian well at 111°F. Ran a coil selective program--geothermal water would have to pass directly through the coil due to the low temperature. The coil would cost approximately $300 and fit the duct space at the furnace outlet at 1000 cfm. It can be done (12-5-95).

2.75 Tim Holt
Reno, NV

Greenhouses. Discussed preliminary equipment requirements for greenhouse, combination unit heaters and bare pipe look the best. Ran several options on GHS spreadsheet and faxed results (12-6-95).

2.76 David Hicks
NREL
1617 Col Boulevard
Golden, CO 80401

General. Sent photos on Klamath Falls district heating. Milgro greenhouses and Integrated Ingredients drying plant for new direct-use brochure (12-6-95).

2.77 Brian Brown
Consulting Engineer
Fort Klamath, OR

Wells. Requested cost to drill wells AL-1 and AL-2 (3000 and 2000 ft) in Alturas. Referred to Roger Peake with the CEC. He is determining the cost of an injection well for the Community Center (12-6-95).

2.78 Mark Cane
REACH
P.O. Box 1748
Klamath Falls, OR 97601
541-882-8803

Resource. Requested geochemical analysis for the Maywood well; data was sent (12-6-95).

2.79 Ian McLean
SKW
Nigerstra Be4
81675 Munich, Germany

Greenhouses. Developing a plan for restoration of the ancient city center of a small market town, 1 1/2 hours east of Munich. Upon realizing that natural hot springs (40 - 60°C) are in the area, he has expanded his concept to include greenhouses. Sent Guidebook, GHS spreadsheet and Bulletins (12-7-95).

2.80 Kenneth McBay
Professional Appraisal Services
1324 Placer Lane
Sacramento, CA 95827

Space Heating. The well that heats the Cedarville school is on private property with a non-binding legal agreement. The property is in receivership and the school wants to establish a value for the well. Provided information on pricing and economics of direct-heat applications (12-12-95).

2.81 David Meisegeier
Washington, DC area
703-934-3119

GSHP. Working on environmental report for EPA on GSHP. Explained environmental issue regarding GSHPs: GSDX - refrigerant/soil leak contamination, Lake system - thermal pollution, groundwater - contamination, depletion - use injection and isolation to avoid contact with refrigerant (12-12-95).

2.82 Carl Orio
Water & Energy Systems Corp.
100 Maple Avenue
Atkinson, NH 03811

GSHP. Discussed groundwater systems and the need for a document that identifies the areas that contractors and engineers need to be concerned with. The actual specifications, in most cases, should be left to the designers (12-12-95).

2.83 Ray Friesenham
NASA Tech Transfer
Texas A&M
3295 W. Bracker Lane
Austin, TX 78759
512-305-0140

Aquaculture. Client is developing an aquaculture project in Indiana and Nevada--120,000 ft^2, 10^6 gal internal closed system. Sent data on thermal wells and springs in Washoe County, Nevada and several papers on using geothermal energy for aquaculture (12-13-95).

2.84 Kent Colahan
OIT Physical Plant
Klamath Falls, OR

Equipment. Epoxy coating material on column of new pump released and was pumped up with geothermal fluid causing discharge piping to plug. Suggested manufacturers representative be on-site for inspection and disassembly. Described preheat procedure when starting new pump (12-14-95).

2.85 Greg Tomberlin
Barlow Associates
Ft. Collins, CO

Equipment. Working on a handbook of geothermal energy and wanted equation for two-phase flow Δp in pipelines. Faxed section out of Armsteads book and Two-Phase Flow Gathering System at COSO Unit 1 by Dietl (12-15-95).

2.86 John Hyter
Paradise, MT

Equipment. Discussed geothermal heating system for 30-unit motel using Quins Hot Springs. Provided information on unit heaters (12-18-95).

2.87 Kent Colahan
OIT Physical Plant
Klamath Falls, OR

Equipment. A form was developed for specifying new lineshaft turbine geothermal well pumps. The headings include: general; column pipe, shaft, and tube; and pump (12-20-95).

