DISTRICT HEATING

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1980 Technical Program

District heating from industrial reject heat

Geothermal district heating

Association incorporation

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Geothermal District Heating: An Overview

Steam and hot water beneath the earth's surface, as an energy source to reduce the consumption of oil, has become increasingly attractive as potential fuel for district heating, although geothermal energy has been used for many years in many places in the world for greenhouses, aquaculture, swimming pools, etc.

In some global locations, using geothermal energy for space heating is not new—Iceland, as an example. That country, composed almost entirely of volcanic rocks, the oldest exposed dating back to the Tertiary Age (one to seventy million years ago), has been using hot spring water for space heating since the 1920's.

Iceland

Iceland's thermal activity is divided into two classes: high-temperature areas (392 F); and low-temperature areas (362 F). The high-temperature areas are located in the active volcanic regions, evident on the surface by hot ground temperatures, mud pools, and fumaroles (vents in the earth where thermal energy escapes—in this case, hot water); however, the rock formation at the surface is so hot that only small amounts of ground water is visible. In the low-temperature areas which are scattered throughout the country, but predominantly found in valleys or along the coast lowlands, hot water springs (68-212 F) abound.

Water tapped from both areas, high and low temperature, is usually alkaline (approximately 8.0 to 9.5 pH). This is due to a lower content of dissolved solids usual in many other countries such as the United States, Japan and New Zealand.

Although Iceland's hot spring water was used for washing clothes and bathing for centuries, it was not until the 1920's that this natural energy form began to be used to heat farm houses, schools, greenhouses, and swimming pools located in the vicinity of the hot springs—and this was accomplished by old-fashioned methods. Now, in addition to localized groups of buildings (farms, etc.) near the springs being heated from the hot-water wells, there are district heating distribution systems serving the villages and cities.

Reykjavik, Iceland's capital, is heated exclusively from deep water wells (no surface springs). The first distribution system, built in 1930, heated 70 residences, a school, and a swimming pool. Now, 15,600 homes (109,800 people) or about 97.1 per cent of the City's population and surrounding area are supplied with district heating.

All pumping stations in the Capital City, except those located at the bore holes, are now completely automatic. Periodic checks are made daily except in winter, when a 24-hour surveillance is maintained. A central control room provides remote control of the pumping plants, bore hole pumps, and other equipment such as pump starting/stopping, etc.

At the present time, about half of the country is heated by geothermal energy and by 1982, the proportion is expected to rise to 80-85 per cent.

Europe

Although space heating by geothermal energy is not a new idea in Europe, this energy source has been used only in a few localities.

In Hungary, geothermal energy has been used for space heating since the 1930's; and at the present time in Budapest, 6000 residences are geo-heated (plus greenhouses, apartments and hospitals).

Since 1974, most countries in Northern Europe have been investigating the potential of geothermal energy as a supplement to imported fuel. France started prior to 1974; had a functional plant in Melun as early as 1971; and today has ten plants in operation.

Denmark and Germany now have demonstration plants; and Sweden, Holland, Austria, and Switzerland are making plans for them.

In 1978, the West German Ministry of Research and Technology agreed to fund a geothermal district heating project in the Rhine Valley in South Germany. In addition to the usual plan scope, consideration was given to actually heating the existing area urban community from the demonstration plant. In April 1979, the city of Buhl, near Baden-Baden, was chosen for location of the plant. (Baden-Baden is a famous and popular hot-spring spa.)

USSR

The Soviet Union is actively pursuing the development of geothermal energy as a substitute for fossil fuels. To date, the primary use of geothermal heat has been for space heating and industrial applications; and a lesser amount for agricultural applications (greenhouses), and spas. In 1967 a geothermal electric power station, using flash steam, went into operation.

United States

In the U.S., the state of Oregon has vast areas of untapped thermal energy potential (less than one per cent has been tapped).

In the city of Klamath Falls, homes have been geoheated for more than 45 years; and the geothermal heating system at the Oregon Institute of Technology, in operation since 1963, displaces an estimated equivalent of 13,900 barrels of oil per year and saves taxpayers about $270,000 annually, by the direct use of geothermal hot water from three wells drilled adjacent to the campus. Both hot water radiators and forced air systems are used in the campus buildings.

