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**FEDERAL ASSISTANCE PROGRAM
QUARTERLY PROJECT PROGRESS REPORT**

GEOHERMAL DIRECT-HEAT UTILIZATION ASSISTANCE

GRANT NO. DE-FG07-90ID 13040

Reporting Period: OCTOBER - DECEMBER 1992

Paul Lienau, Project Director

**Geo-Heat Center
Oregon Institute of Technology
Klamath Falls, OR 97601**

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1.0 Project Summary - October - December 1992

- 1.1 Technical Assistance.** GHC staff provided assistance to 80 requests from 19 states and one from Iceland, Mexico and UK. The type of requests included: space and district heating (18), geothermal heat pumps (16), greenhouses (5), aquaculture (7), industrial (3), equipment (4), resources (11), electric power (4) and general (12). A progress report on the cooperative agreement activities with Mexico for a fruit dehydrator, district heating system and design testing of bricks made from silica is given in item 2.81.
- 1.2 R & D Activities.** Progress is reported on guidelines for design of injection wells and equipment for geothermal district heating. The final report, "Direct Use Geothermal Applications for Brazed Plate Heat Exchangers", has been submitted for review and patent clearance.
- 1.3 Technology Transfer.** Six presentations and 4 tours were given; GHC Quarterly Bulletin Vol. 14, No. 3 was prepared; 71 volumes were added to the library and information was disseminated to 50 requests.
- 1.4 Geothermal Progress Monitor.** Progress reports are included on: (1) Seattle Company Eyes \$1 Million Tilapia Project Using Geothermal Water Near Yakima, WA, (2) Would You Believe A Geothermal Space Shuttle?, (3) Expansion of the Klamath Falls Geothermal District Heating System, and (4) Go-Ahead for Geothermal Pilot Project.
- 1.5** GHC staff that worked on the project during October included: P. Lienau 61%, G. Culver 100%, K. Rafferty 100%, Donna Gibson 98%, and J. Lund donated 88 hours to the project.

2.0 Technical Assistance

The Geo-Heat Center staff provided technical assistance on geothermal direct use to the following during October - December 1992:

	<u>Name</u>	<u>Nature</u>
2.1	Howard Rynnearson Intermountain Forest Products Box 673 Payette, ID 83661	GHP. Discussed geothermal heat pump technology. Sent several technical papers and a list of ground-source heat pump manufacturers (10/1/92).
2.2	Bill Leihdy Alaska Applied Science Box 020993 Juneau, AK 99802	District Heating. Discussed the possible development of a district heating system at Juneau. The AJ Gold Mine is to be re-opened and a 22 MW power plant is to be built in conjunction with the gold mine.

Waste heat from the power plant would be used for district heating. Sent overview study of GDH and reports on piping. Also referred to J. Kaminsky, DOE and N. Taylor of IDHCA for additional information (10/2/92).

2.3 Rob Safford
Dept. of Water
Resources
Boise, ID

Space Heating. Drilled a 174 ft well that encountered 178°F thermal waters. Wants to heat a cabin and snow melt driveway. Recommended radiant floor heat for cabin with 3/4 in. pipe on 9 in. centers for cabin and 3/4 in. pipe on 24 in. centers for driveway. Also, put him in contact with suppliers for valves and controls (10/2/92).

2.4 John Bigelow
Belknap H.S., OR

Space Heating. Discussed developments at Belknap--drilled three wells resulting in approximately 117°F fluids and low flow. Considering using GHP for space heat, greenhouses and soil warming. Suggested a geologist experienced in siting wells in the Cascades (10/5/92).

2.5 Jim Mueller
Valley Pump
K. Falls, OR

Space Heating. Requested advice on hooking up second house to a well at 2520 Garden Avenue. Well is pumped and injected back into bottom--produces 90°F for radiant floor in first house. Second house has gas-forced air. Suggested well probably would not heat both houses and it would be expensive to utilize 90°F (10/6/92).

2.6 Red Fish Unlimited
Palacios, TX

Aquaculture. Discussed how to calculate for fan size for air domes. Single or double layer domes and anchoring was also discussed (10/6/92).

2.7 Orville Cram
706 East 21st Place
Dallas, OR 97058

General. Discussed power generation using geothermal energy and showed him slides of a number of sites (10/8/92).

2.8 Kent Colahan
City of K. Falls
K. Falls, OR

Pool. Explained operation of city pool space heating/hot water system (10/8/92).

2.9 Allen Pynn
Box 528
West Linn, OR 97608

District Heating. Requested a feasibility study for a district heating system at La Grande, OR. Informed him the study had already been done and exploratory wells were drilled. Drilling did not

- confirm a resource in town, it would be necessary to pipe thermal waters from Hot Lakes. Sent earlier reports and information on Hot Lakes resource (10/9/92).
- 2.10 Doug Stiles
K. Falls, OR
- Space Heating. Interested in purchasing property on Old Fort Road, two existing wells, for a retirement center complex. Discussed wells, their capacity, condition, water rights and interference with city wells. Provided well logs and well test information (10/9/92).
- 2.11 Trish Frank
Indian Energy
Assist. Program
Box 3183
La Jolla, CA 92038
- Greenhouse. Ms. Frank is working with California Indian tribes on renewable energy. Discussed geothermal resource possibilities on Torres Martinez Tribal lands near the Salton Sea and Mecca. Existing wells on the lands have temperatures of 33°C. Described the GHC technical assistance program for the development of a greenhouse project (10/9/92).
- 2.12 Rodger Bekooy, P.E.
Carson, Bekooy,
Gulick & Kohn
3220 S.W. 1st Avenue
Portland, OR 97201
- General. Discussed review of new geothermal energy chapter for ASHRAE. The rewrite will include new information on ground-coupled heat pumps (10/13/92).
- 2.13 Bob Lowell
4010 Ashentree Dr.
Atlanta, GA 30341
- GHP. Wants to install a geothermal heat pump in a new home. Discussed ground-coupled versus well water-source and advantages/disadvantages of GHP. Sent several papers giving comparisons with conventional systems. Provided contacts at IGSHPA and University of Alabama (10/13/92).
- 2.14 Miguel Rangel
Auxiliaria Technica
de la Gerencia
Aparatodo Postal 31-C
Morelia, Mich. 58290
Mexico
- Industrial. Requested assistance with the design of a fruit drying plant at Los Azufres. Also, assistance was requested with the use of silica waste material from spent brine as brick and road surfacing material. The GHC is negotiating with CFE to cover expenses. Information on drying plants was sent (10/13/92).
- 2.15 Kent Colahan
Geothermal Supt.
City of K. Falls
K. Falls, OR 97601
- District Heating. The city of K. Falls has been actively pursuing the connection of private commercial buildings on 11 blocks to connect to the city's GDH system. They have approved rate incentives and pursued assistance in obtaining

