DOE/ID/13040--T35

FEDERAL ASSISTANCE PROGRAM

QUARTERLY PROJECT PROGRESS REPORT

GEOTHERMAL DIRECT-HEAT UTILIZATION ASSISTANCE

GRANT NO. DE-FG07-90ID 13040

REPORTING PERIOD: OCTOBER - DECEMBER 1996

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ABSTRACT

This 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-97. It describes 174 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, economics and resources. Research activities are summarized on greenhouse peaking. Outreach activities include the publication of a geothermal direct use Bulletin, dissemination of information, geothermal library, technical papers and seminars, and progress monitor reports on geothermal resources and utilization.

1.0 PROJECT SUMMARY: OCTOBER 1 - DECEMBER 31, 1996

1.1 Technical Assistance. GHC staff provided assistance to 174 requests during the reporting period from 24 states, China, Ireland and Finland. A breakdown of requests relative to applications are: geothermal heat pumps (53), space heating (22),greenhouses (9), aquaculture (12), industrial (2), equipment (12), resources/wells (24), electric power (12), swimming pools (2), and other (26).

1.2 R & D Activities. Progress is reported on the task of greenhouse peaking.

1.3 Technology Transfer. GHC Quarterly Bulletin, Vol. 17, No. 4, was mailed to 1548 U.S. and 347 subscribers in other countries; Vol. 18, No. 1, is in preparation and should be published in January 1997. A presentation was given to a community college engineering class and a GHC staff member participated in a Ground-Source Heat Pump Workshop for the Department of Army. A total of 456 publications were distributed on direct use and 8 volumes were added to the geothermal library. Geothermal Progress Monitor (GPM) reports include: (1) Biotech Companies Profit from Yellowstone Hot Springs.

1.4 GHC staff that worked on the project included: P. Lienau (98%), K. Rafferty (100%), T. Boyd (90%), John Lund (40 hours), and D. Gibson (96%).

2.0 TECHNICAL ASSISTANCE

The Geo-Heat Center provides technical assistance on geothermal direct heat applications to developers, consultants and the public. This assistance could include information on low-temperature (<150°C) resources, space and district heating, geothermal heat pumps, greenhouses, aquaculture, industrial processes and other technologies. The nature of 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 fourth quarter of the 1996 program:

Name	Nature
10/01/96 Tang, Ninghua Prof. General Secretary Chinese Geo. Comm. 19 Xiwai S. Rd. Beijing 100044, China	Re: General Provided assistance to five Chinese visitors to the U.S. - hot spring (spa) managers and mineral water bottling works manager. They visited the GRC meeting in Portland and spas in Calistoga.
10/03/96 Jones, Bob Medford Water Department Medford, OR 541-770-4510	Re: Resource Wanted information on cooling irrigation water before returning it to the river. Water is about 80F. He had heard about GSHP and thought that some burried pipe would do the trick. Explained that the amount of heat he would have to dissipate is huge (due to the flow) and that it would take more pipe than would be economical given the application. Also discused open trench cooling - not an option in the summer in Grants Pass, Oregon.
10/03/96 Knust, Mark Prudential Real Estate Klamath Falls, OR 541-883-3333	Re: Resource Mark called to find out about the same wells that Karl called about. He is with Prudential Real Estate in Klamath Falls and is Karl Trahan's agent in the sale of the geothermal property in the Klamath Hills area.
10/03/96 Lombard, Dave DOE HQ Washington DC 202-586-4952	Re: District Heating Dave called to find out what our involvement was in the San Bernardino GDH system in the years '82 and '83. Checked with Gene Culver and found that the subcontracting (by us to private engineering firms) for the feasibilty studies was under the DOE program. Called Dave Back and Gave him the info.
10/03/96 Oldemeyer, Neal Boise City Public Works Boise, ID 208-384-3905	Re: Equipment Faxed the some diagrams to Neal as to Don Seehusen project on the pre-heat of outside air.
10/03/96 Oldemeyer, Neal City of Boise Idaho Boise, ID 208-	Re: GSHP Neal called to see if we could help with information on outside air preheat for one of their customers - 1st Presbyterian Church. Has heat pump system. Contact Don Seehusen @208-336-1082,FAX: 384-3905.

10/03/96 Seehusen, Don Boise, ID 208-331-1575	Re: GSHP Called Don Seehusen re the Boise 1st Presbyterian church. Discussed per heat of outside air and methods for coil control and freeze protection. Faxed him diagrams of control methods.
10/03/96 Trahan, Karl Florida 904-278-0517	Re: Resource Karl called to say that the well produces about 50 gpm at 160 F, 8 in. casing. Water rights?, He asked how to place a value on the well for the offer. Told him the only way is to tie it to a use and base the value on the displaced energy.
10/03/96 Trahan, Karl Florida 904-278-0517	Re: Resource Karl called to check on whether we have any information on wells 4183T or 4127T on the O'connor property that they are looking at for the aquaculture project
10/04/96 Allen, Eliot Criterion Engineers Portland, OR 503-224-8606	Re: GSHP Eliot called and asked that we send a GSHP package to: Allan Grant, BC Hydro, E-45, 6911 Southport Dr, Burnabee BC V3N 4X8, CANADA.
10/04/96 Huthinson, Gary Klamath County School Dist. Klamath Falls, OR	Re: Resource Gary at city schools called and asked if we could log the well at the Ponderosa Jr High - its cooler than it used to be. He has already checked for leaks. Logged the well on 10/09/96, temperature was down only a few degrees - advised to continue to use the well and monitor output temperature.
10/04/96 Johnson, Tim PO Box 272506 Ft Collins, CO 80527 970-416-0848	Re: Greenhouses Wants to develop a greenhouse in western Colorado or Nevada. Has the old NOAA maps, asked about new info . Explained our program and the new resouce info - where to get it for CO and NV. Sent green house pubs.
10/04/96 Knust, Mark Prudential Real Estate Klamath Falls, OR 541-883-3333	Re: Resource Gave Mark the data from the database on wells near the O'Connor property 22/aa,27/dd,23/bab,27/ad,35/bb,28/aa,35/ca.
10/04/96 McDougal, Rick Belknap Hot Springs McKenzie Bridge, OR 541-822-3512	Re: Pools Discussed the size of the pools to be heated in the new construction at Belknap Hot Springs: 104x16x4 ft and 134x24 ft, heat loads etc.

10/04/96 Trahan, Karl Florida 904-278-0517	Re: Greenhouses Karl called back with the new plans for 16 greenhouses @ 400,000 Btu/hr ea. 200 gpm+/- @ 50F drop. Suggested that he talk to some drillers about deepening the well before looking into other sources at the Klamath Hills site.
10/08/96 Brophy, Paul EGS, Inc. 4845 Parktrail Drive Santa Rosa, Ca 95404 707-538-2146	Re: Resource Paul Brophy called about getting well info from our data base. Referred him to Toni.
10/08/96 Jalasic, Alan DOE HQ Washington DC 202-586-6054	Re: Space Heating Alan Jalasic called to see if we had been involved in the Hamlin School project in South Dakota. Told him we hadn't, only the Phillip school.
10/08/96 Kang, C.T. ctkang@cris.com	Re: Equipment Response to email: discussed corrosion and scaling in geothermal systems. Explained the common practice of isolating with a heat exchanger. Non-metallic piping, H2S, Chloride and SS materials. Suggested that he look at the web site publications.
10/08/96 Knust, Mark Prudential Real Estate Klamath Falls, OR 541-883-3333	Re: Resource Mark called about the location data on the wells at Liskey Ranch. Explained the township, range section and sub section system used in the database.
10/08/96 Lutsky, Frank COCC Bend, OR 541-383-3786	Re: General Requested a slide show presentation on geothermal energy applications for students from Central Oregon Community College. Place - Geo-Heat Center, Oct 31, 1996 at 1:00 pm.
10/08/96 Schnoor, Jack Jergens Company Ohio	Re: GSHP Returned Jack Schnoor(?) call. He is President of Jergens Co. in Ohio. Discussed a GSHP system for their new plant - 100,000 sq. ft, capital costs, system types, savings etc. Talked about outside air, A/C, no A/C. sent commercial cost study.
10/10/96 Bryl, Don PNW Lab PO Box 999, MS K8-17 Richland, WA 99352	Re: GSHP Donald Bryl referred to us by Doug Cane at CANETA Research. Working on a "decision tool" for building systems GSHP. Wanted the cost study for the numbers on GW systems.

