PIPELINE

Progress and Development Update
Geothermal Program Monitor

MEETINGS

Geothermal Resources Council 1998 Annual Meeting, San Diego, CA, September 20-23, 1998

Theme: "Geothermal: The Clean and Green Energy Choice for the World." The meeting will be held from September 20-23 at the Town & Country Hotel in San Diego, California. Distinguished keynote speakers during the meeting's opening session will highlight the role that geothermal can play in the world energy mix, with a focus on global warming, the advantages of geothermal energy over fossil fuels for power generation, and the future of geothermal development.

Special sessions will be held on Sustainability of Geothermal Resources, Pacific Rim, Mexico and Latin America, Direct Heat Utilization, Drilling, Well Completion and Logging, Geology and Geochemistry, Geothermal Exploration, Production Technology, Reservoir Engineering, Environmental Issues, and Geothermal Heat Pumps. Two short courses will be held prior to the meeting: on September 17th and 18th a course on Geothermal Drilling, A New Mindset, and on September 19th a course on Borehole Imaging. Two pre-meeting field trips will be taken to the Cerro Prieto Geothermal Field in Mexico and the Coso Geothermal Field in eastern California, and a post meeting field trip to the Imperial Valley Geothermal Field and Mineral Recovery Site. The Geothermal Energy Association will holds a trade show.

Further information and registration material can be obtained from the Geothermal Resources Council, PO Box 1350, Davis, CA 95617-1350, phone: 530-758-2360, email: grc@geothermal.org.

20th Geothermal Workshop, Auckland, New Zealand, November 11-13, 1998

The Geothermal Institute and the New Zealand Geothermal Association will host the 20th NZ Geothermal Workshop at the University of Auckland on 11, 12 and 13 November, 1998. The meeting will be a forum to exchange information on all aspects of the exploration, development and use of geothermal resources worldwide. Intending authors should submit a title to the convenors by 15 June 1998. All accepted papers will be published in the Proceedings of the Workshop which are widely distributed.

The Workshop is open to papers on all aspects of geothermal technology including, Exploration, Field Development, Utilization, Applications and Case Studies.

Intending authors can submit their title to the convenors by e-mail: geo.wshop@auckland.ac.nz. Further information can be obtained by email: http://www.auckland.ac.nz/gei/ , or by writing

Mike Dunstall, co-convenor
Geothermal Institute
The University of Auckland
Private Bag 92019,
Auckland, New Zealand

New Zealand Geothermal Association 98 Direct Use Seminar, July 2-3, 1998

A direct utilization seminar will be held in Rotorua, New Zealand from July 2nd to 3rd. The purpose of this two-day seminar will be to identify the low grade geothermal resources of the country and present potential use opportunities for such resources and outline examples of successful economic developments, both in New Zealand and overseas. Field visits will be arranged for delegates to visit geothermal direct use applications such as greenhouses, crop drying, timber drying, and aquaculture facilities in and around Taupo and Rotorua following the seminar. If interested in attending the Seminar, or would like more information please contact the NZGA Secretariat at:

c/o IGNS
Private Bag 2000
Taupo, New Zealand
Phone: 07-374-8211

or by email to Ian Thain, the conference organizer: i.a.thain@xtra.co.nz

International Geothermal Days, Azores 1998 - September 13-20

The International Summer School has scheduled three workshops at Ponta Delgada, Azores (Portugal). The first is an International Workshop on Heating Greenhouses with Geothermal Energy on September 14th covering: 1) Technical, Technological and Economic Feasibility of Geothermally-Heated Greenhouses in Europe and the World; 2) State of the Art in EC, Mediterranean and Central/East European Countries; 3) EC "Thermie" Project Ribeira Grande (see article in this issue of the Bulletin), and 4) Problems and Activities for Development of Geothermal Energy Application for Heating Greenhouses.

The second is an International Seminar of Electricity Production from Geothermal Energy on the 15th, and the last is an International Course on Economy of Integrated Geothermal Projects from the 16th through the 18th covering: 1) Nature and Distribution of Geothermal Energy in the World; 2) Technology of Integrated Geothermal Projects; 3) Economy of Integrated Geothermal Projects, and 4) General Problems Related to Development of Integrated Geothermal Projects.