low-interest loans and tax credits for the building owners. As a result, several owners have requested initial feasibility studies done by the GHC. So far these include: Pacific Linen - laundry, Ross Ragland Theatre, Christ Lutheran Church, Presbyterian Church, Eagles Lodge, two apartment buildings, and The Gospel Mission. Additional blanket time has been approved for the current requests from DOE-Idaho. The GHC is working with a local consulting mechanical engineer, who along with possibly outside engineering firms will be involved with the final designs (10/14/92).

2.16 Nicole Szwajkowski
502 W. Green Street
Urbanna, IL 61801

General. Student at the University of Illinois wanted information on geothermal energy and the GHC programs (10/14/92).

2.17 Wally Connolly
Connolly Construction
Co.
4277 Brookshire Lane
Boise, ID 83703

Equipment. Discussed piping materials for residential GDH system. Provided list of manufacturers of non-metallic pipe (10/14/92).

2.18 Dick Hansen
1043 S. Garfield
Denver, CO 80209

General. In the process of building a major greenhouse operation in Utah. Requested software developed by the GHC to aid in the design. Codes and supporting documentation for greenhouse equipment selection (GHS), HEATOOLS and QPIPE were sent (10/16/92).

2.19 John Spacer
Box 127
Sandia Park, NM 87047

Equipment. Requested assistance in commercializing a submersible pump using a Rankine cycle. Explained that the request was not in the GHC area of capabilities (10/16/92).

2.20 Ernest Beauregard
1586 County Road 3
Ridgeway, CO 81432

Space Heating. Recently purchased property with geothermal possibilities. Explained the GHC technical assistance program. Sent several technical papers describing what development of geothermal space heating systems involve (10/19/92).

2.21 Einar Eliasson
Orkustofnun
Grensasvegur 9
IS-108 Reykjavik
Iceland

Industrial. Revised text and illustrations for paper presented at Iceland Industrial Conference on research in the U.S. The paper is to be published, after review, in Geothermics (10/19/92).

- 2.22 Kent Colahan
Geothermal Supt.
City of K. Falls
K. Falls, OR 97601
Pool. Performed temperature profile measurements on the city swimming pool's geothermal well. Discovered a leak in the DHE due to significant corrosion and scale probably caused by chlorine in the pool water (10/19/92).
- 2.23 John McBride
NATAS
Butte, MT
GHP. Discussed monitored data collected on the Montana house horizontal ground-coupled heat pump system in Kalispell. Referred to Pacific Power who has the raw data (10/21/92).
- 2.24 Dan White
Naval Weapons Center
China Lake, CA
GHP. Discussed life-cycle cost analysis on GHP. Southern California Edison is offering a rebate of \$200/kW demand saved on an installed GHP system (10/21/92).
- 2.25 Jeff Birkby
NATAS
Butte, MT
GHP. Requested National Directory of Heat Pump Associations, which was sent (10/21/92).
- 2.26 Lew Pratsch
USDOE
1000 Independence
Avenue SW
Washington, D.C.
20585
GHP. Reviewed a report by George Mason University titled "The Economics of Geothermal Heat Pumps." The main message was that PUCs need to allow modification of rate structure to allow/promote conservation measures. This could be a win-win situation for homeowners and utilities. Results of the study were not favorable to GHP. This was possibly due to small sample (14 homes), old systems, very small geographic area, not taking into consideration performance differences and comparing only to air-source heat pumps (10/22/92).
- 2.27 Howard Ross
UURI
Salt Lake City, UT
Resource. Discussed format for database for State Resource teams. Suggested that in addition to resource characteristic data, current use, geophysics and reservoir engineering studies should be included. The type of study and reference would be identified (10/23/92).
- 2.28 Dr. Paul McDonald
ETSU
Oxfordshire OX110RA
UK
General. Requested information about U.S. geothermal direct use developments and the GHC. Sent several technical papers and back issues of Bulletin (10/23/92).

- 2.29 Bill Neil
Texas A&M
Corpus Christie, TX
Aquaculture. Met with researchers from Texas A&M and Fish & Wildlife people on the design of thermal refugees for fish during cold spells. Designed an air dome to cover a portion of a pond and calculated heat loss (10/23 to 28/92).
- 2.30 Bill Blankenship
Blankenship Oil &
Development Corp.
1035 S. Garfield St.
Denver, CO 80209
Resource. Discussed low-temperature resources in Colorado (10/29/92).
- 2.31 Hank Albertson
HC 60 Box 4700
Lakeview, OR 97630
Aquaculture. Discussed using geothermal energy for aquaculture. Sent information on the technology of heating ponds using geothermal fluids and offered the technical assistance program for a project in the area (11/4/92).
- 2.32 Trisha Frank
CA Energy Extension
Service
Sacramento, CA
Greenhouse. Paiute Tribe has a 90°F geothermal well they want to use for heating a greenhouse. Discussed types of heating systems and cost of equipment at that temperature. Arranged for technical assistance (11/4/92).
- 2.33 Ray Hawks
K. Falls, OR
Electric Power. Discussed using solar as a temperature booster for low-temperature geothermal fluids to power a binary-cycle power plant. Calculations showed that it was not technically or economically feasible due to low solar energy component (11/5/92).
- 2.34 Fredrick Appold
Upper Perkiomen
Middle School
Jefferson Street
East Greenville, PA
18401
General. Requested information on geothermal energy and its uses for a grade-school class studying alternative energy. Sent packet of information on direct uses and electric power generation and added name to mailing list of the GHC Bulletin (11/5/92).
- 2.35 Henry Bolin
Huntington Place
1 Armory Drive
Waterbury, VT 05076
GHP. Discussed ground-coupled heat pump including the design and incremental cost (\$800 - \$850/ton) of the ground loop. Provided technical papers on GHPs and referred to regional heat pump association (11/5/92).