10/10/96 Finn, Donald Geothermal Energy Institute 770 Lexigton Ave. New York, NY 10021 212-888-9000	Re: Resource Don Finn called to ask that we send Aug Bulletin and maps to: Paul Benz, Investors Assoc Inc, 29 Beacon Hill Rd, Chester NJ 07930. and Robert Van Pelt, Prime Corp, 380 Foothill Rd, Bridgewater, NJ 08807.
10/10/96 Henzel, David 714 Hillside Ave Klamath Falls, OR 97601 541-884-1101	Re: Space Heating Discussed downhole heat exchanger configuration to heat two homes. A single loop in the well has a branch to each home with a circulating pump on each branch. Check valve on supply side chatters. The loop tempeature is 150-155F. Requested an evaluation of both systems to determine if the configuration could be improved. Neighbor complained he is not getting enough heat.
10/10/96 McDougal, Phil Belknap Hot Springs McKenzie Bridge, OR 541-822-3327	Re: Space Heating Faxed simple heat loss calculation method to Phil at Belknap for use on the lodge.
10/11/96 Belden, Sara Geothermal Heat Pump Consortium Washington, DC 20004-2696 202-508-5222	Re: GSHP Sara called to ask about some data they have on the Commonwealth Building in Portland. They questioned the COP (high). explained that the preconditioning of the vent air w/o use of the heat pump would increase COP.
10/11/96 Kavanaugh, Steve University of Alabama Tuscaloosa, AL 205-348-1649	Re: GSHP Steve called about a project in Texas which is having trouble (hot loop). Thinking of adding groundwater loop to unload it. Could we participate?
10/11/96 Thomas, Mike Waterfurnace 8215 SW Tualitin Sherwood Rd Ste 341 Tualitin, OR 97062	Re: GSHP Mike called to ask for some pages that were missing from the stuff I handed out at the heat pump sesion at the GRC meeting.
10/11/96 Wright, Richard 59 BC-Remington Blvd Ronkonkona, NY 11779	Re: GSHP Wright is a manufacturer of a replacement, through the wall heat pump set up for ground-source. Looking for money to support the demonstration of the unit. Suggested that he partner with a utility with a lot of motel customers and go after GHPC money. Atlantic Elec?
10/14/96 Morstad, Mike 716 Hillside Klamath Falls, OR 97601 541-882-2715	Re: Space Heating Discussed evaluation of two-home downhole heat exchanger system. Branches to the homes have circulating pumps in each and flow needs to be balanced. Flow controllers installed in each branch should solve the problem. Scheduled inspection for 9:00am 10/16. System shared with David Henzel.

10/15/96 Holmgren, Scott Belmont Hot Springs Box 36 Fielding, UT 84311 801-458-3200	Re: Aquaculture Discussed the use of Belmont Hot Springs, Utah for raising Australian red claw lobsters, tropical fish, 200,000 gal swimming pool, hot tubs and the heating of 4 homes. The 125F springs produces 4000 gpm. Pond sizes are: ten 60'x20', twenty 40'x15' and a channel 3/4 mi by 50' and 10' deep. One spring, 35' deep is also used for scuba diving from Sept to May.
10/17/96 Flynn, Tom University of Nevada LV at Reno Reno, NV 702-784-6151	Re: Aquaculture Tom called to discuss a proposal for a geothermal aquaculture and power plant operated by the university at the Wabuska site. Education and revenue from the plant.
10/17/96 Ganz, Bill Minneapolis, MN 612-997-4263	Re: Equipment He has a piping product that he thought would fit into geothermal DH systems. Told him that we had looked into it and that it was too high cost compared to preinsulated copper. Also the brass fittings could be a problem if exposed to the geothermal fluid.
10/17/96 Kang, C.T. ctkang@cris.com	Re: Electric Power Response to email: passed on the names of the individuals that presented papers on power cycles at the DOE program review, also Ray LaSala @ DOE HQ.
10/17/96 Kang, C.T. ctkang@cris.com	Re: Equipment Response to email: his company (INEX) manufactures a tube product that has very high corrosion resistance. Looking for possible geothermal applications. Suggested that direct use is probably out, but shell and tube exchangers in power applications may be a good place to look. referred him to ORMAT.
10/17/96 Stany, Peter Swedish Trade Council 10880 Wilshire Blvd Ste 1818 Los Angeles, CA 90024	Re: GSHP He is with the Swedish Trade Council in LA. Interested in the market for brazed plate heat exchangers in the US. Explained that they are possible in direct use but most projects use plate and frame due to size and performance. Biggest market is in heat pumps for the refrigeration to water heat transfer.
10/17/96 Wylie, Chris PO Box 3605 Boise, ID 83703 208-343-9656	Re: Resource Was unable to find reference in bulletin article regarding Nepal springs. Found out reference was not listed, found the article in the WGC and sent her a copy.
10/18/96 Talaous, S. TALAOUSS@habaco.com	Re: GSHP Response to email: he heard about us in the Apogee interactive CD on GSHP, was interested in getting more info on cost of commercial systems. Replied that we need a mail address to send it

11/15/96 Carter, Anna Geothermal Education office Tiburon, CA 26241	Re: General Request for information about how projects are constructed. Explained that large projects involve architect, engineer and contractor. Small projects only owner and contractor. Careers in geothermal.
11/15/96 Cionci, Mike 401 Beaumont Circle West Chester, PA 19380	Re: GSHP Residential GSHP, gas available for existing home. Told him that economics aren't great for existing home and gas. Suggested he call utility to see if there are any incentives. Called Mike back with cost of heat values for GSHP vs gas. @ .0681$/kWh and 3.3 COP 6.05$/MMBtu for heat pump and @ .6445$/therm and 90% AFUE, 7.16$/MMBtu for gas.
11/17/96 Eyre, Curtis ceyre@gte.net	Re: Electric Power Please send more info on Geothermal Electricity. Sent him a reply with the GRC URL and also forward message to the GRC.
11/17/96 Grose, Greg A. gregoryg@nv-vb.mingspring.com	Re: Resource Wanted to know if there were any photos of hot springs on the web. Found some URLs with hot spring photos, which were sent to him
11/18/96 Blevins, Susan Energy Resource Associates Alturas, CA	Re: Resource Susan is in the office with a council member from Alturas. Discussed the political situation in Alturas and Susan picked up the data on the springs in Klamath and Lake Co
11/18/96 Vacogen Vacogen@aol.com	Re: Electric Power Looking into Geothermal/Electrical Power Generation. A firm by the name of ORMAT has a pre-packaged power unit. Any leads on how to contact them? Sent them ORMAT's address and forwarded message to the GRC office.
11/18/96 Zhu, Jialing Tianjin Geothermal Research & Training University of Tianjin Tianjin, China fax: 86 22 3358329	Re: General Requested an opportunity to do research on geothermal reservoirs and district heating systems at the Geo-Heat Center. Due to commitments and a previous similar request from an Icelander, suggested she apply to the UNU Geothermal Taining Program in Iceland.
11/20/96 Hawkes, Graham info@suttongrammar.sutton.sch.uk	Re: Electric Power Would like to obtain some information on geothermal power in the US. Would like information on different types of geothermal power plants. Sent him a reply informing him of the GRC library, DOE-INEL, and our direct use webpages.

10/21/96 Disbrow, Jim EIA jdisbrow@iea.doe.gov	Re: General Was wondering if the direct use table entitled "Geothermal Energy Supplied for Major Direct Use Applications, 1993 was the most up to date the GHC had. Sent him the complete updated direct use spreadsheet.
10/21/96 Dyrud, Dave 2025 LeRoy Klamath Falls, OR 97601 541-883-2365	Re: Equipment He has a DHE system that has a "humming" noise. Told him to check the fill valve and see if that is the source of the noise. That would indicate a leak in the system. Discussed pulling the exchanger and replacing the pipe, contractors, time involved, etc.
10/21/96 Trahan, Karl Florida 904-278-0517	Re: Equipment Karl called to discuss the way to heat the water in the tanks. He is afraid that the plate heat exchangers will clog up. Discussed using submerged pipe through which the hot water would be circulated. The results of the calculations for the pipe heating of the tanks: 346 ft for SS and 2315 ft for plastic pipe. Would be practical for the SS pipe.
10/21/96 Stany, Peter Swedish Trade Council Los Angeles, CA 310-446-9154	Re: GSHP Had a long conversation about the application of brazed plate heat exchangers in both direct use and GSHP applications. how big, how many, application considerations (approach, fouling, pressure, materials). Faxed a list of GSHP manufacturers.
10/22/96 Bloomquist, Gordon Olympia, WA 360-956-2016	Re: District Heating Discussed early district heating systems. US Naval Academy - one of earliest (1853). First true DH system was in Shaudes-Aigues, S-France which serves 150 residences, established in 1400s. Article in ASHRAE, CH-95-10-1, 2/8/95.
10/22/96 Hatfield, Nancy RV Manufacturing Harrisburg, Oregon 541-995-8214, x1118	Re: Resource Drilling two geothermal (97F) production wells and one injection well for radiant floor space heating of a manufacturing plant in Burns, Oregon. Wanted to know who to contact for necessary applicatons, processing and permits. For drilling and allocation - WRD, Anita McCloud @ 503-378-8455, x 273 or Dwight French. Injection well permitting - Dick Nichols, DEQ @ 541-388-6146.
10/22/96 Peppersack, Jeff Idaho DWR 1301 Orchard St Boise, ID 83706 208-327-7900	Re: Equipment He called about the heat loss in a stock watering line using low temp geothermal. How much flow does it take to keep the line from freezing. Told him I would run some numbers and get back to him.
10/22/96 Reed, Marshall Office of Geothermal Technologies DOE Washington, DC 20585 202-586-8076	Re: Equipment Referral on a request for funding and assistance on a redevelopment project in Saratoga, Wyoming. Want to install a geothermal snow melt system.