The program is being organized locally by the Institute of Innovative Technologies of Azores (INOVA). A field trip is scheduled after the workshop on Saturday the 19th. Further information can be obtained from John Lund at the Geo-Heat Center, Professor Dr. Kiril Popovski in Skopje, Macedonia (Tel/Fax: 389-91-119-686), or Professor Dr. Jorge Rosa de Medeiros in Ponta Delgada, Azores (Fax: 351-96-65 33 24 or email: Inova@mail.telepac-pt). Registration can be made to:

International Summer School on
Direct Application of Geothermal Energy
ul. Dame Gruev br. I-III/16
91000 Skopje, Macedonia.

GENERAL

The Promise of the U.S. Geothermal Industry

The U.S. geothermal industry is composed of more than 50 mostly small companies headquartered in various states, including California, Colorado, Florida, Hawaii, Maryland, Nebraska, Nevada, New Jersey, New York, Oregon, Texas, and Utah. Direct employment is about 10,000 people in the U.S., and our indirect effect is a minimum of 20,000 additional jobs. Our operation generating capacity in the U.S. is about 2,280 megawatt, producing 14-17 billion kilowatt-hours/year in four states–California, Hawaii, Nevada, and Utah. States having excellent potential for near-term development of geothermal power include Alaska, Arizona, Idaho, Oregon, New Mexico, and Washington.

Geothermal energy is the third largest grid-connected renewable electricity source, after hydropower and biomass. We generate 17 times more electricity than solar energy and 7 times more than wind energy. The power we produce in the United States displaces the emissions of 22 million tons of carbon dioxide; 200,000 tons of sulfur dioxide; 80,000 tons of nitrogen oxides, and 110,000 tons of particulate emissions per year compared with the production of the same amount of electricity from the average U.S. coal-fired plant (coal data from DOE/EIA-0348(90)). Geothermal plants in the U.S. and throughout the world continue to function normally, proving the reliability of geothermal power (Dr. P. Michael Wright, *Geothermal Energy News*, GEA, Vol. 1, No. 3, April 1998).

ARKANSAS

Geothermal Heat Pump Community Planned at Harrison

The first exclusively GeoExchange planned community and golf course in the United States will be built this year in the Ozark Mountains north of Harrison, Arkansas. The GeoExchange system will use lake water as the geothermal source for providing heating and air conditioning, and will also irrigate the golf course and serve as a supply for the fire protection system.

One of the more valuable amenities is the GeoExchange system, featuring energy efficient heating and cooling at a low cost. According to the Environmental Protection Agency, GeoExchange heating and cooling systems are the most energy efficient, environmentally clean and cost effective space conditioning systems available. "We hope the Bear Creek Springs Community will serve as a model for other planned communities across the United States," Paul Lipe, Geothermal Heat Pump Consortium Executive Director, said.

Approximately 950 "Smart House" home-sites of varied form and dimension, in a setting featuring lakes and streams, stony ridges and lush meadows, should appeal to a broad range of residents, according to Robert Rasking, President of the Tusla, Oklahoma.-based Autumn Oaks Communities, Inc.

In addition to Autumn Oaks Communities, Inc., participants in this project include GeoExchange, based in Washington, DC; K & M Shillingford, a strategic alliance partner providing the residential geothermal units (*Business Wire* - March 31, 1998).

CALIFORNIA

The Draft Environmental Impact Statement and Environmental Impact Report (Draft EIS/EIR) prepared for the proposed Telephone Flat Geothermal Development Project (California State Clearinghouse Number 97052078) is available (being proposed by CalEnergy Company of Omaha, Nebraska). The purpose of this document is to identify potential environmental impacts that would result from the proposed construction, operation, and decommissioning of a 48 megawatt (gross) geothermal power plant with associated production and injection wells, well pads, pipelines, transmission line, and access road. The proposed power plant and well field would be located on portions of six federal geothermal leases in the Glass Mountain Known Geothermal Resource Area (KGRA) within the Modoc National Forest in Siskiyou Country, California.

The Telephone Flat Project is the second of two proposed geothermal power plant projects in the Medicine Lake Highlands just south of the Oregon-California border near Klamath Falls. The first project is the proposed Fourmile Hill Geothermal Project. Pending approval of the Fourmile Hill Project (being proposed by Calpine Corporation of San Jose, California) and timely construction of its transmission line within one of six alternative utility corridors selected by the lead agencies, an interconnecting transmission line from the Telephone Flat Project power plant site to the utility corridor is proposed to be constructed.

