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NEVADA LOW- AND MODERATE-TEMPERATURE GEOTHERMAL RESOURCE USE — SUCCESSES AND FAILURES

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ABSTRACT

Nevada is well endowed with both high- and low-temperature geothermal resources. Over 40% of the state is believed to have potential for the discovery of high-temperature (>90°C) geothermal resources, and another 50% has potential for low- to moderate-temperature (<90°C) resources. Surface and subsurface indications of these resources are the more than 1000 thermal springs and wells in the state. These springs and wells are associated with more than 300 resource areas.

GEOTHERMAL GEOLOGY

Geothermal reservoirs in the northwestern part of the state have generally higher temperatures; these reservoirs are usually interpreted as being related to circulation of groundwater to deep levels along faults in a region of higher-than-average heat flow. Spring temperatures range up to boiling in northern Nevada, with subsurface temperatures as high as 220°C. In east-central and southern Nevada, the low- to moderate-temperature geothermal resources are generally believed to be related to regional groundwater circulation in fractured carbonate-rock aquifers. Discharge areas (for example, warm springs) may be several hundred kilometers from the area of recharge, and the waters may have circulated for dozens to hundreds of years to depths of several kilometers. Maximum temperatures attained during this journey could be 100°C or higher, but spring temperatures at discharge points are generally less than 65°C.

DIRECT HEAT USE

The majority of Nevada's population is concentrated in two areas, Reno-Carson City and Las Vegas. Many of the state's geothermal resources are remote from any population centers, thus limiting some potential applications. Although 50 or more small to large communities are located within 8 km of geothermal resources, only a few of these areas have been able to use these resources effectively. The reasons for this under-utilization are varied. Although some reasons relate to technical and engineering problems (resource size and temperature, heat loss during transport, etc.), many more are economic (high capital outlays, long payout, under-capitalization of projects) and perceptual (unconventional vs. conventional technology, short vs. long term cost evaluations, uncertainties about long-term economic risks).

There have been attempts to use Nevada's low- and moderate-temperature geothermal resources at more than 20 areas, mainly in the past 5 to 10 years. Additionally, economic and/or technical appraisals of a number more areas have been conducted, but for a variety of reasons projects were not completed. More details on Nevada's geothermal resource use were reported recently in the Geothermal Resources Council Bulletin (Garside and Hess, 1994).

Some notable Nevada direct-use success stories include space-heating applications at the Moana area in southwest Reno and the district heat systems in Elko. Within an area of at least 9 km^2 of thermal groundwater in the Moana area more than 300 homes use geothermal fluids for space heating. About 150 homes are part of district heating systems, while most of the rest use down-hole heat exchangers in individual wells. A large hotel, a motel, about three apartment or townhouse complexes, five churches, and a county swimming pool also use the resource. Elko Heat Company presently supplies geothermal fluid for space heating to 16 commercial customers and two residential customers. The Elko County School District, in conjunction with the Elko General Hospital, supplies heat to eight buildings (two schools, a municipal swimming pool complex, a gym, a convention center, a hospital, city hall, and a school administration building). The city of Caliente in southeastern Nevada has, with the assistance of federal grants, begun to plan a district heating system for municipal buildings.

Vegetable dehydration processes use geothermal fluids at two Nevada sites, Brady's Hot Springs and the Empire (San Emidio Desert) areas. Onions have been dried at Brady's for over 16 years, and a new facility was recently built in the Sam Emidio area of northern Nevada to dry garlic.

Two large-volume, open-pit gold mines use geothermal water to heat the cyanide heap-leach fluids that extract gold from the ore. The heating of the leach solutions aids gold extraction in cold weather and may enhance overall gold recovery as well.

The best example of an aquaculture success is the catfish-growing facility at Duckwater, 110 km west of Ely, where over 300,000 pounds of prime 8-ounce catfish filets were produced in 1992.

Luxurious hotel spas were more common and more popular in the United States in the late 19th and early 20th centuries. But today, only a few good destination resort spas, like the one at Walley's Hot Springs, continue to flourish. Other areas that presently use their hot springs for bathing include Carson City, Bowers Mansion, and Gerlach.

Many of the failures in Nevada geothermal direct use are related to aquaculture. Attempts to raise Malaysian prawns and tropical aquarium fish were unsuccessful at one or two sites (Wabuska and Hobo Hot Springs); an early attempt at a hydroponic geothermal greenhouse for vegetables (tomatoes and cucumbers) at Wabuska in the 1970's also failed. At least two attempts to raise catfish have not been successful, and raising algae for human consumption using geothermal waters was also unsuccessful.

Geothermal space-heating applications are generally more subject to failure due to resource problems. Examples of this are Carlin High School, where scaling problems resulted in abandoning the well, and the County Hospital at Caliente, where fluid temperatures declined.

Many of Nevada's unsuccessful low-temperature geothermal ventures had problems that were unrelated to the technology of the application; geothermal direct-use applications require good economic and market evaluations and good management, as well as good geothermal resources.

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Garside, L.J. and Hess, R.H., 1994, Nevada geothermal resource use - 1993 update: Geothermal Resources Council Bulletin, v. 23, n. 2, p. 47-54.