CHENA HOT SPRINGS

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INTRODUCTION

I visited Chena Hot Springs Resort, about 60 miles (100 km) northeast of Fairbanks, Alaska, in the summer of 1981 and wrote an article on my experience for the *Bulletin* (Vol. 6, No. 3, Fall, 1981, pp. 23-25). My experience included driving the gravel road from Fairbanks, and in the process, losing a window in my brother-in-law's car from a passing truck. The site at that time was primitive with few buildings, gas was $2.00 per gallon (about double compared to Fairbanks) and a convention center was on the drawing board. We did enjoy soaking in the various pools.

This August, I again visited the resort, with many of my fellow geothermal experts. This time I drove on a paved road all the way from Fairbanks. The occasion was the 1st Annual Renewable Energy Fair and dedication of the low temperature, 200 kW, geothermal binary power plant by the owner Bernie Karl, Governor Frank Murkowski and U.S. Senator Ted Stevens. This plant, built by United Technologies Corporation (UTC) of Hartford, CT (www.utc.com), uses the lowest temperature geothermal resource in the world for power generation – at 165º F (74ºC) – and is the first in Alaska. Following the dedication of the power plant, the Alaska Geothermal Working Group held two days of meetings, which included a reception in the Aurora Ice Museum, drinking "Appletini" from individually hand-carved champagne ice glasses, bartended by Bernie Karl.

Much has been added to the Chena Hot Springs Resort since 1981, an ice museum, lodging, expansion of the greenhouse and visits by many Japanese tourists who love to see the Aurora Borealis in the winter and soak in the geothermal waters. A summary of the various projects are described below, and a more detailed article is provided in this issue on the Aurora Ice Museum.

HOT SPRINGS AND POOLS

In 1905, Robert Swan looking for a place where he could ease the pain he suffered from rheumatism, set out in a boat loaded with supplies on the Chena River looking for the hot springs that had been reported by a surveying party the year before. Traveling the North Fork of the Chena and then into Monument Creek, he found the hot springs in August of 1905. This led to the development of the hot springs, and by 1911, the property had a stable, bathhouse and twelve small cabins for visitors. Later the waters were analyzed and found to consist of silica (85 ppm), sulfate (68 ppm), chloride (29 ppm), sodium (110 ppm) and bicarbonate (115 ppm), similar to water from one of the famous springs at Carlsbad in the former Czechoslovakia (see, Lund, 2000). Today the resort consists of the main lodge with a dining area, bar and conference room, an Activity Center, the office/storage building, a large lodge building with numerous well furnished rooms, six cabins, the pool/spa building, the Ice Museum, the power plant building, airplane hangar, dog kennels and numerous other smaller buildings such as a massage and renewable energy center. The hot springs averages around 110ºF (43ºC) which are fed into an outdoor pool, and an indoor pool around 94ºF (34ºC). Several hot tubs are also available.

The outdoor pool directly fed by the hot springs.

At present there are 20 geothermal wells on the property, the deepest at around 1,010 feet (300 m) and producing up to 165ºF (74ºC). Much of the reservoir analysis and drilling supervision had been done by Dick Benoit of Sustainable Solutions, Reno, Nevada and David Blackwell of Southern Methodist University. All the buildings are heated with the geothermal waters, saving about $183,000 per year.

Dick Benoit venting the main geothermal supply line to the power plant.

GEOTHERMAL POWER PLANT

The approximately 200 kW binary power plant was installed at the resort in July 2006, and has been running ever since. The secondary fluid in the plant is R-134a, which has a lower boiling point than water and is heated by geothermal water at 500 gpm (32 L/s) through a heat exchanger at 165ºF (74ºC). Cooling water from a shallow well or infiltration gallery is around 40ºF (4ºC), providing a large temperature difference ("delta T") which improves the efficiency of the system. The resort has used diesel generators in the past, since it is isolated from the electric grid, costing around 30 cents/kWh. The new power plant will provide 7 cents/kWh electricity, a major savings for the resort. The high cost of diesel energy and the large "delta T" certainly makes this unit economical. Maintenance is estimated to be $50,000 per year. The unit uses Carrier chiller components to dramatically reduce the cost of production and allow for modular construction. The total unit cost around $1,500 per installed kW. Plans are to add another 200 kW unit, and shortly reach one MW. Bernie Karl is looking at expansion in the future, depending upon on sustainable production from the geothermal resource, however, the bar has been lowered from around 208ºF (98ºC) to 165ºF (74ºC) for geothermal electric power generation (see Geo-Heat Center Quarterly Bulletin, Vol. 26, No. 2 – September 2005 for a description of other lower temperature combined heat and power uses at http://geoheat.oit.edu/bulletin/bull26-2/bull26-2.pdf).