- 2.36 Randy Shih
K. Falls, OR
Space Heating. Discussed a number of resource sites in the K. Falls area for using geothermal energy to heat a home (11/9/92).
- 2.37 Andrew Tokarz
Central European
Institute
Box 4614
Oak Brook, IL 60521
District Heating. Discussed possible district heating developments in Poland using geothermal energy. Requested a review of a GDH project in Poland and resource characteristics. Provided information on GDH in the U.S. and suggested we could formally invite engineers from Poland to visit U.S. GDH systems if it would be a benefit (11/10/92).
- 2.38 Lafe Smith
Pacific Linen
350 S. 7th Street
K. Falls, OR 97601
District Heating. Completed a preliminary review of the potential for the laundry to connect to the city GDH system. Results indicated that a system for serving boiler makeup water heating, space heating and domestic hot water would incur a capital cost of approximately \$25,000. Retrofit of these three systems would displace 4.1 billion Btu/y of natural gas costing \$14,000 at current natural gas prices. It was recommended that Pacific Linen initiate a discussion with the city to determine the cost for geothermal heat and the logistics for extending the pipeline to the facility (11/12/92).
- 2.39 Dan Lyster
Mono Co. Energy
Officer
Mammoth Lakes, CA
Well. Discussed geothermal wells on Paiute Tribal lands. Lyster had no information; however, the Indian Health Service may have information (11/12/92).
- 2.40 David Riley
37481 Moss Rock Road
Corvallis, OR 97330
Electric Power. Discussed proposed power plant at Pueblo Valley in southern Harney County, Oregon. Provided several papers on power generation and direct heat applications. Also, explained the GHC technical assistance program for direct use projects (11/16/92).
- 2.41 Neal Eberlien
K. Falls, OR
District Heating. Christ Lutheran on Spring Street decided to connect to the city GDH system. Calculated coil sizing for the forced air system and assisted with ordering the coils from Oregon Air Reps (11/16/92).

- 2.42 **Gerardo LeBert** **Industrial.** Discussed cooperative work with the CFE in Mexico. Three specific projects have been designated for more detailed investigation: a pilot plant fruit dryer to be constructed at Los Azufres, a cold storage/refrigeration plant at Cerro Prieto and use of silica waste material as brick and road surfacing material. Plans are to visit Morelia in mid-December to work on the drying plant project (11/19/92).
- 2.43 **Dwight Tracey** **District Heating.** Completed a preliminary evaluation of the potential for the Herald News building to connect to the city GDH system. A capital cost of \$20,000 - \$25,000 would be necessary to retrofit to geothermal. The current natural gas annual purchase only amounts to an average of \$700. These figures suggested that continuing with natural gas is the best economic alternative. Also, provided depth and temperature of five wells in the vicinity of Mr. Tracey's home (11/23/92).
- 2.44 **Don Barbour** **Aquaculture.** Working on greenhouses and aquaculture near Burns, OR at Crane Hot Springs. Discussed resource, required temperatures and flows. Provided the name of three drillers, three hydrologists and a consultant in aquaculture (11/23/92).
- 2.45 **Steve Schneider** **Wells.** Discussed resource in general in the Crane Hot Springs area. No specifics are available since there are no wells nearby (11/23/92).
- 2.46 **Gene Koch** **GHP.** Discussed direct expansion ground loops. Has installed system which has been operating satisfactorily for six months (11/23/92).
- 2.47 **Robin Cox** **Space Heating.** Discussed the installation of a hot water coil in home connecting to a GDH system (11/23/92).
- 2.48 **Dr. Chun-Lun Shieh** **GHP.** An ASHRAE Technical Committee has been developing a consensus set of terms which can be used by major groups (i.e., ASHRAE, IGSHPA, EPRI, etc.). The current version incorporating committee members comments are: Ground-Source Heat Pump:
- CFE
Morelia, Mich.
Mexico
- Herald & News
Box 788
K. Falls, OR 97601
- Geo-Culture, Inc.
8251 S.W. Cirrus Dr.
Beaverton, OR 97005
- Schneider Drilling
St. Paul, OR
- Valley Refrig.
3800 Cobury Road
Eugene, OR 97401
- Connally Estates
Boise, ID
- CHIYODA Int'l Corp.
1100 Olive Way
Seattle, WA 98101

Heat pump systems employing the earth's surface water or groundwater as a heat source/sink including ground-coupled and groundwater source systems. Groundwater Heat Pump System: Heat pump system in which surface water or groundwater is physically delivered to and from the heat pump for the purpose of serving as a heat source/sink. Often referred to as an open loop system. Ground-Coupled Heat Pumps System: Heat pump system in which a closed loop of piping containing a heat transfer liquid or refrigerant serves to transfer heat between the heat pump and the ground, groundwater or a body of surface water serving as the heat source/sink. Often referred to as a closed loop system (11/24/92).

