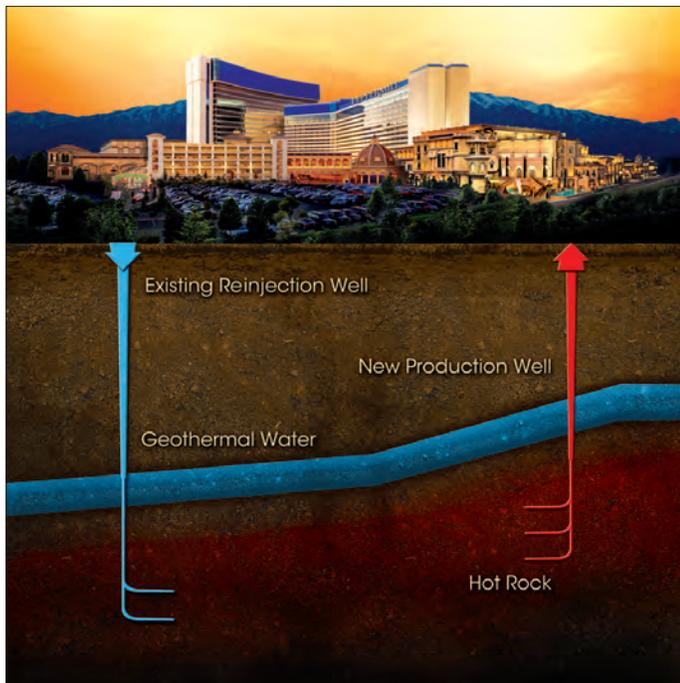


Peppermill's Geothermal Green Initiative is a Winner

by Dean Parker, Peppermill Executive Facilities Director, and Alan Baily, Geothermal Resource Group, Inc.

The Peppermill Resort and Spa has a long history as a participant in the geothermal industry. A frequent host to the annual Geothermal Resource Council (GRC) Annual Meeting and Geothermal Energy Association (GEA) Expo, the Peppermill takes great pride in being involved in a vibrant and very important international industry.



The geothermal heating system at the Peppermill Resort Spa Casino

The Peppermill has taken a pioneering role in environmental stewardship initiatives, as it is one of the few resorts in the USA that is completely heated by their own on-site geothermal deep well system. All water sources on the resort including pools, Jacuzzis, spas, domestic hot water, and mechanical hydronic water, are heated by this renewable energy source.



Dean Parker, Peppermill Executive Facilities Director talks about the geothermal deep well system which provides heat for the resort's luxurious swimming pools and Jacuzzis.

The Peppermill is located on approximately 50 acres, right on the edge of the Moana Geothermal Resource, and has several geothermal wells on location. All are direct-use wells, drawing from the tertiary volcanic's of the Kate Peak formation. Since the early 1980's, the Peppermill has used the resources of low-temperature thermal waters as a small heat source for an outer hotel building and a small outside swimming pool. Initially, two shallow wells (PW #1 and PW #2) were drilled as open loop wells to a depth of 934 feet (285 meters). The shallow wells produced approximately 127 degrees F (53°C), at 120 gallons per minute (gpm) (7.6 liters per second).

The Peppermill IW #4, was drilled in the early 1980's at the same time as #1 and #2 production wells, and then reworked in 1987 to a total depth of 3,307 ft (1,008 m) in the andesites of the Tertiary Kate Peak formation. It was initially drilled as a deep injection well for the shallow production wells, but the injectivity declined over the years due

to scaling issues. It was just recently abandoned earlier this year with much regret. The Peppermill paid careful attention to the abandonment process in order to ensure that no cross contamination would occur between the Moana and Kate's Peak formations.



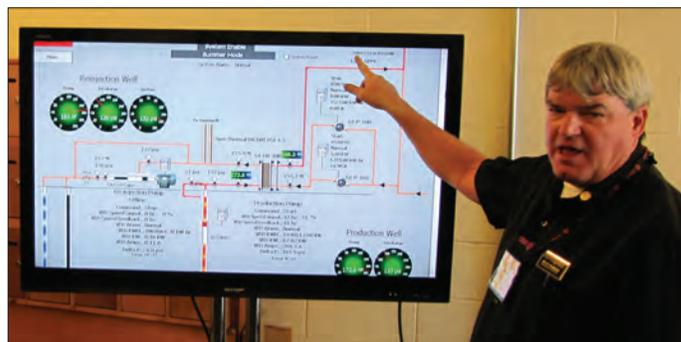
The Peppermill pools with the #8 Production Well being drilled in 2009 in front of the Central Plant facility. COURTESY PEPPERMILL

In 2006, the Peppermill began construction on a large expansion of their facility, adding an additional one million square feet (92,903 m²) to their facility, and the ownership decided to make geothermal an integral part of this development plan. In 2008, the shallow wells were shut down and completely overhauled with new submersible production pumps, heat exchangers, water storage tanks, and stainless steel piping. The new geothermal system was designed to provide partial domestic and mechanical heat to the new 600 suites in the Tuscan hotel tower, two outside swimming pools and Jacuzzi's, and was put back into production that same year.