2.88 Walter Hermann
807 Linden Lane
Davis, CA 95616

Equipment. Discussed using geothermal energy for snow melt systems on property with thermal waters. Referred to Wirsbo and sent information on Klamath Falls--highway and sidewalk systems (12-21-95).

2.89 Gerardo Tango
CPG
P.O. Box 23
Covington, LA 70343

GSHP. Discussed residential ground-source heat pump system types and costs. Sent packet of info and order form for "Ground Water Source Heat Pumps" by S. Kavanaugh (12-21-95).

2.90 Albert Catani
905 Fayette Avenue
Belle Vernon, PA 15012

GSHP. Discussed using a ground-source heat pump for a hydronic HVAC system. GSHPs can be integrated into hydronic heating systems; but, it is generally not practical on a retrofit basis. Most existing hydronic baseboard systems operate with water temperatures of about 180°F. Water-source heat pumps are only capable of providing a maximum of about 120°F water. As a result, the capacity of the existing baseboard equipment would be substantially reduced. Conventional baseboard equipment is not designed for and would not be effective for cooling purposes. Sent package of info on GSHPs (12-27-95).

2.91 Kurt Rose
Cedarville, CA

Equipment. A ranch near Cedarville has 3 geothermal wells which produce 206°F water. Apartments (14 units) are heated using a radiant heating system. Wants to add a swimming pool, RV park and metal building to the geothermal heating system. The CEC will be contacted for approval to conduct a feasibility study on the project (12-27-95).

3.0 R & D Activities.

The direct use research and development program objectives are to aid industry in resource and technical development problems. To investigate and analyze methods or approaches of reducing the costs of developing, designing and operating low-temperature geothermal projects. The following are summaries of activities for the first quarter of Fiscal Year 1996.

3.1 Low-Temperature Resource Assessment Program

A draft-final report has been completed for the "Low-Temperature Resource Assessment Program." The report has been reviewed by ESRI and INEL, and has been submitted to the DOE Program Manager for review and approval before distribution.

Products of the new resource assessment include updated resource maps, a descriptive final findings, and a digital database for each of 10 western states. Databases developed by State Geothermal Resource Assessment Teams (State Teams) are available as Open-File reports from each state.

The 10 State Team databases were searched by the GHC for all the well and springs with temperatures greater than 50°C. The inventory identified 1,469 located within 8 km of 271 collocated cities and communities with a population of 7.4 million in 10 western states that could potentially utilize geothermal energy for district heating and other applications.

In order to aid developers in determining the relative economic merit of the sites identified by the State Teams, software was developed, Geothermal Energy Cost Evaluation characterizes the energy sources in terms of capital cost and unit energy cost in similar fashion to that used for conventional fueled heat sources.

We recommend a Phase 2 Low-Temperature Program to complete proposed studies on geophysics exploration, hydrologic testing, and feasibility for 48 high-priority sites identified by State Teams. In addition, the states of Alaska, Hawaii, Nebraska, North Dakota, South Dakota, Texas and Wyoming need to update their low-temperature resources and establish new digital databases. This will further stimulate development of this greatly under-utilized, environmentally-benign resource.

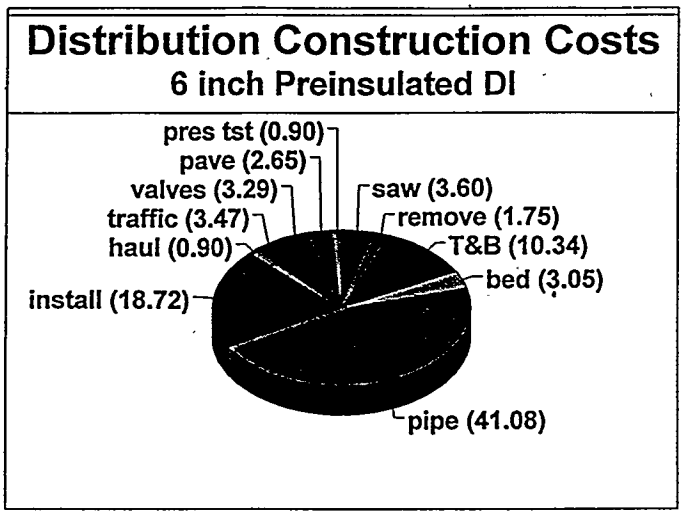
3.2 Geothermal District Heating System Cost Evaluation