10/23/96 Klingele, Dennis Consulting Engineer Yakima, WA 509-966-5300	Re: GSHP Discussed Oregon tax credits for installation of residential ground source heat pumps. Provided contact with the Oregon Dept. of Energy. Tax credit was extended in 1995 to 1998. Only ground coupled types are eligible for tax credits of up to $1200 in 1996-97 and $1000 in 1998, depending on savings.
10/23/96 Mutchler, Theresa tmutchlerf@aol.com	Re: GSHP Response to email: explained that the economics of GSHP is highly site specific. First cost will always be higher than a standard heat pump. Will savings repay ? GHC can help calculate with sufficient info., advised to check with utility for incentives. Use IGSHPA certified contractor.
10/23/96 Nelson, Art Morrison Knudsen Boise, ID	Re: District Heating Called for information about district heating. His company is doing work in Bosnia. Discussed DH and gave him numbers for IDEA and IEA. Also suggested that he look at chapter 11 in the 1994 ASHRAE book.
10/23/96 Rose, Mike mdrose@mindspring.com	Re: GSHP Response to email: explained about the different types of residential GSHP GW, GC. Concerns with GW - water quality and disposal. Both can do dhw heating. Closed loop piping types. Best applications - new construction, northern climate and no natural gas
10/23/96 Sheridan, Francis Honeywell 2010 Swanee Place SE Olympia, WA 98501 206-236-6077	Re: GSHP Requested assistance with the analysis of using geothermal heat pumps for two high schools in the Vancouver School District. Sent info on design and cost comparison of different types of systems. Also, case histories of using GHPs in other school systems.
10/23/96 Smith, Brian Sterling Grace New York. NY 516-625-1685 ph: 516-686-2213	Re: General His company has a resource in the Coso area. He was looking for possible direct use applications. Discussed direct use in general and some applications - greenhouses, dehydration. Discussed our COST spreadsheet, faxed him the input.
10/24/96 Sheridan, Francis Honeywell Vancouver, WA 206-236-6077	Re: GSHP Discussed the potential for a groundwater system for a school in Vancouver (USA). His company does ESCO work. Gve him data on capital costs, flow requirements. Discussed potential savings.
10/24/96 Trahan, Karl Florida 904-278-0517	Re: Equipment He called to find out how much it would cost to heat the ponds with fossil fuel. At 400,000 Btu/h, 13 tanks and 1500 hr/yr @ 70 % it would be about $60,000/yr for gas.

10/25/96 Boehner, Brad 11670 N 15 E Idaho Falls, ID	Re: GSHP Residential GSHP, 4000sq. ft. Discussed gwhp, gchp, and capital costs. Cost of heat for propane, elec resistance and gshp.
10/25/96 Sheridan, Francis Honeywell Vancouver, WA 206-236-6077	Re: GSHP More discussion of GWHP for high school. Ventilation issues, vertical GC, GW, regulatory,efficiency. Suggested that he check with the groundwater regulatory folks.
10/28/96 Moore, Alex PERI 1700 Rockville Pike, Suite 550 Rockville, MD 20852 361-468-8428	Re: GSHP Requested assistance with technology characterization of ground source heat pumps. Sent GSHP case studies and cost containment reports. Also, wanted GHC to act as a peer-review for the strawman on the technology characteristics.
10/28/96 Smith, Brian New York, NY 516-686-2213	Re: Industrial Discussed dehydration process with Brian Smith. Talked about what is included in the COST spreadsheet analysis. Suggested that he call Les Youngs in CA about the resource on his property.
10/29/96 Ait-Laoussine Taj TALAOUSS@habaco.com	Re: GSHP Response to email: he was looking for metered data for GSHP. Explained that all the data we have is on the disk in the back of the report that I sent him. Most of the cases in the report had no data or poor data.
10/29/96 Beeland, Gene P.O. Box 85 Buxton, NC 27920	Re: General For the Geothermal Progress Monitor, Gene requested the GHC 4th quarterly progress report and Bulletins Vol 17, 1&2.
10/29/96 Bowers, Steve Elko County School District Elko, NV 702-738-5196	Re: Equipment Steve called to ask about how to locate a leak in the plate heat exchanger serving their system (Elko School Dist). He has already isolated each side and pressure tested to verify leak. Told him the only way I know is to disassemble the unit and back light each plate to expose the perforations.
10/29/96 Brown, Brian Consulting Mechanical Engineer Ft Klamath, OR 541-783-3347	Re: Equipment Called Brian to get cost data on the city's geothermal snow melt system. First 3 blocks - $100k. Pipe only about 1$/sq. ft, 4 to 6 $/sq. ft for the whole thing.

10/29/96 Kenny, Mike Brothers West Aquaculture Klamath Falls, OR	Re: Aquaculture Mike stopped by to pick up the publications and discuss the project.
10/29/96 Reed, Marshal DOE HQ Washington, DC 202-586-8076	Re: Equipment Called Marshall Reed at DOE to ask how to respond to the snow melt system design info he sent us. Said they don't have a funding mechanism for this type of project....asked us to respond with design comments.
10/29/96 Strasser, Gerhard sarvam@arrakis.es	Re: Pools Inquiry on our www home page - wanting information on how to connect a Japanese bath (spa), sauna, etc. for his "friends - community". Sent information on spa journals and contact in Spa, Belgium.
10/29/96 Troy, Patrick Ireland troy@indigo.ie	Re: GSHP Response to email: advised that we have quite a bit of information on GSHP in the US. Must be sent through the mail though. Suggested that he look at our web site for list of pubs.
10/30/96 Al-Enezi Ahmad 3100 SE 168th St #3 Vancouver WA 98683 labuser@uofport.edu	Re: GHSP Response to email: student at Portland state working on a GSHP project. Needs residential design info. Referred him to Steve Kavanaugh for his residential book. Sent our heat pump package.
10/30/96 Bartlett, Charles PMPC Consulting Engineers P.O. Box 370 Saratoga, WY 82331	Re: Snow Melting Discussed a proposal for a snow melting system in Saratoga, Wyoming. With 100F fluid available, the use of a plate-and-frame heat exchanger to transfer heat to an antifreeze solution, would permit the use of plastic (PE) piping. Explained the Klamath Falls system for sidewalks which cost about $6/sq. ft.
10/30/96 Svanavik, Lars 1932 Portland Klamath Falls, OR 541-884-4346	Re: Equipment Lars stopped by to ask about replacing the expansion tank on his system. Discussed system pressurization and tank types.
10/31/96 DeClerk, Al aldeclerck@aol.com	Re: GSHP Response to email: discussed the application of snow melting for GSHP residential. Gave him typical output and water temperature values (165 Btu/hr sq ft and 130 F) for his location. Explained that for his driveway this works out to about a 20 ton heat pump. Driveway load occurs at the same time as space heat requires separate heat pump and much longer loop. Annual energy problem - about 900$/yr in this case. Not a great application.