The insulated supply and disposal pipelines for the power plant are each about 3,000 ft. (1,000 m) long, but fortunately, the cold water supply is gravity fed from a large collection gallery, thus there is no pumping cost for the condenser side of the plant.

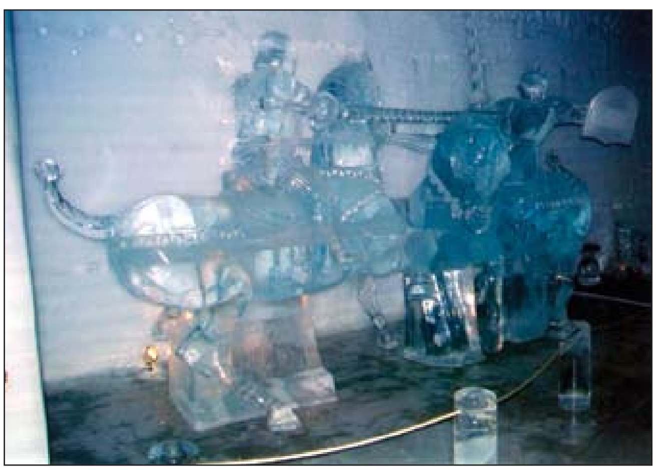
The Ice Museum chess set.

The 200kW United Technologies power plant.

THE AURORA ICE MUSEUM

The Aurora Ice Museum was built as a way to boost tourism at the resort, along with offering year-round employment for many of the ice artists in the area. The museum, a structure made of ice blocks cut from a local beaver pond in winter, is open all year-round – even in the summer when the temperatures reach 90ºF (32ºC)! The museum features a great hall and lounge area, chandeliers made of individually carved ice crystals, countless sculptures including a functional gigantic chess set, life sized jousting knights, and observation tower made of ice and four galleries with varying themes, one room even has an ice toilet. The architect of most of the art is 13-time World Ice Art Champion Steve Brice, and his wife, four-time champion Heather Brown. A 15-ton (53 kW) absorption chiller designed by Energy Concepts Co., powered by the geothermal resource keeps the museum frozen. The 200 gpm (13 L/s) geothermal water is then cascaded to the pool supplementing the pool heat, and may be sent to the greenhouse in the future. It has 10,000 visitors annually, and hosts numerous weddings. Details on the cooling system are provided in another article in this issue by Gwen Holdmann and Donald C. Erickson.

The Ice Museum with protective covering.



Knights jousting.

HORTICULTURE PROJECTS

Chena Hot Springs Resort is working toward becoming a self-sustaining community, which includes independence in food production. A small test greenhouse was installed in 2004, heated by the geothermal resource. They were able to maintain the greenhouse temperature of 85ºF (29ºC) while the outside temperature dropped to -45ºF (-43ºC), typical for interior Alaskan winters. The resort recently added a two-bay 4320 ft^2 (400 m^2) greenhouse where tomatoes, lettuce, green beans, peppers, cucumbers and numerous greens and herbs are grown. During my visit I tasted fresh raspberries and had lettuce and tomatoes in my salads at dinner. It is managed by a trained horticulturist, Rusty Foreaker.

The new greenhouses.

Interior of greenhouse.

Additional information on Chena Hot Springs Resort can be found on their webpage: www.chenahotsprings.com or by calling (907) 451-8104. Chena also has a geothermal projects website at www.yourownpower.com, which gives more detail on all of their renewable energy and sustainable development projects.

REFERENCES

Lund, John W., 1981. "Chena Hot Springs, Alaska", *Geo-Heat Center Quarterly Bulletin, Vol. 6, No. 3*, (Fall), Klamath Falls, Oregon, pp. 23-25

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