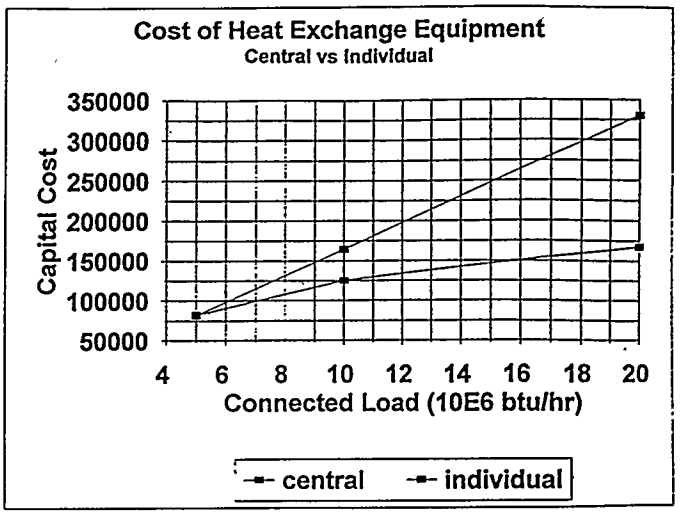
Activities on this task have expanded on the original scope to include evaluation of heat exchanger location and customer branch line cost in addition to the original main distribution piping. Because residential systems would be non-profit owned, it is the total system cost (including some elements on the customer property) rather than simply the distribution network that is of interest.

Work so far indicates that, for all but the smallest systems, it is less costly to employ central heat exchanger than individual customer heat exchangers for this type of service.

Customer branch lines, which can approach the unit cost of the distribution system itself (on a per home basis) are installed in primarily three ways: field insulated, pre-insulated rigid and pre-insulated flexible. For new construction, the first two methods are most competitive. In retrofit applications, the third approach is less costly if more than 2 or changes in direction are necessary between the street and the home.

Costs for existing geothermal district heating systems (which are typically lump-sum bid) have been desegregated into 11 individual cost areas to enable evaluation of component cost factors.





3.3 The Silica Waste Utilization Project

The main objective of this project is to produce mixes of various combinations of hydrated lime, portland cement, and plastic fibers with the waste silica from the disposal ponds in Cerro Prieto Geothermal Field, to determine their suitability for use as insulating bricks in low-cost housing. A total of 41 mix designs have been completed: 17 silica-cement, 17 silica-lime, 3 silica-lime-fiber, and 4 silica-cement-lime mix designs. The bricks were either moist (water bath at 25°C) or heat cured (sealed pan in oven at 60°C) depending on if the additive was cement (moist) or lime (heat). All brick samples were subjected to a 10-day weathering cycle. A weathering cycle consisted of a 12-hour wet period where the samples where sprayed for 15 minutes with water to simulate rain, then allowed to soak in water and a 12-hour dry period where the samples were placed in a 60°C oven. The process was repeated for 10 days. The samples were then allowed to dry completely to determine the percent loss to the sample do to weathering. The silica-lime samples were showing minute thermal cracks, which indicated problems pertaining to the way the silica-lime bricks were being cured. Therefore, the curing process was modified, and later silica-lime samples were cured at an oven temperature of 40°C and sealed within a moisture-proof plastic bag. This increased the strength and weathering properties of the samples. However, the silica-cement samples still had higher strengths and weathering capabilities than the silica-lime samples per percent of additives. We are still waiting on the thermal-conductivity results, before further testing is completed.

4.0 Technology Transfer.

The Geo-Heat Center prepares and publishes information and educational materials on direct heat applications that includes: a quarterly Bulletin, technical papers, computer programs and progress monitor activities. In addition, resources of a technical library and tours of geothermal facilities in the Klamath Falls area are made available.

4.1 Geo-Heat Center Quarterly Bulletin. Bulletin Vol. 17, No. 1 is in preparation and is expected to be published in February. Articles will include:

1. "Direct Uses of Geothermal Energy 1995" by Derek Freeston.