10/31/96 Wisian, Ken wisian@passion.isen.smu.edu	Re: Resource You can find a *.wpg file of the surface heatflow map of the US at anger.isem.smu.edu/pub/heatflow.wpg for anonymous ftp. Per conversation with David Blackwell.
11/01/96 Chitwood, Rick Chitwood Energy Services Mt. Shasta, CA	Re: District Heating Rick called to discuss the Alturas schools project. He is on the committee that is trying to sort things out and get the system going. Discussed disposal and system controls. District has settled with the contractor but probably didn't get enough money to get the system straightened out.
11/01/96 Patrick, Troy Ballinakill,Newtownshandrum, Charleville County Cork Ireland troy@indigo.ie	Re: GSHP Response to email request: discussed the status of GSHP in the US. Performance where they work best, US climate considerations. US electricity costs and natural gas competition
11/01/96 Peake, Roger California Energy Commission 1516 N 9th St Sacramento, CA	Re: Space Heating Roger needs the binder for the Hoxey project in Northern CA. He is meeting with their atty this week.
11/01/96 Simpson, Stu Washington Dept of Gen. Admin. Olympia, Wa 360-902-7199	Re: GSHP Stu called to ask about a groundwater system for a school in Moses Lake, WA. Looks like it is the lowest life cycle cost, but he is worried about water flow requirements. Sent him part of the GW chapter from the new book.
11/04/96 Smith, Brian P.O. Box 163 55 Brookville Rd. Glen Head, NY 11545-0163 516-686-2213	Re: Greenhouses This consultant is developing plans for building geothermal greenhouses near Coso Hot Springs, CA. The steps involved in the development of a direct heat project were discussed. Several examples which included technical as well as permitting aspects of a project were sent to him.
11/05/96 Garland, William 2100 A Salt Springs Rd. McDonald, OH 44437 (330) 530-6518	Re: Heat pumps Would like some information on geothermal heat in Ohio. Sent him a heat pump packet.
11/05/96 Hanson, Harry Maryland Geological Survey 2300 St. Paul Street Baltimore, MD 21218 40-554-5554	Re: Aquaculture Discussed groundwater characteristics - water quality, temperature and yield characteristics for raising tilapia and cat fish. The survey is investigating areas in Maryland for developers interested in aquaculture projects. Sent "Inland Aquaculture Handbook" by the Texas Aquaculture Assoc. which discusses many of the questions posed by Mr. Hanson.

11/06/96 Konkolewski, Karen 16616 Sioux Lane Gaithersburg, MD 20878	Re: General Requested information on geothermal energy for an oral report.
11/06/96 Phetteplace, Gary US ARMY Cold region Lab gephet@crrel.usace.army.mil	Re: District Heating email to Gary about a message I saw on the HOLLY (district heating listserv) about the UC Davis folks looking into infared thermography. Suggested Gary send them some input since he knows something about that technology.
11/06/96 Rogers, John Indian Health Services 2201 6th Ave RX 24 Seattle, WA 206-615-2454	Re: GSHP Long conversation about the application of GSHP to medical clinics on Indian reservations. Mostly cold climates, no natural gas. Discussed capital costs, savings, hole construction, grouting, etc.
11/06/96 tarv tarv@portup.com	Re: GSHP Response to email: explained that the economics are impossible to characterize generally and depend on the home, local electricity rates and rates for competing fuels. Best in no gas areas and with new construction. Check with utility for incentive. Need address for heat pump package of info.
11/07/96 Goetz, Norman norman.goetz@reed.edu	Re: Electric Power Response to email: reiterated my comments to John Bigelow about the use of a low head hydro turbine to drive the compressor of a heat pump. Low load factor, thus poor economics. Open compressor - shaft seal leakage, non off the shelf equipment. Better to just generate power.
11/07/96 Keating, Dave dkeating@eia.doe.gov (202) 426-1297	Re: General Transfered the file "dudb96.wb2" to the ftp site 198.76.0.3/Info1/ftp/pub/temp for Jim Drisbrow. Worked with Dave Keating to transfer file.
11/07/96 Lewis, Jim Lewis Aquaculture Lakeview, OR 541-947-3979 jimmy@talltown.com	Re: Aquaculture Request for database info on sites in Lake County, OR.
11/08/96 Goetz, Norman Norman.Goetz@reed.edu	Re: Space Heat Response to email: turns out that his project is not the same one as John Bigelow was involved in. This project has a 120 F waste water source from a hot spring. Explained that it was possible to use the waste water directly without a heat pump and reduce costs (both operating and capital) no problem to insulate the line to reduce heat loss.

11/08/96 Hammerstead, Herman	Re: GSHP Discussed the possibility of installing a geothermal heat pump to heat a swimming pool in southern California. Referred to Kevin Rafferty - he will e-mail.
11/08/96 Lewis, Jim Lakeview, OR jimmy@talltown.com	Re: Resource Sent an e-mail with the Oregon Database as an attachment. Also place them within our website.
11/12/96 Chitwood, Rick Consulting Engineer Chitwood Energy Services Mt Shasta, CA	Re: Equipment Rick called to ask about cooling ponds to lower the temperature of the schools effluent prior to discharge to the storm sewer system. Sent him our HEATOOLS spreadsheet.
11/12/96 Gale, Jim Pacific Clutch and Brake North 1124 Freya St Spokane, WA 509-535-4696	Re: GSHP Discussion about residential GSHP. New home - contractors, 1 system or two, equipment, costs.
11/12/96 Goetz, Norman Norman.Goetz@reed.edu	Re: Space Heat Response to email: explained that radiators are not the best choice at the available temperature. A small fan coil unit would be the best. Due to the temperature it would not be possible to protect it with an isolation heat exchanger. Freeze protection would be better done by maintaining flow than by draining the line.
11/12/96 Green, Ken BCS Sacramento, CA 410-997-7778	Re: General Discussed potential export of U.S. products and service to developing countries regarding geothermal direct use applications. Suggested he get in contact with David Anderson, GRC with respect to electric power plant hardware. This service is being provided for the California Energy Commission.
11/12/96 Kendall, Mark ODOE Salem, OR 503-373-7809	Re: GSHP Called Mark Kendall to discuss the treatment of heat pumps in the tax credit system. He knows about the screwy termionology in the rules hopes to change it next time around. GW could be considered if using an injection well.
11/13/96 Blake, Thurman 54015 Ave. Juarez LaQuinta, CA 92253 619-564-0418	Re: Greenhouses Discussed purchase and rebuilding of greenhouses near Newcastle, Utah. Wanted to know if there was any financial assistance available. Told him he need to contact Economic Development agencies in Utah. Also, discussed potential developments in the Klamath Basin for greenhouse and aquaculture projects. Explained Oregon financial possibilities and tax credits.

11/13/96 Hennick, Ron P.O. Box 1079 Mt. Shasta, CA 96067 916-926-5794	Re: Greenhouses In the GHC office to look at resource maps of the Klamath Basin and other areas of Oregon. Interested in a geothermal site to build greenhouses to raise hydroponic tomatoes. Also, discussed potential sites in northern California.
11/13/96 Olson, Dave Honeywell 272 Van Buren Ste C Eugene, OR 541-968-3362	Re: GSHP He called to discuss the potential for a heat pump system at a school in Vancouver. Went over similar information with him as with Sheridan. Evidently this guy is further up the ladder from Sheridan.
11/13/96 PBassLo PBassLo@aol.com	Re: GSHP Response to email: advised that disconnecting the safety controls always involves potential either to the unit or to the owner. Suggested that they install old fashioned mechanical controls and wire in series with the compressor contactor.
11/14/96 Blevins, Susan Energy Resource Associates Alturas, CA	Re: Resource She is working on a project to evaluate the impact of natural spring flow on water quality in the Klamath Basin. Needs database output with Chemistry for Klamath and Lake Co.
11/14/96 Carter, Anna Geothermal Education Office Tiburon, CA	Re: Equipment Anna is working on a slide show and needed some visual stuff on plate heat exchangers. Gave her contact names for the manufacturers: APV, Tranter, Alpha Laval, and Graham.
11/14/96 Goetz, Norman norman.goetz@reed.edu	Re: Space Heat Response to email: discussed the availabilty of coils with corrosion resistant tubes. Explained that they are available but very expensive - cheaper to just use the standard copper coils and replace as necesssary. "Cupro nickel" is a waste of money for H2S problems.
11/14/96 MacKenzie, Connie Total Health & Wellness Resorts 743 Corydon Drive Huffman, TX 77336 281-324-7126	Re: GSHP Discussed the installation of a geothermal heat pump for a new resort and cabins. Explained the different types of heat pumps - groundwater, ground coupled and pond loops. Provided a contact in Texas with experience installing GSHPs and sent information on the technology.
11/14/96 Theis, Kristi NREL 1617 Cole Blvd. Golden, Co 804011 303-275-3652	Re: General Requested a review of geothermal direct use information that will be posted on the DOE Office of Geothermal Technologies web site. Also, requested the direct use project database.