2.49 Dr. Charles Tantillo
VP of Administration
Stockton State
College
Pomona, NJ 08240

GHP. Discussed the ground-coupled heat pump system (1350 tons) that will replace outdated heating and cooling units for the campuses 357,000 sq. ft. of instructional and educational related space. The "well field" will consist of an estimated four hundred wells each drilled to a depth of 400 ft. By reducing operating and maintenance costs, the college is expected to save \$455,000 on an annualized basis and 2100 tons of environmental pollutants would be removed from the air by avoiding electrical/gas energy consumption. Requested information on any comparative analysis that may have been done between a closed-loop ground-coupled versus an open-loop groundwater system (11/24/92).

2.50 Lori Williams
Sierra Pacific Power
Reno, NV

Electric Power. Discussed proposed generating plant--S.P. offering \$0.02/kWh and "small" capacity factor. Also, discussed resource, plant costs, sales contract, etc., with Mr. Charles Hooper who is proposing the project (11/24/92).

2.51 Ali Kahn
CA Division of Oil
& Gas
50 "D" Street
Santa Rosa, CA 95104

Resource. Discussed Oregon regulations in terms of assessment, royalties, drilling costs, and responsible agency according to the 250°F resource temperature. Referred to Oregon Dept. of Geology for further information on drilling high temperature wells. Provided a number of technical papers and summary of Oregon regulations (11/25/92).

- 2.52 Jan Everitt
Realty World
K. Falls, OR
Resource. Ms. Everitt has a client reportedly looking for 100 acres with geothermal in/near K. Falls. Provided maps of resource areas, discussed about seven potential sites and considerations (i.e., pumping levels, chemistry, drilling costs and risks) (11/28/92).
- 2.53 Tracy Pipkin
12055 S.W. Why Worry Lane
Beaverton, OR 97005
Aquaculture. Discussed different species that have been raised using geothermal fluids. Sent information on Tilapia. Referred to Small Business Development Center for business development assistance (11/30/92).
- 2.54 Kathy Weinberg
3856 Pallos Verdas
Dallas, TX 75229
GHP. Discussed geothermal heat pump technology - ground coupling, water source, efficiency and possible energy savings. Provided a number of papers on geothermal heat pumps and other direct use of geothermal energy (12/2/92).
- 2.55 Dr. Charles Hooper
Standish, CA
Electric Power. Reviewed cost information for a proposed binary power plant near Amedee Hot Springs, California. Also contacted Sierra Pacific Power Co. who is offering contracts for power at 2¢/kWh and PG&E at 3¢/kWh plus \$60.35/kWyr capacity payment. Recommended Dr. Hooper contact SMUD, SOCAL and SDG&E to try to get better sale prices. Discussed possibilities of aquaculture and greenhouse projects (12/2/92).
- 2.56 Mike Jenkins
Red Bluff, CA
Aquaculture. Currently growing red claw lobsters in tanks using solar and tank heaters. Looking for a geothermal resource of approximately 180°F and 800 gpm. Suggested Litchfield, Wendell, Amedee, Fort Bidwell and Sierraville as possible sites (12/3/92).
- 2.57 Hal Greene
K. Falls, OR
Space Heating. Proposing a golf driving range near a site of an injection well of 140°F. Discussed a radiant floor system to utilize the 140°F geothermal fluid (12/3/92).
- 2.58 George Austiguy
1301 N. Orchard St.
Boise, ID 83706
Aquaculture. Discussed using geothermal fluids for an aquaculture project. Sent HEATOOLS for calculating heat loss from ponds (12/3/92).

- 2.59 Scott Kessler
Modoc County
202 W. 4th Street
Alturas, CA 96101
General. Works for Planning Department of Modoc County and wanted to attend a workshop on geothermal. Referred to the GRC and sent a number of technical papers, feasibility studies and the Guidebook (12/4/92).
- 2.60 Pat Hollman
K. Falls, OR
Resources. Discussed geothermal well at 1425 Pacific Terrace. Provided well log and discussed construction. The well is inaccessible for a project - buried in from lawn (12/4/92).
- 2.61 Dennis Trexler
Earth Sciences
Univ. of Nevada
Reno, NV
Greenhouses. Called for information on greenhouses in Colorado and New Mexico. He is consulting for a potential greenhouse operation (12/8/92).
- 2.62 Tom Matsomota
Agricultural Conslt.
San Francisco, CA
Greenhouses. Looking at cascading a greenhouse off a binary power plant at Empire, Nevada. Discussed geothermal heating of a double-poly 50,000 - 100,000 ft² greenhouse. Provided names and phone numbers of several operators of greenhouses he could visit (12/9/92).
- 2.63 Dan Lyster
CEC
Sacramento, CA
Resources. Discussed possibility of a geothermal resource on the Benton Paiute Indian Reservation. There are no springs or wells on the reservation; however, some do exist north of the reservation, probably could drill wells and obtain hot water (12/10/92).
- 2.64 Bill Richardson
Third Age Industries
6107 SW Murray Blvd.
Beaverton, OR 97005
General. Discussed direct use applications, including space heating, greenhouses, aquaculture and industrial processing. Literature was sent on all the above applications, including Bulletins and a publications listing (12/10/92).
- 2.65 Doug Wescott
1850 Lower K. Lake Rd.
K. Falls, OR 97603
GHP. Discussed ground-coupled heat pumps and sent technical papers (12/14/92).