2. "Boise Capital Mall Geothermal Well Production History" by Ken Neely.

3. "Mexico Fruit Dehydration" by John Lund.

4. "New Zealand Geothermal Stamps" by John Lund.

5. Geothermal Pipeline - Progress and Development Update

4.2 Technical Papers, Presentations, Computer Programs and Tours.

1. Presentations & Tour

   Mark Kline, Strategic Account Manager for Pacific Power. Potential of geothermal energy and briefing on developments in the northwest (10-3-95).

2. Technical Papers

   Four technical papers were presented at the GRC Annual Meeting in Reno, NV (October 8-10, 1995):

   - "Low-Temperature Resource Assessment" by P. Lienau
   - "Marketing the Klamath Falls Geothermal District Heating System" by K. Rafferty
   - "Onion Dehydration" by J. Lund
   - "Geothermal Heat Pump Performance" by T. Boyd

3. Tour

   Mehmet Erboga, H. Kayhan Topel and Mehmet Degan, Denizli, Turkey. City and OIT geothermal district heating systems discussed, design temperatures/pressures and flows (10-12-95).

4. Presentation

   FHA students (75) sponsored by the Extension Service. General presentation on geothermal energy (10-24-95).

5. Tour

   HVAC engineering class. OIT geothermal heating system (11-6-95).

6. Teleconference

   Geothermal Heat Pump Teleconference downsite was held at OIT. Local contractors and OIT engineering students (12) attended.

7. Computer Software

   Greenhouse heating system equipment selection spreadsheet was updated to include propane back-up system (11-22-95).

4.3 Geo-Heat Center Homepage URL:http://www.oit.osshe.edu/~geoheat

Introduction. The Internet has experienced explosive growth in the past year. What is the Internet you might ask? The Internet (also known as the Net) is a global community of communities. As of November 1994, it is estimated that there are 30 million Internet users in over 80 countries. These millions of people, from all walks of life, count on the Internet as an integral part of their day-to-day activities (Internet Passport, 1995). The Internet is a new way to bring information to people with the touch of a keyboard or the click of a mouse.

What It Contains. The Geo-Heat Center Homepage (URL http://www.oit.osshe.edu/~geoheat) is an introduction into what is offered by the Geo-Heat Center. Its main headings include:

- What is Geothermal?,
- Services offered,
- Publication list,
- Bulletin,
- Collocated resources,
- Directory of consultants and Equipment manufacturers, and
- Other places of interest.

Below is a description of the main headings and what is available in each.

What Is Geothermal. This webpage contains a brief summary explaining what geothermal is. This page is mainly for people who are unfamiliar with geothermal energy and how it is used.

Services Offered. This webpage explains some of the services offered by the Geo-Heat Center, like technical assistance, resource information, tours and library access. It also has a link to the Library's subject matter listing; where, you can find the keywords to help find information within our Library, and the Geothermal Resources Council library.

Publications List. This webpage contains the publications which can be requested through a form within the webpage. It has a listing of technical papers, research reports, past bulletin articles, and the geothermal guidebook.

Bulletin. This webpage is the jump-off point to the most recent issue of the GHC Quarterly Bulletin (Vol. 16, No. 4). It will take you into the Table of Contents where you can jump to the article you wish to view. Text only is avaiable for the articles in this Bulletin, no figures or tables were included. The next issue of the Bulletin (Vol. 17, No. 1) will also be placed within the webpage, but will contain all the text, figures and tables.

Collocated Resources. The Geo-Heat Center just completed a Collocated Resources study of the 10 western states. The study identified 271 cities and communities that could potentially utilize geothermal energy for district heating and other applications. A collocated community is defined as being within 8 km of a geothermal resource with a temperature of at least 50°C. The Collocated Resources webpage contains a brief description of the what a collocated resource is,and provides links to the 10 western states. The links for each state include a brief description on the state, and a listing of the collocated communities by county. It contains such information as: location, well depth, resource temperature, flow, TDS, weather information, current use, and general information of each area.