11/20/96 Koldjeski, John 1400 Stringbean Alley Sutter Creek, CA 95685 9717	Re: Resource Called about his property in Cedarville - what can he do with the resource? Discussed resort, RV park and how to heat trailers. 60 gpm @142 F.
11/20/96 Westbrook, Edwin 7913 Claudia Drive Oxon Hill, MD 20745-1417 301-839-3302	Re: GSHP Discussed the use of a geothermal heat pump for a new home being built in Maryland. Suggested the handbook on residential systems, "Ground and Water Source Heat Pumps". Provided a survey of costs for installed systems and a isting of contacts and dealers in the Maryland area.
11/21/96 Ferbend, Eileen ebferbend@worldnet.att.net	Re: General Response to email: request for information on the software that is listed on the DOE web site. Advised that we don't really have any information other than the documentation that goes with the software. Also mentioned that the software is intended for engineersand for use with direct use geothermal.
11/21/96 Hodgson, Susan California Division of Oil and Gas Sacramento, CA 916-323-2731	Re: General Discussed several articles on the direct heat use of geothermal for the GRC Bulletin. Provided articles on collocated resources, cost evaluation, Klamath Falls district heating system, OIT geothermal heating system and information on an interactive project map for the web.
11/21/96 Kenny, Mike Brothers West Aqua Klamath Falls, OR 541-883-1314	Re: Aquaculture Mike called to ask about heating the air in the greenhouse instead of the water. They don't want to put any pipe in with the fish. Told him I didn't think it was a good idea - too indirect but I would make the calculation. Advised that it would result in high equipment costs.
11/22/96 Morehouse, Dan EWEB 500E 4th Eugene, OR 97440	Re: GSHP Dan called to ask abou the design for a commercial GSHP system for an office building. Discussed loop length and importantce of pumping energy. Sent Commercial GSHP pubs.
11/25/96 Coulter, Andrew Nature Conservancy 2589 Main, No. 200 Lander, WY 82520 307-332-2971	Re: GSHP Discussed using a 70 deg F well using a heat pump to supply an institutional type building space heating and cooling. Discussed the different types of technologies that could be applied and sent a packet of information.
11/25/96 Duncan prosolv@pacbell.net	Re: Greenhouses Response to email: explained the Geo-Heat Center services and our publication on greenhouses. Advised that he check our website.

11/25/96 Goldstein, John Plants Unlimited 16450 Kent Ave San Lorenzo, CA 94580 510-276-2384 (2383FAX)	Re: Greenhouse He operates a greenhouse (1 a) in San Lorenzo. Has an option on real estate in Byron, CA (w of Stockton, S of Sac, E of Livermore), property has wells and springs. They want to put up another 100,000 sq ft of greenhouse. Advised that he should determine flow from the existing wells and springs. Well test. Pump companies. Quick calc for 350 gpm @ 35 drop for the 100k sq ft.
11/25/96 Havalina, Bill Century 21 Real Estate Klamath Falls, OR 97601 541-882-2121	Re: Resource Discussed a well used by a groundwater heat pump to heat and cool two homes. Wanted to know permit requirements for disposal of water. Referred to the Water Master.
11/25/96 Klochko, Chad 24792 Pennie Deerborn Heights, MI 48125	Re: General Requested information on geothermal energy for a speech, 8th grader, needs visual aids. Sent some bulletin articles, and some brochures.
11/25/96 Kreek, Michael gtc@sover.net	Re: GSHP Response to email: explained that the software is not downloadable and under revision. Also that it is not suitable for ground source heat pump systems, only direct use.
11/25/96 Lowe, Ronda Global Restoration 921 West 3rd Meridian, ID 83642 208-888-3196, fax: 208-884-4784	Re: Resource Discussed appraisal of property with geothermal potential at Crane Creek, near the Weiser area. Explained that an application is necessary that requires a specified temperature and flow rate to determine the value. Referred to a professional appraiser that has had experience of appraising a well for space heating school buildings.
11/25/96 Ritz, Regina Integrated Designs 202 West Street Sausalito, Ca 94965 idesign@nbn.co-m	Re: GSHP Requested free information and a directory of GHP installers with networking links. Provided IGSHPA link of installers. Also, requested feedback on a landscape architect's resource page - provided her Toni Boyd's address.
11/25/96 Theis, Kristi NREL 303-275-3652	Re: General Could you put the Hot Lake gif file back on the webpage so we can copy it again.
11/26/96 Cohen, Josh Innerquest Wilderness Adventures 1001 Bridgeway Ste 455 Sacremento CA 94965 415-289-0100	Re: Resource He runs a company that specializes in trips to remote hot springs in CA. Wanted to know locations of springs in CA. Suggested that he contact Les Youngs or geologists with the BLM.

11/26/96 Kenny, Mike Brothers West Aqua Klamath Falls, OR 541-883-1314	Re: Aquaculture Called Mike and told him that it would require about low 90's air to maintaain the tanks at the right temp.
11/26/96 Victory, Brenda P.O. Box Porter, OK 918-483-4306	Re: GSHP Discussed using and existing well to supply a groundwater heat pump to a new home. Suggested she have water chemistry analyzed for corrosion and scaling properties. If fouling is a problem, may have to go with ground coupled system. Sent information on GHPs and directory of installers in area.
12/02/96 Kanoglu, Mehet (702) 784-1701	Re: General Would like information regarding Pollution Emissions. Found some information in our library, sent him a fax containing the information also sent him the GRC library webpage URL, to search.
12/02/96 Blevins, Susan Alturas, CA	Re: Aquaculture Discussed bio-filters for geothermal discharge from aquaculture projects.
12/03/96 Brown, Brian Consulting Mechanical Engineer Ft. Klamath, OR 541-783-3347	Re: Space Heating Brian called about energy use in the Klamath County Court house. discussed values from references ASHRAE 42,000 Btu/sqft yr, 32,600, 42,000x0.7 (accounting for eff) = 29.9k - use 30,000 Btu/sqft yr.
12/03/96 Kissock, John jkisssock@engr.udayton.edu	Re: GSHP Response to email: advised him that design information for GSHP is available in the ASHRAE handbook of Applications Chapter 29 and also from commercial software companies. Provided numbers for IGSHPA and Kavanaugh.
12/03/96 Ramos, Mark 28 Federal Street Blackstone, MA 01504 508-473-8200	Re: GSHP Discussed the installation of a ground source heat pump for a new home. Explained the the three technologies and suggested he contact an experienced installer in his area. Also, suggested he contact his local electric utility for any rebates of low cost loans available.
12/03/96 Whitehall, Paul mchill@aol.com 800-841-6184	Re: Electric Power He has some surplus equipment from one of the Geysers plants (East Geysers) H2S abatement system (Stretford) and condenser water circulation pumps (33,000 gpm) - looking for a buyer.

12/04/96 Cengel, Yunus Prof. University of NV Reno, NV	Re: District Heating He called looking for information on district heating in Nevada for residences. Discussed metering and flow limitation.
12/04/96 Ebbage, Roger Lane County Community College Eugene, OR	Re: General Roger called to set up the schedule for their visit this Feb. they can do it either the 3rd or 5th - will call back.
12/04/96 Goldstein, John Plants Unlimited California 510-276-2384	Re: Greenhouse Discussed solar/geothermal for their greenhouse - told him it wouldn't pencil out. Discussed the prospect of peaking with fossil fuel - nat. gas may be available at the site. Explained that system could be designed for 50% of the peak and still get 90 -95%+ of the annual. Their costs last year were .55 $/sq ft at 63 F for glass w/plastic.
12/05/96 Janavicius, Jason University of Nevada Reno 2990 Tierra Verde W. Reno, NV 89512 702-784-6468	Re: District Heating Discussed energy metering and system components for a new 15,000 single-family residential geothermal district heating development in the Reno area. The resource being considered is in the Steamboat area and the development would take place at the junctions of Mt. Rose highway and highway 395.
12/05/96 McDougal, Phil Belknap Hot Springs McKenzie Bridge, OR 541-822-3512	Re: Equipment Phil said that the heat exchanger that WESCOR delivered was designed for 70 gpm instead of 35. What will happen if they feed it just 35 gpm. Told him I could run it on the HEETX spreadsheet but the manufactures program would be more accurate.
12/08/96 Dale, Fred 105 Doswell Ct. Ocean Springs, MS 39564 (601) 875-6489	Re: Resource Comment - need comprehensive list of hot springs in US. Sent a reply for several web sites, plus referred him to our direct use project map.
12/10/9 6 Brandsness, Andy Attorney of Law 411 Pine Klamath Falls, OR 97601 541-882-6616	Re: Resource Discussed an injection well at a residence which does not accept water. Explained possible reasons. Recommended he get an estimate from a local well driller for reaming and cleaning the well and a HVAC contractor to improving the heating system in the home.
12/10/96 Brieske, Steve sbrieske@aol.com	Re: District Heating Discussed geothermal heating for a new residential area near Sedona, Arizona. Explained geothermal direct-heat applications and heat pump technologies. Offered the GHC technical assistance program.