- 2.66 Bob Kingzett
Trendwest
K. Falls, OR
District Heating. The Ross Ragland Theatre will be connecting to the city GDH system through about a 4-block extension. The foundation has passed about \$75,000 of the \$140,000 required for the extension and conversion. The GHC provided a preliminary design and economic analysis for the system (12/14/92).
- 2.67 James Jelen
BNF Technologies
4401 Ford Avenue
Alexandria, VA 22302
General. Requested information on geothermal energy for school kids, including several papers on the Atlantic Coastal Plane (12/16/92).
- 2.68 Lew Golden
1444 Crescent
K. Falls, OR
Space Heating. Wanted to know if home could be heated using geothermal energy. Two wells exist near the home - well logs were provided (12/16/92).
- 2.69 Shealene Consultants
12 Primrose Place
Ewing, NJ 08638
General. Writing tour book on energy - provided information on geothermal developments in the K. Falls area (12/16/92).
- 2.70 Hank Dearborn
K. Falls, OR
District Heating. Provided a computer predicted energy use for a market near the city GDH distribution piping. Recommended they also consider a 35% state tax credit available for all capital costs associated with the conversion (12/18/92).
- 2.71 Dennis Trexler
Earth Sciences
Univ. of Nevada
Reno, NV
Greenhouses. Discussed greenhouse heating system. He is working with Tom Matsumoto, power plant at Empire not up to capacity because of cooling water problems. The resource temperature is 275°F and 160°F is discharged out of the binary power plant (12/18/92).
- 2.72 Klamath Pump Center
K. Falls, OR
Resource. Wanted well at 450 Michigan Avenue temperature profiled while pump suction line was out. Attempted the profile, but couldn't get down the well which has a 2 in. DHE, 3/4 in. DHE and pump suction in 8 in. well (12/18/92).
- 2.73 Roger Peake
CEC
Sacramento, CA
General. Provided all the information on California direct use projects that were in GHC files. The CEC will use it for a report to the California legislature. Calculated SOx, NOx and CO₂ amounts saved by geothermal direct use projects in California - SOx = 173.3 tons, NOx =

62.25 tons and CO₂ = 89,306 tons.
Provided estimates of beneficial heat
below 90°C = 2,177 MW_t (12/18/92).

2.74 Colin Williams
USGS
Palo Alto, CA

GHP. Discussed how to get utilities and more direct use people involved in GHP workshops for GRC. Suggested contacting marketing and energy service people from utilities, CEC contacts, and state low-temp. resource teams. Discussed low-temp. resources assessment program (12/21/92).

2.75 Bill Blankenship
1035 S. Garfield St.
Denver, CO

Resources. Discussed prospects for San Luis Valley, Colorado. A band approximately 2 miles wide of potential resources runs the length of the Valley from Poncha Springs in the north to Alamosa in the south. Current development includes: Poncha Hot Springs is used for space and pool heating in Salida, raising of tilapia in Alamosa, raising alligators at Hooper and mushrooms 5 miles north of Alamosa. At Mineral Hot Springs, approximately center of valley, a test hole was drilled by Mr. Blankenship to 500 ft to top of a clay zone. He was exploring funding sources to drill a deep well (exploratory) at the site. Referred to UURI, Colorado Geological Survey, and Geothermal Resources Management for possible geophysical or heat flow data for the site (12/21/92).

2.76 David ?
Innovations Group
Norco, CA

Resource. City of Norco drilled new well for domestic water supply - hit 110°F artesian flow - wanted to know how to cool it. Discussed the well with George Lambert, City Manager and suggested a public relations program to tell people how much they could save on hot water heating (12/23/92).

2.77 Stan Calvert
DOE
Washington, D.C.

General. Requested fact sheet on geothermal direct use potential for briefing book to be presented to transition team. Fact Sheet included low-temp resource potential, space heating, geothermal heat pumps, greenhouses, aquaculture and industrial processing (12/30/92).

- 2.78 Will Price
Criterion Engineers
Portland, OR
GHP. Provided projected cost of vertical ground-coupled heat pump systems and performance data on heat pumps and desuperheater models (12/30/92).
- 2.79 John Nimmons
Seattle, WA
GHP. Discussed Metro heat pump graphs and tables. Suggested he not get too involved with life cycle cost analysis until he sees what building owners want (12/31/92).
- 2.80 Jim Tracey
NCAT
Box 3838
Butte, MT 59702
GHP. Collecting data on home energy rating system for Edison Electric Institute. Wanted utility information on GSHP that the GHC has been gathering. Faxed some preliminary data (12/31/92).
- 2.81 Dr. Gerardo Hiriart
Comision Federal
De Electricidad (CFE)
Morelia, Mexico
Subtask 1.6 of Project Technical and Development Assistance Activities refers to a cooperative agreement of technical assistance and information exchange on geothermal direct use projects in Mexico. The following is a trip report by John Lund, GHC Research Associate, to Morelia/Los Azufres. Currently John is working on the design of a pilot fruit dehydration plant to be located at Los Azufres.

John Lund traveled to Morelia (Michoacan State), Mexico from 15 December through 21 December, 1992. The purpose of the trip was to visit the Los Azufres geothermal field and to investigate the development of direct use geothermal projects using waste brine from the field and at Cerro Prieto. His travel and expenses in Mexico were paid by Comision Federal De Electricidad (CFE). His contacts at Morelia were Dr. Gerardo Hiriart and Engineer Miguel Rangel of the geothermal section.

One day was spent visiting Los Azufres to look at potential project locations and a second day spent at headquarters in Morelia discussing the design of several projects. In both cases, he visited with engineers, foresters and agricultural specialists assigned to CFE.

Specific projects discussed during the visit were:

1. The design of a pilot fruit dehydrator to be located at Los Azufres. The primary product would be the drying of pears. This design would be completed in January, so that construction would be completed for the summer/fall harvest.
2. The design of a small district heating system for the office area of Los Azufres. This would be completed by Spring 1993.

3. The design and testing of bricks made from silica from Cerro Prieto. These bricks using cement/lime and other cementing products would be tested to strength and thermal properties jointly by CFE and OIT. This project would be performed during Spring 1993.
4. Preliminary design of an ice plant/cold storage room for Cerro Prieto. This plant would be used for storage of vegetables grown near Mexicali.

It was also proposed that Dr. Hiriart and Engineer Rangel would visit the Geo-Heat Center in February 1993.

Since some of the work would be applicable to the U.S.--especially the use of silica in bricks, a proposal for future work will be prepared and submitted to USDOE.

Dr. Lund's time on this project to date, has been donated. The only expense for this trip was travel to San Diego and return, and per diem for travel time in the U.S.

3.0 R & D Activities.

Injection Well Design. Work continues on the study of low-temperature injection wells. Case histories have been written on the Boise VA well and Richardson well at Susanville, CA (October, 1992).