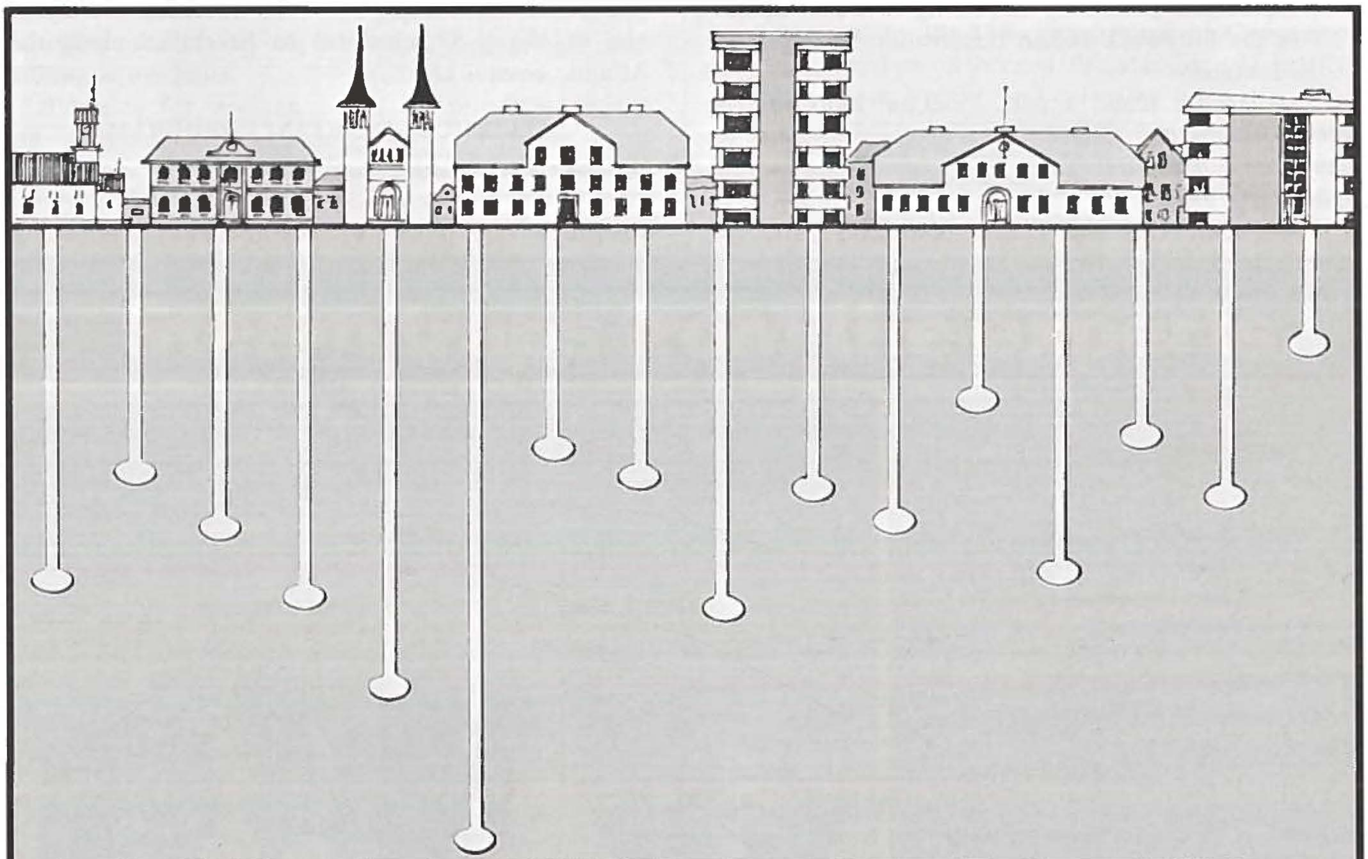
The widespread use of geo-heat in Klamath Falls, has, in part made Oregon one of the nation's leaders in direct applications of geothermal energy. Uses range from the deicing of pavements and sidewalks and milk pasteurization, to space heating of industrial buildings and greenhouses. Applications in other areas of the state include greenhouse, pool and space heating.

Geothermal energy is now being consumed in Oregon at an annual rate of approximately .5 trillion Btu, the equivalent of 83,000 barrels of oil per year. Heat utilization from hot water wells in Klamath Falls is estimated at 60 MW_t during peak periods. Other space heating applications around the state contribute about 1 MW_t to current geothermal energy consumption.

The potential for additional and expanded use of geothermal resources in Oregon is substantial. Considering the amount of untapped heat, Oregon's resources are a sleeping giant. Interest in the development of geothermal energy resources has been increasing during the last decade. Several million dollars have been spent investigating Oregon's geothermal energy potential by industry, government, and academic researchers.

Geothermal research in Oregon is being conducted by the U.S. Geologic Survey (USGS), Oregon Department of Geology and Mineral Industries (DOGAMI), universities, and private industry. One of the largest research efforts to date began in 1977 when the U.S. Department of Energy (DOE), USGS, DOGAMI, and the U.S. Forest Service, began a geothermal resource assessment of Mt. Hood, Oregon's highest peak (3427 meters), as a supply of energy for the city of Portland.