12/10/96 Idzior, Ashley 4591 N. M-13 Pinconning, MI 48650	Re: General Would like information about geothermal energy. Have a class project where we need to present geothermal district heating with a model, report and poster. Sent a couple of bulletins, plus some drawings to help them. Received a reply - thank you for the material.
12/12/96 Johnson, Eric Reno Gazette Journal Reno, NV 702-788-6328	Re: District Heating Discussed development of a massive geothermal district heating system (30 million sq. ft or 522GWh/yr) near the Steamboat area. Explained development and cost to consumers for district heating systems in Klamath Falls.
12/13/96 Pernell, Howard 919 Newcastle Klamath Falls, OR 97601 541-884-6580	Re: Space Heating Inspected a geothermal home heating system that utilizes a downhole heat exchanger and a ceiling radiant type system. The heating system is apparently working ok, the well may have had materials from the wall fall into the well and block the producing zone. Recommended the owner not use temperature setbacks to see if the well continues to maintain temperature in the home. He may need a driller bail the bottom of the well.
12/13/96 Potter, Kevin NREL Washington, DC 202-651-7530	Re: General Discussed growth projections of geothermal direct use applications. He is considering the role of renewables based on restructuring of the electric utilities. Starting with known installed capacities for 1995 growth rates were projected out for every five years to the year 2000. Assumptions applied were: (1) natural gas prices welll remain low, (2) no government incentives and 522 GWh/yr geothermal district heating system will be installed in Reno, Nevada by the year 2000.
12/13/96 Yoshida, Tak 1526 SE Powell Blvd. Portland, OR 97242 503-238-0230	Re: Resort Discussed development of geothermal direct use project at Home Valley, WA. A well was completed this fall that produces 300 gpm of 150F geothermal fluids. A Master Plan for resort/spa, Condos/retirement facilities, greenhouses and aquaculture is to be developed. Discussed type and size of pipe to deliver fluid from well site to a 350 ft elevation development site.
12/16/96 Baumgartner, Bob Clifton, VA baumgart@pipeline.com	Re: GSHP Discussed temperature setback for a residential geothermal heat pump system. The amount of energy use during recovery is dependent on the thermostat slowly "ramps up" to normal temperature or resets immediately. If it is the type that slowly brings the temperature back up (thereby eliminating the use of resistance heat) set back will save energy and money. If the thermostat is the older type, it is recommended to leave the temperature at one setting
12/16/96 Busino, Brad 950 St. Davids Lane Niskayuna, NY 12309 518-377-7695	Re: GSHP Discussed the types of geothermal heat pumps, installation costs, performance, hen the technology started and the number of units installed per year. Sent a packet on geothermal heat pumps.
12/16/96 Cartwright, Michael 5 Llaret Court Reno, NV 89512 702-322-9028	Re: Resource Discussed land exchange with BLM in Riverside County California with prospective development for geothermal direct use projects. The exhcange involves 58 sites, the largest of which is 640 acres. Discussed criteria for development of geothermal applciations. Provide direct use Guidebook and database of thermal wells and springs for Riverside County.

12/16/96 Henderson, Tom NV state Public Service Commission Nevada	Re: District Heating Questions about standards for construction of district heating systems. Discussed the nature of piping construction, materials, pressures. Told him that there are no special standards that I know of.
12/16/96 Lang, Michael P.O. Box 1473 Ennis, MT 59729 406-682-4793	Re: Space Heating He is buying a hot spring near Ennis, MT, Montana Rose greenhouse. Two properties, one on either side of the highway. One has rights for 50 gpm the other for 350 gpm. Discussed what could be done with the resource - district heating , resort, greenhouse, pool. Loads and heat available. Suggested that the higher flow for the same price ($500k) would be the way to go.
12/16/96 Maus, David Texas 713-339-6000 281-339-3336	Re: Aquaculture David is building a thermal refuge for the ponds -needed the design info for the water diffuser. Faxed him the sparger design info.
12/16/96 Trahan, Karl Florida	Re: Aquaculture Karl called to say that the pump outfit couldn't get into the bottom 50 ft of the well - said the casing collapsed. Other well is 900 gpm @160 F at the Klamath Hills site.
12/16/96 Trahan, Karl Brothers West Aquaculture Klamath Falls, OR	Re: Aquaculture Karl and partner in office - discussed piping, heating systems, well, flow requirements and cost of the 3000 ft line. Explained that the cost of the line would pay for a lot of well workover. Showed them material costs for the piping - about twice what they thought. They had a quote for bare steel. Explained about external corrosion.
12/18/96 Vaarala, Jha FINLAND tmi@juhav.pp.fi	Re: GSHP Response to email: explained that I couldn't tell from his earlier message what kind of system he was interested in. Gave him std. US terminology.
12/19/96 Blythe, Bob INEL blythrl@inel.gov	Re: General emailed him to ask that a change be made to the website where our software is listed announcing that the stuff is not for ground source heat pump systems and is intended for use by engineers.
12/19/96 Knaak, Carl vickanid@eonet.com	Re: General Response to email: advised that our software is designed for use by engineers for direct use, not heat pump systems. briefly described HEETX and DHE.

12/19/96 York, Michael 965 Swan Horshoe Rd Big Fork, MT 59911 406-837-3422	Re: Greenhouse He has a 128 F resource in western Montana. 1200 gpm. Wanted copies of bulletin V9#2 and V12#3. Greenhouse heating. Discussed water chemistry: pH 9.5, Cl 55 ppm, Na 198 ppm, and TDS 388 ppm.
12/20/96 Enge, Janet Durango, CO 970-259-8512 (FAX)	Re: General She was writing an article for the local newspaper on geothermal. Needed some info for background. Explained the size of geothermal energy compared to wind and solar (and other Bozo technologies), She was surprised that geothermal was the biggest. Sent her som references DOE/EIA report tables.
12/20/96 Sachs, Harvey GHPC sachs@ghpc.org	Re: GSHP Response to email: advised Harvey that unitary heat pump systems are not a good match for max. security prisons because the design is based on keeping the mechanical equipment outside the security line. All are central plants.
12/20/96 Vaarala, Juha FINLAND tmi@juhav.pp.fi	Re: GSHP Response to email request: he is interested in groundwater heat pumps but has very low water temperature and is concerned about freezing in the evaporator. How do we deal with this? Told him that water temps in the US are such that we don't usually have the problem of freezing. Told him we would use closed loop if the temperature was very low. Suggested that he contact some folks in Canada - Ontario Hydro.
12/23/96 Brown, Brian Consulting Mechanical Engineer Ft Klamath, OR 541-783-3347	Re: Equipment Brian called about how to calculate the lateral requirements fot the pump at the Klamath County Jail - vendor is telling him some small numbers. Went over the procedure. Key assumption is that all the column expansion occurs before any shaft expansion. Manufacturer knows more about the relative rates evidently.
12/25/96 Alexopoulos, Lambros 1957 Bretton Lane York, Pennsylvania 17404 717-764-9058	Re: GSHP He is part of a group that will be constructing a church in Mount Holly Springs, Pennsylvania. Would like to research every option we may have in the way of heating this building. Sent him a Heat Pump packet.
12/26/96 Rudd, Van 450 Laguna Klamath Falls, OR 97601 541-882-1446	Re: Resource Geothermal well with DHE installed cooled from 190 - 130F slowly. Advised soughing problem and gave names of local plumbers and well drillers. Advised to pull coil and bail out the well. Geothermal well was drilled in 1952 to a depth of 290 ft @ 200F.
12/27/96 Weber, Pete 900 Thoroughbred Trace Sugar Hill, Georgia 30518 770-945-0489	Re: GSHP Comment - I would like to know more about geothermal heating and cooling. Recently moved to Georgia and now have a heat pump. Works fine until temp. drop below 45 F. Would like to know more about geothermal heat. Sent him a heat pump packet.

12/30/96 Briggs, Ed CEBriggs@aol.com	Re: Aquaculture Response to email: advised that our prawn project was terminaated about 15 yrs ago, but we can send him all the reports that are currently in print.
12/30/96 Hill, Richard 331 E Liberty Reno, NV 89501 702-348-0888	Re: Industrial Called Richard Hill in response to his email on geothermal use in the brewing process. He is going to build a micro brewery in Reno, has a hot well - how to integrate it into the process? His family built the original Peppermill Casino, which is geothermally heated.
12/30/96 Hoeflich, John 1984 Laurel Avenue Redding, CA 96001-3139	Re: Electric Power Discussed hot dry rock resources and pointed out the research and work at LANL. Also discussed HDR well depth, plant size and pollution emissions.
12/30/96 McLarty, Lynn princeton@usa.pipeline.com	Re: District Heating Response to email: provided the contact phone numbers for 10 geothermal district heating systems and 3 pipe manufacturers.
12/30/96 Mechler, Dean mechler@nwiowa.com	Re: GSHP Response to email: advised that the length of the loop is a function of the building size type, climate, heat pump eff, type ground coupling and soil. For contractor in your area check IGSHPA web site.
12/30/96 Strong, Larry Green River Developing 39006 244th Ave SE Enumclaw, WA 98022	Re: GSHP He is a contractor in WA. Wants to get into GSHP - commercial. Explained that almost all commercial jobs are vertical. Since he is an excavating contractor, residential would be better. Discussed system types training etc. Suggested IGSHPA.