Work continues on design guidelines for injection wells and has begun on equipment related to district heating (GDH). The GDH equipment is being investigated relative to recommendations made to commercial building owners that are considering connecting to the city of Klamath Falls GDH system. The GHC is providing preliminary retrofit design and brief economic analysis (November, 1992).

The final report, "Corrosion Evaluation on Brazed Plate Heat Exchangers", is attached for DOE review and patent clearance.

4.0 Technology Transfer.

GHC staff provided the following outreach and information dissemination services.

4.1 Presentations and Tours.

1. Presentations. GRC Annual Meeting presentations included (1) Direct Use and Its Future Growth in the U.S. and (2) Geothermal Spas in Czechoslovakia at San Diego, October 4-7, 1992.

2. Discussion and Tour. Three engineers from PNOC Philippines. Discussed Philippine resources for direct use and U.S. program. Toured OIT GDH system October 10, 1992.
 3. Attended IGSHPA Annual Meeting in Nashville, TN. Requested monitored data on GHP systems from several utilities, October 25-28, 1992.
 4. Tour and Discussion. Bill Blankenship, Denver, CO, discussed Colorado resources and toured OIT geothermal heating system October 29, 1992.
 5. Low-Temperature (Direct Use) Wells by G. Culver at the GRC Geothermal Drilling, Well Control and Regulatory School, 55 persons, Sacramento, CA, November 16-20, 1992.
 6. Presentation on geothermal energy and tour of OIT system, from Central Oregon Community College, 20 persons, November 5, 1992.
 7. City Geothermal District Heating System and potential in the Klamath Basin was presented to the Leadership Klamath Session, 20 people, December 17, 1992.
 8. Tour and brief presentation on OIT geothermal heating system presented to Larry Lytle and Bille Fourche, South Dakota, December 10, 1992.
- 4.2 GHC Quarterly Bulletin. Quarterly Bulletin Vol. 14, No. 3 was sent to 1690 U.S. subscribers and 298 foreign. Copy is attached as Appendix I.
- 4.3 Geothermal Library. Seventy one volumes were added to the library during the first quarter.
- 4.4 Information Dissemination. The GHC provided the following with publications:

<u>Name</u>	<u>Nature</u>
-------------	---------------

10/2/92

Howard Rynnearson
International Florist
Products
Box 673
Payette, ID 83661

1.	PRF
2.	GHC Brochure
3.	Using the Earth to Heat & Cool Homes
4.	Earth-Source Heat Exchanger for Heat Pumps
5.	Geothermal Heat Pumps - Trends and Comparisons
6.	Demand & Energy Study of High Efficiency Heating & Cooling Equipment in Oklahoma

Bill Leihdy
Alaska Applied Sciences
Box 020993
Juneau, AK 99802

7. Ground-Coupling with Water-Source Heat Pumps
8. Bulletin Vol. 14, No. 1
9. Geothermal Energy Brochure
1. PRF
2. GHC Brochure
3. Geothermal Energy Brochure
4. Geothermal District Piping - A Primer
5. A Materials and Equipment Review of Selected U.S. Geothermal District Heating Systems

10/5/92

Allen Pynn
P.O. Box 528
West Linn, OR 97068

1. Economics of Direct-Use Project Development
2. Pricing Direct-Use Geothermal Energy
3. Culture of Freshwater Prawns Using Geothermal Waste Water
4. Geothermal Direct Use
5. Geothermal Greenhouse Development
6. Direct Heat
7. Bulletin Vol. 14, No. 1 and 2

Univ. of Hawaii Library
Serials Dept.
2550 The Mall
Honolulu, HI 96822

1. Bulletin Vol. 14, No. 2

10/6/92

Bob Griffiths
BWSWD
2440 Old Penitentiary
Boise, ID 83202

1. Bulletin Vol. 14, No. 2

Elizabeth Jacox
ID State Historical
Society
450 N. 4th Street
Boise, ID 83702

1. Bulletin Vol. 14, No. 2
2. Copy of ASHRAE Article

Dean Worbois
P.O. Box 8182
Boise, ID 83707

Same as above.

Glida Bothwell
Ada Community Library
10664 W. Victory Road
Boise, ID 83704

Same as above.

Carol Green
Reference Librarian
Boise Public Library
715 S. Capital Blvd.
Boise, ID 83702

Same as above.

10/8/92

Wendell Beaubian Jr.
3 Ricefield Road
Georgetown, SC 29440

1. Heat Pump Package

Allen Pynn
P.O. Box 528
West Linn, OR 97068

1. GHC Brochure
2. Geothermal Energy Brochure
3. Geothermal Direct Heat Application Potential
4. OIT - Geothermal System
5. The Current Status of Geothermal Direct Use Development in the U.S., Update: 1985 - 1990
6. Direct-Use Geothermal Potential Within the BPA Marketing Area
7. Direct Use of Geothermal Resources
8. Direct Heat

10/13/92

Bob Lowell
4010 Ashentree Drive
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1. GHC Brochure
2. Bulletin Vol. 14, No. 1
3. Heat Pump Package

Walt Brewer
Jason Group
15070 Ave. Venusto, #232
San Diego, CA 92128

1. PRF
2. GHC Brochure
3. Bulletin Vol. 14, No. 2
4. Chapter 13 - Heat Pumps

Trisha Frank
Indian Energy Assistance
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Box 3183
La Jolla, CA 92038

1. PRF
2. GHC Brochure
3. Chapter 15 - Greenhouses
4. Geothermal Greenhouse Development
5. Greenhouse Heating With Low Temperature Geothermal Resources in Lake County, CA
6. Bulletin Vol. 14, No. 2