Four open-house public meetings have been scheduled to receive comments on the Draft EIS/EIR at the following places (all from 4:00 to 8:00 PM):

Monday, July 6, 1998	Home Economics Bldg. Tulelake Fairgrounds Tulelake, CA
Tuesday, July 7	Main Lodge Mt. Shasta Park Mt. Shasta, CA
Wednesday, July 8	Miners Inn Convention Ctr 122 East Miner St. Yreka, CA

Thursday, July 9	Art Building Intermountain Fairgr. McArthur, CA

The public comment period on the Draft EIS/EIR closes on July 22, 1998. Written comments on the Drafts EIS/EIR should be addressed to:

Mr. Randall M. Sharp
USFS/BLM Project Leader
Telephone Flat Geothermal Project
800 West 12th Street
Alturas, CA 96101
Phone: 530-233-8848

HAWAII

Hawaii's River of Molten Rock Inflicts $61 Million in Damages

Rivers of molten rock have consumed the community of Kalapana on the Big Island, destroying 181 homes, a church and a community center. The total $61 million in damage also includes destruction of a visitor center and maintenance shop at Hawaii Volcanoes national Park.

When Kilauea erupted January 3, 1983, on the island of Hawaii, scientists at the U.S. Geological Survey's Hawaiian Volcano Observatory believed it would be short-lived, much like a pair of one-day displays the year before. Since then, however, lava of various depths has covered 39 square miles, and as if flows seven miles downhill into the sea, it has created 570 acres of new coastal land. It's estimated at 2.1 billion cubic yards of lava, enough to cover New Jersey a foot deep.

The lava has covered 16,000 acres of rare rain forest and lowland forest, and entombed thousands of ancient Hawaiian archaeological sites. One of the most significant archaeological losses was the 700-year-old Waha'ula heiau, or Hawaiian temple, which was overrun last August. Hawaiian tradition says the stone platform and walls were built by the priest Pa'ao, who came to Hawaii from islands to the south in the 1200s. There is no indication when this eruption will stop.

Don Swanson, scientist in charge of the observatory atop the volcano, points to a sign on an office wall bearing a quotation from economist John Kenneth Gallbraith: "I predict, not because I know, but because I'm asked." "There is nothing to preclude this eruption going on for another 15 years," Swanson said. "We don't see any reason to think that it's winding down." Kilaeua attracts 1.5 million tourists each year, even though the spectacular fountains of lava that highlighted the early years of the eruption have subsided (AP - *Herald and News*, Klamath Falls, OR - January 22, 1998).

MICHIGAN

McDonald's Goes Underground: Fast-Food Chain Tries Geothermal (Heat Pumps)

In the metro-Detroit area, a new McDonald's store is digging in, looking for more energy-efficient, cost-saving heating and cooling. If the geothermal approach proves successful, it could go nationwide. The utility, Detroit Edison, got S. E. Michigan "Mickey Dee" to sign a 10-year energy supplier agreement.

A McDonald's outlet being built in Westland, a suburb of Detroit, is taking on earthy airs by installing a geothermal system to provide air conditioning and heating. As the chain's first store to use geothermal comfort conditioning, as well as other energy-efficient measures, McDonald's bean counters will be taking a close look at the numbers to decide on whether to roll out or not.

Energy savings are expected to be in the range of 20 to 40% over McDonald's conventional hvac system. Payback, therefore, may be several years. But McDonald's is taking a long-term perspective.

Three WaterFurnace 11-ton rooftop geothermal units are being installed. The rooftop units in this application match the exact footprint of McDonald's standard rooftop units, to replace those models. Size of the restaurant is 1,511 sq. ft with a 1,200-sq. ft play place. Usually a McDonald's needs 37.5 to 40 tons of heating/cooling. In this case, because of the energy-efficiency improvements, 33 tons are required.

SH&G Associates of Detroit, an architect-engineering firm, is the designer of the system. Modeling and analysis was done to size the system. A thermal conductivity test was conducted on the soil, and the firm also looked at the geology. "We started hitting some really hard rock at 200 feet," remarked Kohlert. "So that's why we only planned to go to 200 feet instead of 300 feet for the geothermal "wells" (or loops). LoopMaster International, Indianapolis, drilled the "wells," 32 in all, 196 ft deep and 5 inches in diameter. Pipe used was 1-1/4 inch. A U-bend was connected to two 1-1/4-in. pipes; these U-bend coils were placed in each "well." Water is then circulated through this closed system.