New sources of geothermal heat allowed the Peppermill to retire its Cleaver Brook natural gas boilers in 2009.

In 2009, the Peppermill noticed significant energy savings from the geothermal shallow well operations at the Central Plant natural gas Cleaver Brook boilers, and elected to expand the capacity of its geothermal heating systems, making it the primary heat source for the entire 2.1 million square foot (195,096 m²) campus. The shallow wells are now shut down due to the deep well operations but are still extant and considered viable. The Peppermill is currently evaluating methods of using those wells in the future.



Dean Parker, Peppermill Executive Facilities Director explains a schematic of the geothermal system.

The Peppermill started drilling the new #8 production well in August 2009, and the #9 injection well in December 2009. The new production well is located on the North West side of the property, located adjacent to their Central Plant facility. The well reached a total depth of 4,421 ft (1,348 m) and produces 174°F (79°C) of heat to the facility. The production pump produces up to 1,200 gallons per minute (gpm) (75.69 liters per second), but has the capacity to produce up to 2,000 gpm (126.14 meters per section), if needed. The 400 horsepower production pump is controlled by a variable frequency drive, and is placed at a depth of 400 ft (122 M) within the well. In the summer months, the geothermal heat energy averages around 8,000,000 Btu's, and will reach a winter average around 33,000,000 Btu's. The geothermal water is pumped into the Central Plant, going through an Alfa Laval heat exchanger, and then discharged.

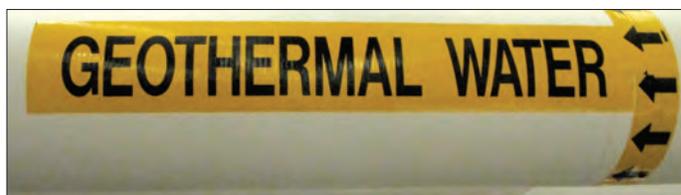
Before the spent water reaches the injection well, the heat averaging around 130 to 140°F is piped through smaller heat exchangers that provide an energy heat source to the outside swimming pools, and guest parking garage ramp snow melt system. The water is then discharged at the IW #9.

The injection well sites on the far south east side of the property, located approximately 1,500 feet apart, and connected using 10" schedule 80 steel pipe. The injection well was drilled to a total depth of 3,900 ft (1,189m), in the same Kate Peak formation, and can handle up to 2,000 gpm of spent geothermal fluids.

The new system has reduced the Peppermill natural gas consumption by 85%, which gave the property a 3.2 year rate of return (ROI) on their financial investment, making this a very sound business decision. In addition to the direct cost savings of the geothermal system, the Peppermill has also experienced a very positive green energy benefit in their marketing efforts. At this time, no future drilling is planned on the Peppermill property. The success of the deep drilling program at the resort has spurred a good deal of interest in developing the moderate temperature resource among other larger commercial applications that can benefit from this same deep-resource exploration. There has been some discussion of low enthalpy, utility grade-development as well, but further evaluation is still underway to determine if this resource has that potential. ■



A tour listens to **Dean Parker** outside the Central Plant facility at the 2012 GRC Annual Meeting.



All water sources on the resort including pools, Jacuzzis, spas, domestic hot water, and mechanical hydronic water, are heated by geothermal water.



Attendees on a previous tour of the Central Plant facility at the Peppermill observe the use of geothermal waters to provide heat at the resort.

The GRC and the Peppermill are pleased to offer six tours of the Peppermill direct use geothermal system throughout the GRC Annual Meeting.

Monday: 12:40 – 1:20 pm and 4:40 – 5:25 pm
(Two tours)

Tuesday: 12:40 – 1:20 pm and 4:15 – 5:00 pm
(Two tours)

Wednesday: 12:00 – 12:45 pm (One tour)

Tours will depart from and return to the Tuscany Ballroom registration area.

No advanced registration required, however a sign-up sheet will be available at the GRC registration desk.