10/16/92

Nicole Szwajkowski
502 W. Green Street,
#208
Urbana, IL 61801

1. PRF
2. GHC Brochure
3. Bulletin Vol. 14, No. 2

10/19/92

Ernest Beauregard
1586 County Road 3
Ridgeway, CO 81432

1. PRF
2. GHC Brochure
3. GHC Programs
4. Geothermal Energy Brochure
5. Bulletins Vol. 13, No. 1, 2, 3 and 4, and Vol. 14, No. 1 and 2

Allen Pynn
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1. Equipment & Services for Worldwide Applications
2. Low-Temperature Geothermal Resources
3. Geothermal Direct Use Development in the U.S.
4. A Materials & Equipment Review of Selected U.S. Geothermal District Heating Systems

10/27/92

Todd Whipple
714 1/2 W. 26th Street
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1. PRF
2. GHC Brochure
3. Geothermal Energy Brochure
4. Chapter 13 - Heat Pumps
5. Chapter 15 - Greenhouses
6. Chapter 16 - Aquaculture
7. Bulletin Vol. 14, No. 2

11/4/92

Hank Albertson
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1. GHC Brochure
2. PRF
3. Bulletin Vol. 13, No. 2
4. Chapter 16 - Aquaculture

11/5/92

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1. PRF
2. GHC Brochure
3. About Geothermal Energy
4. Geothermal Resources
5. Geothermal Energy Brochure
6. Bulletins Vol. 13, No. 2 and 3, and Vol. 14, No. 1 and 2

Henry R. Bolin
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1. Bulletin Vol. 14, No. 1
2. GHC Brochure
3. Using the Earth to Heat and Cool Homes
4. Geothermal Heat Pumps - Trends and Comparisons
5. Earth-Source Heat Exchanger for Heat Pumps

6. Ground-Coupling with Water-Source Heat Pumps
7. Demand and Energy Study of High Efficiency Heating and Cooling Equipment in Oregon
8. Ground-Source Heat Pumps

11/10/92

Andrew Tokarz
Central European
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P.O. Box 4614
Oak Brook, IL 60521

1. PRF
2. GHC Brochure
3. GHC Programs
4. Design of the Klamath Falls Geothermal District Heating Network
5. Bulletins Vol. 13, No.3 and Vol. 14, No. 2
6. Geothermal District Piping - A Primer
7. Data Acquisition for Low-Temperature and Long-Term Monitoring
8. A Materials and Equipment Review of Selected U.S. Geothermal District Heating Systems

11/12/92

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1. PRF
2. Bulletins Vol. 13, No. 3, and Vol. 14, No. 1 and 2

11/13/92

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1. A Tale of Two Heat Pumps
2. Chapter 9 - Well Pumps
3. Chapter 10 - Piping
4. Chapter 11 - Heat Exchangers
5. Chapter 12 - Space Heating Equipment
6. Chapter 13 - Heat Pumps
7. Chapter 15 - Greenhouses
8. Chapter 16 - Aquaculture
9. Geothermal Agriculture in Hungary
10. Geothermal Heat Pump Utilization in the United States
11. Geothermal Energy Utilization for the Homeowner
12. Direct-Use Geothermal Potential Within the BPA Marketing Area
13. Groundwater Heat Pump Brochure
14. Heat Pump Economics
15. Culture of Freshwater Prawns Using Geothermal Waste Water
16. Use of Geothermal Energy for Aquaculture Purposes

17. Ground-Coupling with Water-Source Heat Pumps
18. Geothermal Greenhouse Development
19. Some Considerations for Large Water-Source Heat Pumps
20. Corrosion in Low-Temperature Geothermal Applications
21. Community Heat Pump System, Klamath County, Oregon
22. Binary Generators - You'll Wonder Where the Power Went
23. Binary Generators - Tweaking More Bangs per Btu
24. A Layman's Guide to Geothermal Aquaculture
25. Optimization of Geothermal Home Heating Systems
26. A Material and Equipment Review of Selected U.S. Geothermal District Heating Systems

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1. PRF
2. Bulletins Vol. 13, No. 1, 2, 3 and 4, Vol. 14, No. 1 and 2

11/25/92

Ali Kahn
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50 "D" Street, No. 300
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1. PRF
2. GHC Brochure
3. Oregon Regulations
4. Back issues of Bulletin

Dr. Charles Tantillo
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1. PRF
2. GHC Brochure
3. OIT Geothermal System
4. Chapter 13 - Heat Pumps
5. Ground-Coupling with Water-Source Heat Pumps
6. Bulletins Vol. 14, No. 1 and 2

12/2/92

Kathy Weinberg
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1. GHC Brochure
2. PRF
3. Geothermal Energy Brochure
4. Geothermal Resources
5. Bulletins Vol. 13, No. 3 and Vol. 14, No. 1 and 2
6. Using the Earth to Heat and Cool Homes
7. Earth-Source Heat Exchanger for Heat Pumps

8. Geothermal Heat Pumps - Trends and Comparisons
9. Ground-Coupling with Water-Source Heat Pumps
10. Energy and Demand Study of Heating and Cooling Equipment

12/8/92

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1. PRF
2. GHC Brochure
3. Geothermal Energy Brochure
4. Bulletins Vol. 13, No. 3 and Vol. 14, No. 2
5. Guidebook

12/15/92

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1. GHC Brochure
2. Using the Earth to Heat and Cool Homes
3. Geothermal Heat Pump Utilization in the United States
4. Earth-Source Heat Exchanger for Heat Pumps
5. Demand and Energy Study of High Efficiency Heating and Cooling Equipment in Oregon
6. Ground-Coupling with Water-Source Heat Pumps
7. Bulletin Vol. 14, No. 3

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1. Chapter 15 - Greenhouses
2. Chapter 16 - Aquaculture
3. Some Considerations for Large Water-Source Heat Pumps
4. Geothermal Greenhouse Development
5. Geothermal Heat Pump Utilization in the United States

12/17/92

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22302-1498

1. PRF
2. GHC Brochure
3. About Geothermal Energy
4. Atlantic Coastal Plain
5. Bulletins Vol. 3, No. 3; Vol. 4, No. 1; Vol. 14, No. 1, 2 and 3
6. Geothermal Resources
7. Geothermal Energy Brochure
8. Geothermal Energy - Heat from the Earth - Power for the Future

5.0 Geothermal Progress Monitor

5.1 Seattle Company Eyes \$1 Million Tilapia Project Using Geothermal Water Near Yakima.

A Seattle company wants to build an aquaculture center near the town of Moxee to raise golden tilapia, a food fish grown commercially in Africa, Asia and the United States.