The Electric Power Research Institute (EPRI) provided some funds for the project and also provided technical consulting. EPRI may also conduct the study of energy consumption data to be collected at the new McDonald's and a standard restaurant. When the study of the geothermal system is completed, McDonald's will evaluate the energy savings, environmental benefits, and marketing impact (incremental sales increase), to decide if this approach will be used in other states (Greg Mazurkiewicz - *Air Conditioning, Heating & Refrigeration News* - December 15, 1997).

NEBRASKA

Going Underground (Finally)

Although ground-coupled heat pump systems are an established hvac technology, it has been only within the last few years that schools have emerged as a viable application section in Nebraska. Safety was the initial concern–but no more. In the fall of 1995, the four schools (each 69,000 sq. ft) in the Lincoln (NE) School District, Campbell Cavett, Maxey and Roper, each opened their doors to more than 500 students in grades K through six. The school openings marked the completion of a joint project involving Lincoln Public Schools

and the municipal power utility, Lincoln Electric System (LES), to implement vertical-loop, geothermal heat pump systems in each school.

Ground-coupled heat pump (GCHP) technology, a category of ground-source heat pump technology, originally was chosen following a life-cycle cost analysis on five candidate hvac technologies performed by Alvine and Associates, an Omaha-based engineering design firm responsi-ble for designing the hvac system to be used in each school. The analysis projected that GCHP technology would work most efficiently to meet the schools' heating/cooling needs.

In fact, the GCHP systems were expected to save the school district at least $128,000 a year, and Lincoln School District taxpayers nearly $3.8 million, over the next 20 years. After a year in operation, annual peak load for the new schools using the GCHP systems was determined to be roughly half of what was projected for the hvac system originally proposed before LES and the Lincoln School District decided to evaluate their options.

In addition, comparative energy analysis data compiled by LES staff after a year illustrated that the geothermal schools were achieving superior results over Lincoln elementary schools with other types of hvac systems in terms of total energy costs and total energy consumption. Data collected at several schools through the 1996-97 school year showed a significant advantage for the GCHP schools. In fact, the results actually exceed the savings projected through the initial studies and economic evaluations. The GCHP schools achieved total energy cost savings of 57% when compared to the hvac schools, along with a 40% reduction in electrical demand and a 20% reduction in electrical energy consumption.

The GCHP system designed for each school includes more than 50 water-source GCHPs, virtually one for each room in the school. The systems used either Trane Company or WaterFurnace International heat pumps, located for easier serviceability above the hallways outside the classrooms and other school rooms. The pumps are connected via a ground heat exchanger to 120 loops of thermally fused 1-in., high-density polyethylene tubing. The loops are buried in an open field, bored vertically about 240 feet into the ground, and configured in 12 rows of 10 loops and in three groups of 40 loops.

In each system, a heat transfer fluid solution consisting of 22% Dowfrost©propylene glycol-based fluid (from the Dow Chemical Co., Midland, MI) and 78% deionized water (supplied by Barton Solvents, Council Bluff, IA) is constantly circulated through the underground loops into a variable-speed pump, which then circulates the fluid through the ground heat exchanger to circulator pumps located inside each school. From there, the Dowfrost solution is circulated to the individual water-to-air heat pumps servicing each school room. Total system capacity for each school is 10,000 gallons, according to Loop Tech International, Hunstville, TX, which performed each loop field installation (Ronald S. Feuerbach, P.E. and Doug Bantom, P.E. - *Engineered Systems* - April 1998).

OREGON

"Green" Power for Sale in Oregon

For the first time, some Oregon consumers can choose to buy power in shades of green. Electric Lite, a South Carolina-based power company, is offering the Northwest's first "green" power sales, energy the company says is produced with less environmental damage. The plan guarantees that power generated on consumer's behalf comes largely from renewable sources. The power costs more, but Electric Lite officials say demand has grown for green option since customers in four Oregon cities got the chance to choose their power company. In a test program, Portland General Electric Co., has allowed 50,000 customers in Sandy, St. Helens, Hillsboro and Oregon City to choose another power company.

Electric Lite's green power option guarantees that no more than 15 percent of the power comes from coal-fired or nuclear plants. On average, as much as 40 percent of the Northwest's power can come from coal or nuclear plants. They also guarantee that at least 50 percent will come from renewables, or what the company is calling clean, sources. Electric Lite says much of its green power will initially come from geothermal plants. The geothermal power will come from plants in northern California. The plan will cost the average household $69 a month, compared with the $59 standard plant. The average PGE residential bill is about $62.