3.0 R & D ACTIVITIES

The direct use research and development objectives are to aid industry in resource and technical development problems. To investigate and analyze methods or approaches to reducing the cost of designing, developing and operating low-temperature geothermal projects. The following is executive summary of work recently completed on greenhouse peaking:

3.1 FOSSIL FUEL-FIRED PEAK HEATING FOR GEOTHERMAL GREENHOUSES

Executive Summary

Heating of greenhouses is one of the largest uses of low-temperature geothermal resources. In most cases, the existing projects use the geothermal heat in systems which supply 100% of the peak and annual heating requirements. As these facilities expand, some operators may encounter limitations in either the production or disposal of the geothermal fluids. Such flow restrictions can result in the necessity of operating new facilities (at lower temperatures) using effluent from the existing developments.

From an engineering standpoint, the obvious strategy is to select heating equipment (fan coil units or unit heaters) which perform well under low-temperature conditions. Unfortunately, this type of equipment is not acceptable to many growers, particularly cut flower and bedding plant operators. These operators prefer the so-called bare tube system in which the hot water is circulated through small diameter plastic tubes located under or adjacent to the plants. These systems are low cost, easy to install and unencumbered by the necessity for fans to circulate the air. On the negative side, however, they require substantial quantities of tubing to provide 100% of the heating needs at low outside temperatures.

This report explores the cost of installing and operating a fossil fuel-fired (propane or fuel oil) peak heating system designed for 20 to 50% of a greenhouse peak heating load.

Due to climate related temperature occurrences, it is possible to design a geothermal system for only 50% to 60% of the peak heat loss of a greenhouse and still meet well over 90% of the annual heat energy needs of the structure. This is a result of the fact that the coldest outside temperature (for which heating systems are normally designed) occur only a few hours per year. The bulk of the hours in a typical heating season occur at roughly halfway between the minimum temperature and the temperature maintained inside the greenhouse. As a result, a down-sized geothermal system is able to satisfy most of the annual heating requirements.

Two broad approaches to installing a peaking system are individual unit heaters or a central boiler. The unit heaters, because of the large number of individual pieces of equipment, tend to result in a higher capital cost for a given heat output than the boiler approach.

The boiler design, on the other hand, results in higher fuel cost in a given application than the unit heater system. This is a result of its incorporation into the heating loop and its negative impact on the capacity of the geothermal heat exchanger during peaking. The unit heaters, since they are a separate system, do not influence the capacity of the geothermal system during peaking.

Figures A, B and C provide information on the costs (ownership, maintenance and fuel) associated with the operation of a fossil fuel (propane and fuel oil) fired peaking system in three different climates assuming a 60° temperature in the greenhouse. In general, the propane fired boiler system is the least total cost system for most applications due to its low installation cost. Only in the coldest climate (Helena, MT) where fuel consumption (rather than equipment cost) is the dominant cost factor does an other system (oil boiler) provide for least cost.

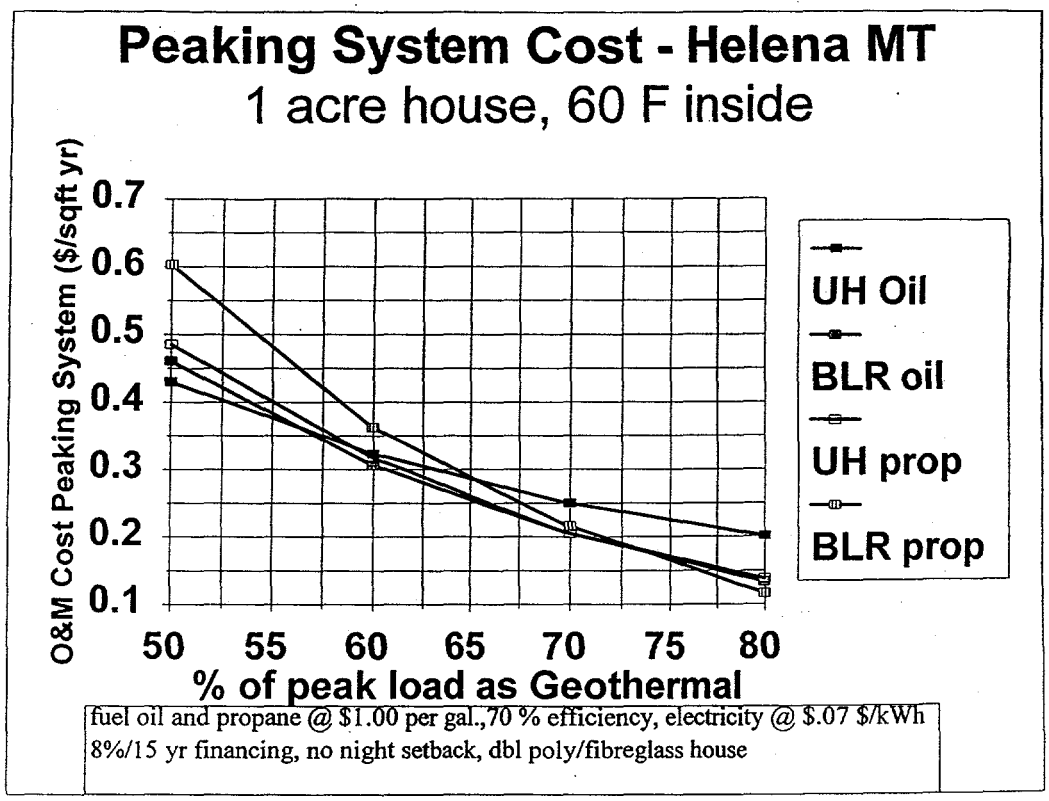

Figure A.

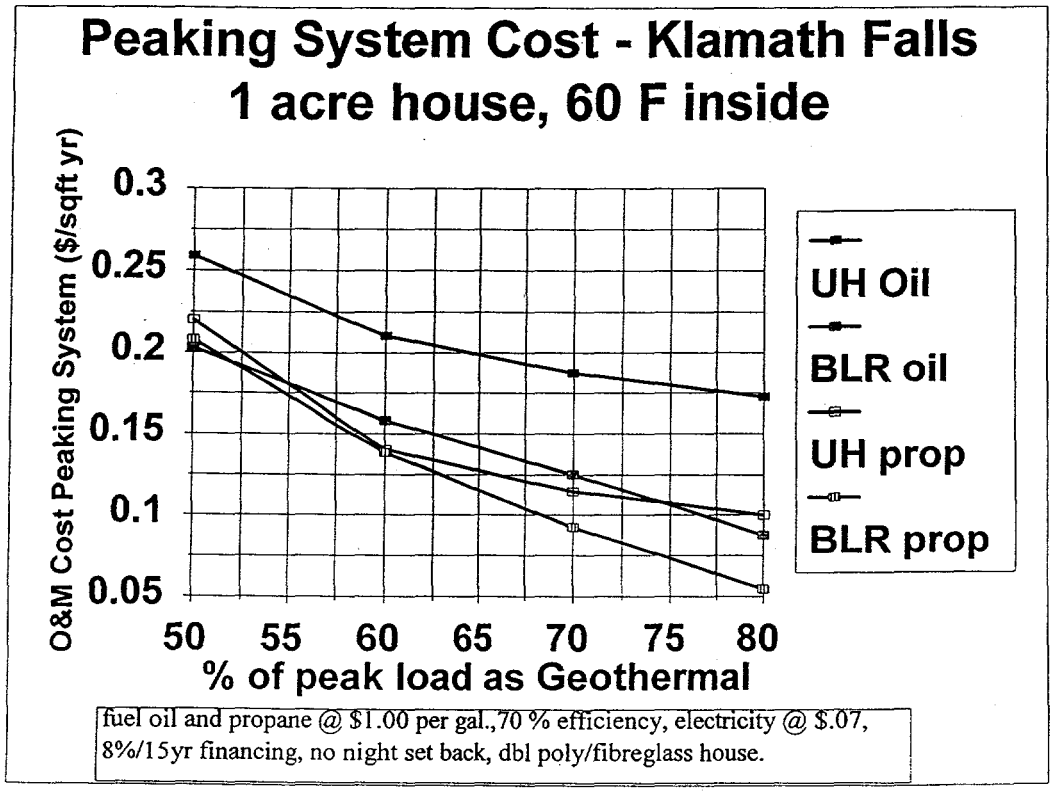

Figure B.