Directory of Consultants and Equipment Manufacturers. This webpage contains listings of consultants and what they do. It also contains a listing of equipment manufacturers for various types of geothermal equipment such as well pumps, plate heat exchangers, piping, and commercial GSHP design information. This listing can be updated; therefore, company names may be added or deleted by contacting the Geo-Heat Center.

Other Places of Interest. This webpage contains links to other websites concerning geothermal information. This list can be updated. So if you know of a good website and think it should be added, please contact the Geo-Heat Center and let us know the URL (Uniform Resource Locator). We would gladly include it on our list.

4.4 Geothermal Library. During the period of October 1 to December 31, 1995, 13 new volumes were added to the library. The library now has a total of 5177 volumes cataloged. Subject listing for the library is available through the webpage. We are working with the GRC to have both, the GRC and GHC libraries, accessed through the Internet.

4.5 Information Dissemination. The GHC provided publications to individuals according to the following topics:

Topic	No. Publications
Geothermal Heat Pumps	232
Space Heating	22
Greenhouses	24
Aquaculture	17
Industrial	8
District Heating	14
Equipment	15
Resources/Wells	30
Other	84
Total	446

5.0 Geothermal Progress Monitor

IDAHO

5.1 Injection Well Permit Required for Water Return Heat Pump Systems

Idaho residents who install certain kinds of heat pump systems that use groundwater from wells for heating and cooling are required by state law to first get an injection well permit before the system can be used.

Approximately 145 permits for the heat pump systems have been issued around the state, mainly in the Boise and Twin Falls areas. However, specialists from the Idaho Department of Water Resources say they have identified at least a half dozen of the heat pump systems which have been installed without first obtaining the required injection well permit and suspect there may be others.

The specialized heat pump water return systems are a relatively new technology for heating and cooling, sometimes known as "pump and dump." The procedure involves pumping groundwater from one well into the systems's heat exchanger unit, then returning the water back into the same or another well.

The injection well permit is required because the heat pump system returns the water back into the well. Putting fluids back into the ground in a well deeper than 18 feet means the well is then operating as an injection well and must be permitted. A drilling permit is also required for wells over 18 feet in depth. Injection well permits are not required for wells less than 18 feet deep; however, on these wells, an inventory statement describing what fluid is being returned is required.

Injection well permits, which cost $50, can be obtained at any IDWR regional office in Coeur d'Alene, Boise, Twin Falls and Idaho Falls or at the IDWR state office, 1301 N. Orchard Street in Boise.

"The injection well permit is vital to protecting the groundwater resource from contamination. A well can become a direct conduit into the groundwater system through which contaminants can enter and pollute the groundwater," said Helen Thornton, state injection well permitting coordinator.

"The injection well permitting process provides the means to assure the citizens that this type of disposal of fluids below the ground surface is monitored and the quality of Idaho's groundwater protected," she added.

Closed-loop heat pump systems do not require injection well permits. Those are systems in which the fluid is totally contained within a confined system of pipes and is not dumped back into a well. However, a drilling permit is required for these types of wells when they are greater than 18 feet deep.

For more information on the injection well permit process, contact Thornton at (208) 327-7950. (Source: *Idaho Currents*, Vol. 12, December 1995)

5.2 Idaho Fish Farmer Eaten by Gators

Well... it hasn't actually happened yet; but, it's possible that you could see a headline like this sometime in the near future.

"...but for now, it's almost time to harvest Leo Ray's first batch of alligators, and they don't appear to be all that cooperative. He's still confident though, having just taken delivery of a new herd of 300 six- to seven-inch reptiles that he plans to grow-out for next year.

"Leo started out with 200 little gators last year and they were up to about 4 feet in length when we visited the Idaho-based gator farm in September. That makes for a very healthy cash crop according to Leo. Not only is the meat in demand, but the skins are worth over $100 each.

Leo has a very unique aquaculture operation, even for Idaho. His water comes from several geothermal artesian wells. At a constant temperature of 95°F, he has to mix the water with regular stream water to get the 85°F which is perfect for raising catfish, one of his other crops.