Analysis of what is currently known about Oregon's geothermal areas, indicates considerable undeveloped potential for both direct-use applications and electrical generation. The potential for electric power generation is uncertain now because no reservoirs capable of generation have been reported. Direct uses offer the greatest immediate potential. Applications most likely to be developed are industrial and agricultural processing, space heating, and district heating systems. District heating appears to be feasible in Klamath



Depth	Water Supply	Temperature °C.
1266 m	36.8 l/sek	96.2°C
861	31.0	107.5°C
1077	40.3	100.5°C
1316	34.0	105.0°C
1613	23.2	94.0°C
2198	8.2	135.0°C
741	49.1	131.0°C
862	32.4	128.0°C
1306	15.1	130.0°C
928	32.8	130.0°C
1014	23.3	126.0°C
634	15.2	122.0°C
1239	39.1	128.0°C
764	47.0	129.0°C
978	44.2	128.0°C
403	14.7	115.0°C

← Elliðaár → ← Laugavegur →

Fig. 1—Thermal energy underneath Reykjavik, Iceland.

Falls, Lakeview, La Grande, Burns, Oakridge, and the Vale-Ontario area.

The City of Klamath Falls is proposing to construct a geothermal district heating project which will initially heat 14 government buildings in the downtown area (Phase I.) Subsequently, Phase II will expand the system to serve 11 city blocks; and when completed, Phase III would heat the entire 54-block central business district. The project would be funded by the City, DOE, Klamath County, and the State of Oregon.

Department of Energy engineering and economics study contracts are being negotiated to:

—investigate the feasibility of heating the municipal maintenance facility, and supplying heat to the sewage treatment plant in Glenwood Springs, Colorado.

—evaluate the direct use of geothermal energy for space heating, hot water heating, and air conditioning at the University of New Mexico campus in Albuquerque.

—explore the possibility of heating 1000 new homes at the Fort Peck Indian Reservation near Poplar, Montana.

Near Malta, Idaho a pilot "thermal loop" power plant is being constructed to use geothermal water to generate commercial electricity; completion target date, early 1980.

The Pacific Gas and Electric Company produces electricity from geothermal energy at the Geysers Power Plant about 90 miles north of San Francisco. It is the only geothermal power project in operation in the United States, and the largest in the world using geothermal "steam." The "geysers" here are not really like the geysers which send up fountain-like jets of hot water and steam at intervals; they are fumaroles which emit steam steadily. PG&E has been producing electricity from natural steam since 1960; and by 1983 will have 21 units in operation, with cumulative plant capacity of 1,568,000 kilowatts.

Puna, on the big island of Hawaii, is the site of one of the hottest geothermal wells in the world and has near-term prospects for development. Investigative studies have shown that sugar mills and aquaculture farms are potential direct users; and there is interest in construction of a 20-MW power plant.

Geothermal resources are commonly associated with the geologically, youthful Western U.S., but DOE has officially begun a major drilling program to locate geothermal energy resources on the East Coast. A 1000-ft well drilled at Fort Monmouth, New Jersey, is one of about 50 scheduled to be drilled along the Atlantic coastal plain.

TECHNICAL ASSISTANCE PROGRAM

Under the technical assistance program up to 100 man hours of consultation can be provided, at no cost, to private, public, or corporate entities intending the direct utilization of geothermal energy. Application