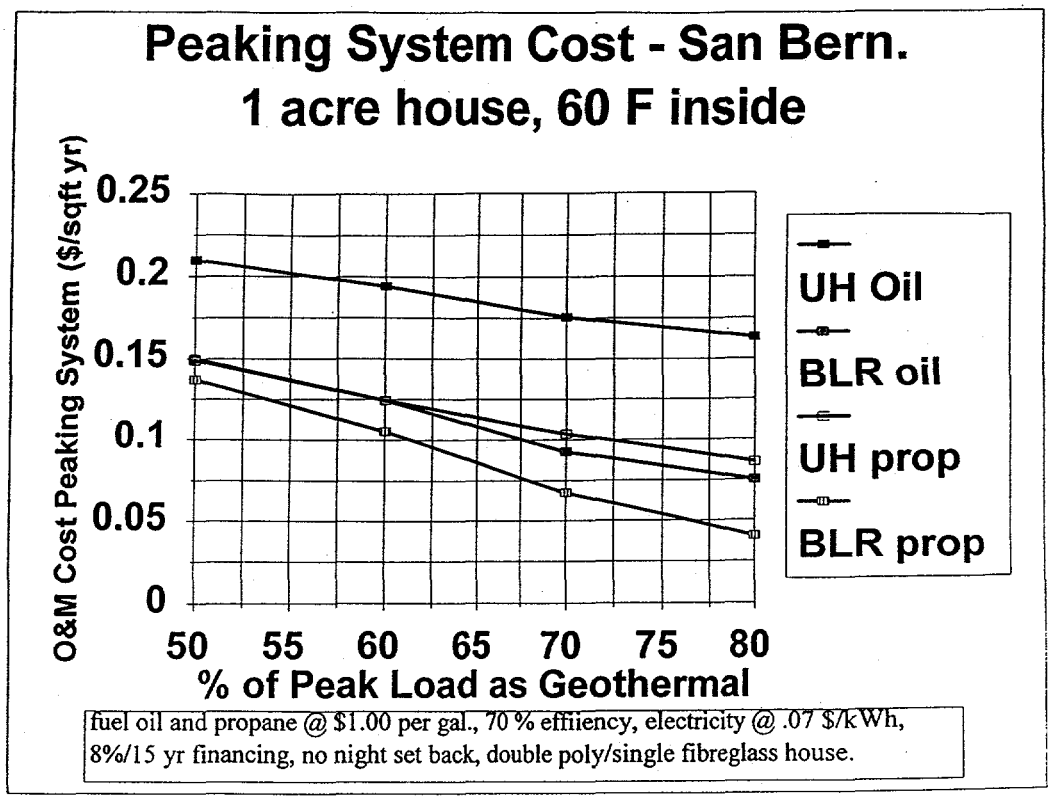

Figure C.

Fossil fuel-fired peaking is unlikely to be used in applications where an acceptable geothermal system can economically meet the peak heating load. In applications where the geothermal resource flow is limited, this approach permits the grower to use the heating system of choice for a reasonable increment in operating cost.

4.0 TECHNOLOGY TRANSFER

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

4.1 Geo-Heat Center Quarterly Bulletin. Bulletin Vol. 17, No. 4 was distributed in November to 1548 domestic, and 347 foreign subscribers. Bulletin Vol. 18, No. 1 is in preparation and will be published in January. Articles include:

1. "Greenhouse Climate" by K. Popovski,
2. "Peak Heating for Geothermal Greenhouses" by K. Rafferty,
3. "Geothermal Carbon Dioxide for Use in Greenhouses" by M. Dunstall and B. Graeber,
4. "Geothermal Greenhouse Update" by P. Lienau,
5. "Geyser Pipeline Project" by M. Dellinger,
6 Geothermal Pipeline - A Progress and Development Update from the Geothermal Progress Monitor.

4.2 Technical Papers, Presentations and Tours

1. Presentation. Engineering principles as applied to geothermal direct-heat projects was presented to engineering students from Central Oregon Community College (10-31-96).

2. Design of Ground-Source Heat Pump Systems Workshop. A workshop was conducted on the design of commercial scale ground-source heat pumps for designers within the Corps of Engineers. The workshop was organized by the Department of the Army Cold Regions Research and Engineering Laboratory (CRREL). Instructors included: S. Kavanaugh, University of Alabama; K. Rafferty, Oregon Institute of Technology; G. Phetteplace, CRREL and W. Sullivan, Sandia National Laboratories.

   "Ground-Water Heat Pump System Design" by K. Rafferty included:

   - Introduction
   - Flow Requirements
   - Wells
   - Well Pumps
   - Heat Exchangers
   - Disposal

   The workshop was held in Reno, Nevada, 10-12 December 1996.

3. Renewable Technology Projects. The National Renewable Energy Laboratory (NREL) requested a growth projection for geothermal direct-heat development to the year 2010. Below is the projection developed by the GHC to the year 2010 based on historical growth of geothermal direct-use and heat pumps. Space heating projection assume a planned development of 522,000 MWh/yr by year 2000 at Steamboat Springs near Reno, Nevada.

Application	1995	2000	2005	2010	Growth (%)
	Annual Energy (MWh/yr)				
Space Heating	386,000	992,000	1,207,000	1,468,000	9.3
Greenhouses	197,000	226,000	260,000	298,000	2.8
Aquaculture	408,000	473,000	548,000	636,000	3
Industrial	176,000	185,000	194,000	204,000	1
Resorts/Spas	446,000	453,000	460,000	466,000	0.3
Subtotal	1,613,000	2,329,000	2,669,000	3,072,000	4.4
Heat Pumps	2,276,000	3,649,000	5,850,000	9,379,000	9.9
Total	3,889,000	5,978,000	8,519,000	12,451,000	8.1

4.3 Geothermal Library. During the period of October 1 to December 31, 1996, 8 new volumes were added to the library. The library now has a total of 5275 volumes cataloged.

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

Topic	No. Publications
Geothermal Heat Pumps	280
Space Heating	5
District Heating	3
Greenhouses	1
Aquaculture	8
Industrial	6
Equipment	8
Resources/Wells	25
Other	113
Total	456

5.0 GEOTHERMAL PROGRESS MONITOR

5.1 Biotech Companies Profit from Yellowstone Hot Springs

Yellowstone's more than 10,000 geysers, hot springs, mud pots and fumaroles awe and delight 3 million park visitors each year. They are also drawing the interest of biotechnology companies and academic researchers like Ward, a professor at Montana State University, and Ramsing, a postdoctoral student. Long thought to be too hot and harsh to sustain any form of life, the park's geothermal attractions contain an astonishing variety of micro-organisms, whose ability to survive both high temperatures and extremes of acidity and alkalinity--from battery acid to household ammonia--makes them potentially valuable.

The spur for this biological gold rush is *Thermus aquaticus*, discovered in the nearly boiling waters of Mushroom pool, about 8 miles from Old Faithful. An enzyme from Taq, as the microbe is known, drives the polymerase chain reaction, or PCR. This laboratory genecopying process in turn makes possible DNA fingerprinting, which has revolutionized the study of blood and other evidence in criminal investigations. Cetus, the company that patented Taq and the PCR technique, sold them for $300 million in 1991 to Hoffmann-LaRoche, which now earns more than $100 million a year from sales of the process.

While the Taq enzyme has proved to be a microbial mother lode. Yellowstone thermophiles are being used in other commercial applications as well. These include converting organic wastes like cellulose into ethanol and other fuels, producing an environmentally safe road de-icer and a non-toxic paint stripper for military aircraft, and various genetic engineering projects. They also are used in pulp and paper processing, gold and copper mining, acid mine drainage and

engineering projects. They also are used in pulp and paper processing, gold and copper mining, acid mine drainage and reclamation, food processing and the perfume industry. And scientists from the National Aeronautics and Space Administration are studying the geothermal features as a possible model for evidence of past life on Mars.

About 40 universities and private laboratories hold permits to hunt for the thermophiles in Yellowstone's bubbling primordial pools. Researchers liken the vast, largely untapped microbial ecology of the park's hot springs to the incredible biodiversity of the Brazilian rain forest. "The biotechs are hunting hard, hot and heavy," says Ward, who also serves as a kind of guide for companies wanting to prospect the pools. "Everyone wants to discover another *Thermus aquaticus*."

Though Yellowstone's $20 million budget for next year isn't enough to prevent cutbacks in visitor services or to repair some of the national park system's worst roads, the cash-strapped park has yet to see a dime of the hundreds of millions of dollars Hoffmann-LaRoche and other biotech companies have made from its microbes. The federal government, which sells timber from the national forests and profits from royalties paid on oil, gas and coal leases on public lands, has no similar provisions for selling micro-organisms; although, it is angling for a share of the potentially immense future profits.

Academics on tight budgets fear that being forced to pay for the privilege of doing basic research in a public park could crimp their efforts. But park officials and some biotech companies eager to claim rights to any valuable new discoveries think Yellowstone should be able to cash in on its unique resource. The park's chief scientist, John Varley, wants biotech companies to pay a royalty of 0.5 percent to 1.5 percent on new discoveries. For the park, that could turn billions of tiny organisms into gold.. (Source: *U.S. News & World Report*, December 2, 1996)