New World International Inc., owned by investors from Washington state and California, said the center would be the first major commercial aquaculture project in eastern Washington.

The company expects to invest \$1 million and employ 25 people for the first phase of the project, said David McFadden, assistant director of New Vision, the Yakima County Development Association, who worked with the company to find acceptable sites.

If all goes well, the company would invest \$15 million in the next two phases and employ up to 150 people, McFadden said.

The project was thought up in a graduate studies course at the University of Washington taught by George Pigott, New World president and director of the food science institute at UW. The class put together preliminary engineering plans and a business plan.

"It was a good opportunity to marry education with the real world of commercial fisheries," Pigott said.

New World looked at sites across the United States and abroad. It chose Yakima County because of the accessibility of geothermally heated water, inexpensive feed and an available labor force.

Tilapia is the oldest farm fish in existence, dating back to 2000 B.C., said Gleyne Bledsoe, a Ph.D. graduate student and business owner in the fishing industry.

The fish are grown commercially in Africa and Asia as well as in the United States, he said.

Tilapia sells well in the ethnic market, but they're also adaptable to American tastes because they have a bland, non-fishy taste, he said.

Initially the fish will be sold live to ethnic markets such as Chinese restaurants, then later frozen, both cleaned and whole. The company also has plans to produce filets, which will be breaded and sold.

Waste from fileting will be used to produce fish protein concentrate and fish silage for fish or animal feed.

Pigott predicted an increase in the demand for fish grown through aquaculture because of dwindling wild fisheries. And as the world population grows, consumption of fish is expected to increase in the future, he said.

Tilapia require warm water--about 85 degrees--so the New World project will use geothermal wells near Moxee, he said.

The fish will be grown in series of large tanks.

If all goes well with the first phase of the project, an expanded facility will be built at a site to be determined.

Pigott said he hopes to begin the first phase of the project in 30 to 60 days (Aquaculture News, August 92).

5.2 Would You Believe A Geothermal Space Shuttle?

In a recent ASHRAE Journal, appeared an article of how NASA's Space Shuttle engine test facility recently retrofitted its heating system. Early engineering studies had identified an existing water well that was producing large amounts of warm water from an underground aquifer. This warm water proved to be a prime candidate for use as source water in a heat pump in the test area as an alternative to modular gas-fired or electric boilers.

This alternative energy use was especially effective because of the dangers of open flame boilers in a potentially explosive area where liquid oxygen and liquid hydrogen fuels for the shuttle engines were present. After installation, they measured a 78 percent Btu reduction (energy saved) and almost \$100,000 a year in cost savings. This equates to approximately \$3 million in energy savings over the twenty-year life of this equipment (Geyser Steamline, F/W 92).

5.3 City of Klamath Falls Expanding Its Geothermal District Heating System.

Last spring the Klamath Falls City Council passed a resolution agreeing to assist business building owners in the downtown area to hook-up to the geothermal district heating (GDH) system. The Klamath Falls System, as other small town systems, found itself in a difficult marketing position. The availability of low-cost natural gas as a competing fuel, relatively small building sizes, past system reliability problems and lack of marketing manpower have hampered efforts to add new customers. A new marketing plan, developed with input from the Geo-Heat Center, is successfully addressing many of these issues.

The new marketing approach eliminates the use of energy meters and offers heat on a flat rate basis. The flat rate is custom designed for each building, based upon historic fuel use of their current heating system. In most cases, the flat rate is designed to give the customer a positive cash flow while paying the retrofit loan.

The rate offers the customer approximately a 50% savings compared to natural gas costs. In addition, the requirement for a customer heat exchanger was eliminated. Elimination of the heat exchanger greatly reduces the costs for small buildings, thus increasing the incentive to connect to the system.

To assist with retrofit costs, the State of Oregon Department of Energy offers a Small-Scale Energy Loan Program (SELP). Using this low-interest program, the business owner could retrofit his building using funds borrowed from the state. To further enhance this project, a 35% tax credit is available for connecting to a geothermal system. This tax credit must be taken over a five-year period. These two programs could substantially increase the number of building owners to whom connection is economically attractive.

Due to lack of available staff time on the part of city, the Geo-Heat Center and a private consultant are assisting in the marketing effort. The Center's input is in the area of assisting individual building owners with their decision regarding connection to the system. Because funds are not available for major line extensions, the thrust of the marketing has been at building owners located adjacent to existing distribution lines. To date, two new customers have signed a service agreement with the city and assistance is being provided to thirteen other building owners. Two of these, the Ross Ragland Theatre and Presbyterian church, will require a major line extension that will be sized for additional customers along its route. Potentially, fifty buildings in the downtown area could, connect to the system.

The new marketing plan offers customers a reliable, competitively priced heating source. This should result in an increasing customer base for the system, a boost in the local economy and a bright future for the Klamath Falls system.

5.4 Go-Ahead For Geothermal Pilot Project

BPA has agreed to contract principles for the first of three geothermal pilot projects. The proposal is the 30 MW Newberry Geothermal Project near Bend, Oregon, co-sponsored by CE Exploration and the Eugene Water and Electric Board. Under the terms of the proposed agreement signed in December, BPA will take 20 MW of output and EWEB the other 10 MW. BPA will be working with the U.S. Forest Service and the Bureau of Land Management on the EIS, which will take about 18 months to complete. The project is expected to begin producing power in 1996 (BPA Journal, January 1993).

APPENDIX I

*not
attached*

GHC Quarterly Bulletin