The warm water works its way down a gentle slope, used over and over again in isolated groups of raceways and alligator containments, eventually reaching yet another crop, tilapia, at the bottom of the slope.

Leo also raises trout at a separate cold-water site and he has a processing plant to handle his whole product line and a distribution system that covers upwards of 50 cities in the Pacific Northwest.

So, why alligators? It comes down to two simple factors, says Leo--free heat and free food. He can maintain a constant temperature in the 90s for the entire growth cycle of the animal and, as for the free food, what better way to dispose of morts then feed them to a bunch of hungary alligators. As unlikely as it seems, you may soon be able to go into a fine restaurant and order an Idaho alligator steak, along with your baked Idaho potato of course. (Source: *Northern Aquaculture*, Vol. 1, No. 8, December 1995)

OREGON

5.3 Newberry Geothermal Pilot Project

The proposed energy facility is a double-flash steam geothermal electric power generating plant. The gross generating capacity is 33 megawatts, with a net electric power output of 30 meagwatts. The components of the power plant include condensing steam turbines, generators, condensers, wet cooling tower, pumps and non-condensible gas removal systems. Related and supporting facilities include a geothermal fluid and steam gathering pipeline system and associated equipment, steam separation stations, a fluid return pipeline system and associated equipment, a 115-kilovolt transmission line approximately 8.5 miles in length, switchyard, and access roads. The transmission line will connect the power plant to the existing Midstate Electric Cooperative's 115-kilovolt system at or near a substation located near the junction of U.S. Highway 97 and LaPine Recreation Road. The related geothermal production, injection, and monitoring wells and wellhead equipment, sumps, and pumps are excluded from the site certificate because they are within the jurisdiction of the Oregon Department of Geology and Mineral Industries.

FINANCIAL STATUS REPORT

(Short Form)

(Follow instructions on the back)

1. Federal Agency and Organizational Element to Which Report is Submitted	2. Federal Grant or Other Identifying Number Assigned By Federal Agency	OMB Approval No.	Page	of
USDOE, Idaho Operations Office 785 DOE Place, Idaho Falls, ID	DE-FG07-90ID 13040	0348-0039	1	1 pages

3. Recipient Organization (Name and complete address, including ZIP code)

Geo-Heat Center, Oregon Institute of Technology
3201 Campus Drive, Klamath Falls, OR 97601

4. Employer Identification Number	5. Recipient Account Number or Identifying Number	6. Final Report	7. Basis
93-6011419	18-264-0024	☐ Yes ☒ No	☐ Cash ☒ Accrual

8. Funding/Grant Period *(See Instructions)* From: (Month, Day, Year)	To: (Month, Day, Year)	9. Period Covered by this Report From: (Month, Day, Year)	To: (Month, Day, Year)
10-01-95	09-30-95	10-01-95	12-31-95

10. Transactions:	I Previously Reported	II This Period	III Cumulative
a. Total outlays	-0-	81,665.69	81,665.69
b Recipient share of outlays	-0-	7,212.22	7,212.22
c. Federal share of outlays	-0-	74,453.47	74,453.47
d. Total unliquidated obligations			-0-
e. Recipient share of unliquidated obligations			-0-
f. Federal share of unliquidated obligations			-0-
g. Total Federal share *(Sum of lines c and f)*			300,000.00
h. Total Federal funds authorized for this funding period			74,453.47
i. Unobligated balance of Federal funds *(Line h minus line g)*			225,546.53

11. Indirect Expense	a. Type of Rate *(Place "X" in appropriate box)* ☐ Provisional ☐ Predetermined ☐ Final ☒ Fixed			
	b. Rate	c. Base	d. Total Amount	e. Federal Share
	67.5	32,338.58	21,828.54	21,828.54

12. *Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation.*

13. Certification: **I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents.**

Typed or Printed Name and Title	Telephone (Area code, number and extension)
Paul J. Lienau, Director	(503) 885-1750
Signature of Authorized Certifying Official	**Date Report Submitted**
Paul J. Lienau	2-9-96

Previous Editions not Usable

Standard Form 269A (REV 4-88)
Prescribed by OMB Circulars A-102 and A-110