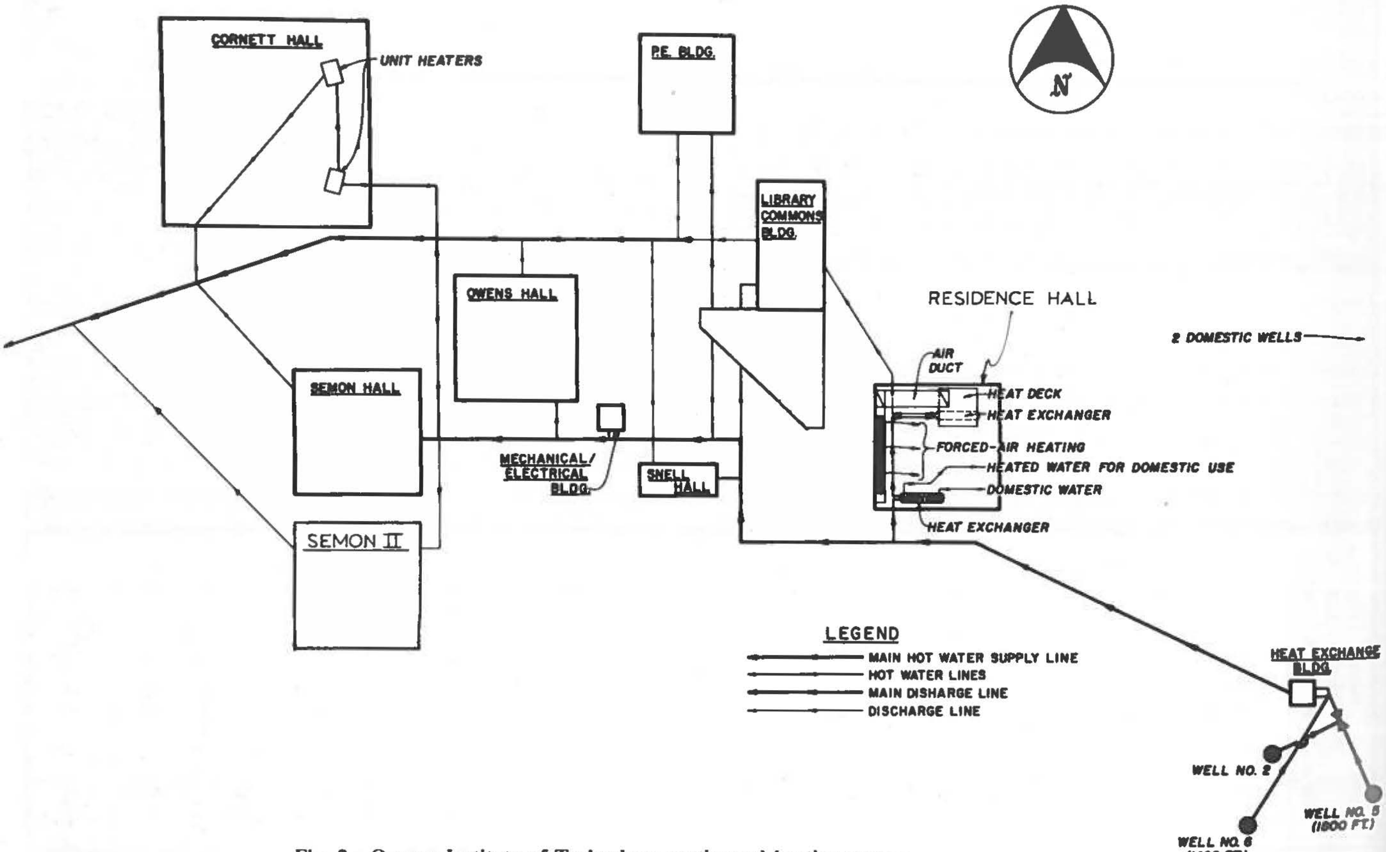


Fig. 2—Oregon Institute of Technology geothermal heating system.

areas include but are not limited to, space heating and cooling, district heating, aquaculture, food production and processing, drying, chemical and pharmaceutical processes, animal husbandry, etc. Assistance will be given primarily for projects in the Pacific Region states of Alaska, Washington, Oregon, California, Nevada, Arizona, and Hawaii. Projects in other regions and large electrical power generation projects should request assistance through other technical assistance programs.

Consultation may be in the form of limited resource evaluation, engineering feasibility and economic studies, materials selection and corrosion problems, conceptual design, consultation with private engineering or consulting geologists, etc.

The program is intended to provide assistance to persons with little or no experience in the geothermal field in order to promote the rapid development of geothermal resources. The program is **not** intended to compete with consulting engineers and geologists and Geo-Heat personnel will not provide detailed plans, specifications or services when qualified private consulting is available.

Requests for assistance will be prioritized based on proposed implementation dates. Existing fossil fuel users considering conversion to geothermal energy will be provided early assistance.

Additionally, technical personnel are available for informational seminars or speaking engagements to interested groups, trade and technical associations, technical seminars, etc.

For further information or assistance contact: Gene Culver, Associate Director, Geo-Heat Utilization Center, Oregon Institute of Technology, Klamath Falls, Oregon 97601 (Telephone: 503/882-6321)

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J-M's Research and Development Center in Denver is one of the first thermal insulation testing facilities to be accredited under the National Voluntary Laboratory Accreditation Program (NVLAP). The accreditation certification validating 25 thermal testing procedures was awarded by the U.S. Department of Commerce. Tests provide data on thermal, fire, stability and density, strength, vapor barrier, and corrosion properties.

J-M has been testing insulation materials since the early 1900's and in addition to tests performed on its own products, the R&D Center does research work for government agencies and trade associations.