Oregon lacks a formal definition of green power; but, environmental groups that have reviewed Electric Lite's proposal liked the plan. "I believe they've met the test," said Pete West, senior policy associate with Renewable Northwest Project. "We've had trouble defining what green power means; but, I think what they are offering will help create more of the right thing."

Consumers don't actually have green power diverted directly to their homes. Instead, Electric Lite is agreeing to buy more of its energy from renewable sources to supplement the energy now sold to its customers. Customers who sign up for the plan are paying a little more to support those efforts (Brent Walth - *The Oregonian* - February 12, 1998).

SOUTH DAKOTA

Natural Heating - Thousands of West River Residents Go Geothermal

Guest at Stroppel Hotel in Midland soak in it, children at Evans Plunge in Hot Springs splash in it, and tropical fish at a hatchery in Philip thrive in it. But for thousands of West River residents, the naturally hot waters from the underground Madison limestone formation heats their homes, schools and businesses. Steve Wegman of the South Dakota Public Utilities Commission estimated that there are about 10,000 deep wells in western South Dakota and about 5,000 users of geothermal heat from the Madison.

In a recent report on geothermal heating in South Dakota, John Lund of the Oregon Institute of Technology estimated that the vast Madison formation contains about 179 cubic miles of recoverable water with temperatures ranging from 86° to 216°F.

Editors note: this article and one on "Fish Thrive on Madison's Warm Waters" along with several photographs and a map, were front-page news in the *Rapid City Journal* - January 4, 1998 - written by Dan Daly - Journal Staff Writer. These articles were based on the GHC Quarterly Bulletin, Vol. 18, No. 4 (December 1997) devoted to geothermal energy use in South Dakota. Geo-Heat Center staff assisted with background material for this article.

WASHINGTON

Callahan Hot Springs Rezone Approved by Commissioners

The Skamania County Board of Commissioners approved an application Monday for a rezone on Berge Road in Home Valley for a hot springs resort. Former county commissioner Ed Callahan applied for the rezone. He is a partner with a Japanese developer, Shikosa Management, which owns several parcels in the Home Valley area. The hot springs project is in the Home Valley urban area and includes a hot springs bathhouse, thermal pools, offices and a parking lot. Among the conditions placed on the development are a 50-ft undisturbed buffer to be maintained between the development and all springs and streams, as well as storm water retention measures (*Skamania County Pioneer* - February 11, 1998).

WYOMING

Suit Accuses Park Service of Illegally Selling Resources

The National Park Service on Thursday was accused in a lawsuit of illegally selling federal resources in secret contracts with biotech researchers who want to patent microbes from Yellowstone's hot springs. "The Park Service cut a back-room deal and bent laws to allow the commercial exploitation of Yellowstone," said Joseph Mendelson, a lawyer for one of the plaintiffs, the International Center for Technology Assessment, a public interest group. The plaintiffs argue that U.S. law prohibits any natural resources–from mineral to pine cones–from being removed from national parks. The contract could be worth millions of dollars to Diversa Corp. of San Diego. The Park Service has refused to disclose what kind of royalties the federal government would receive as a result of the so-called bioprospecting for patents on the tiny organisms in the rare thermal pools (*The Oregonian* - March 6, 1998).

JAPAN

Creative Ideas on Melting Snow on Road Surfaces

A round-table discussion between Teruyuki Fukuhara, Professor at Fukui University, Jiro Sugawara, Deputy Manager, Koriyama Road Work Office, Tohuku regional Construction Bureau, Ministry of Construction, and Shigenobu Miyamoto, Senior Researcher, Fukui Prefecture Technology Research Institute on Snowfall and Construction, is reported in "New Energy Plaza," Vol. 13, No. 2, 1997, *New Energy Foundation*. A "Sprinkler-Free Sidewalks and Roadway Sprinkler" system is used where groundwater at 15°C flows through heat exchanger ducts buried in the sidewalk and water that dropped to 7°C after melting snow on the sidewalk is sprinkled on the roadway. Heat piles (pipes?) are also used for melting snow on bridges. Water is sent through polyethylene ducts through foundation piles. Water warmed by the surrounding soil at 12°C flows slowly in the piles and is sent to the heat exchanger duct buried under the pavement for snow-melting. The cost for bridge decks is 400,000 yen per square meter (about $300 per square foot).