TEMPERATURE "BOOSTING"

Kevin Rafferty
Geo-Heat Center

Owners of low-temperature geothermal resources often ask whether it is practical to raise the temperature of geothermal fluid using conventional fuels. For example, if a well produces water at a temperature of 150°F and a nearby industrial process requires hot water at 185°F, is it practical to "boost" the temperature of the geothermal fluid with a boiler to meet the requirements of the use? We have never seen an application in which this strategy was feasible.

The reason is primarily due to the way in which heating systems, space heating or industrial process are operated. Figure 1 presents a simplified diagram of a closed-loop heating system in a building. Hot water is supplied from the boiler at a temperature of 180°F. The water passes through the heating system and is returned to the boiler at a temperature of 160°F. All of the supply water returns to the boiler to be reheated. No cold water, which must be pre-heated, is added to the system. In order for a geothermal resource to contribute to the energy requirements for this system, it must have a temperature greater than 160°F. Anything less than this would require heat to raise the geothermal water to the lowest temperature of the process (160°) plus the energy required by the process itself. Using a geothermal fluid in this way (beginning at a lower temperature than the process minimum and boosting it) would actually result in an increase in conventional energy consumption. The ability to supply energy to the process is complicated by the nature of the controls on some systems. At less than peak load, many systems return water to the boiler at higher temperatures, in a linear relationship to load. For example, at 100% load, the return temperatures is 160°F,at 50% load 170°F, at 25% load 175°F and so on. This complicates the ability for a low temperature resource to contribute to the energy requirement.

In processes where large amounts of cold "make-up" water are added (open system), there is very good potential to use geothermal resources which produce fluids at a temperature less than the minimum of the process. Domestic hot water heating is an excellent example. Consider a domestic hot water system serving a restaurant where the tank is maintained at a temperature of 160°F. A nearby geothermal resource produces 120°F water. Obviously, this is too low to supply any heat to the storage tank of the system, but it is able to preheat the water sufficiently to meet a portion of the heating requirements. In this case, cold water at 55°F, on it's way to the water heater could be raised to approximately 110°F with the geothermal water. The entering cold water can never be heated to the geothermal water temperature (in this case 120°) due to temperature losses which occur in the heat exchanger. The preheating of the cold water could reduce the total energy required for water heating in this case by approximately 48%. Domestic water heating is one of the most favorable examples for the use of geothermal resources less than the process temperature. This is because all of the water entering the system is make up and must be heated. In many processes, make-up requirements are much smaller and savings to be generated correspondingly smaller.

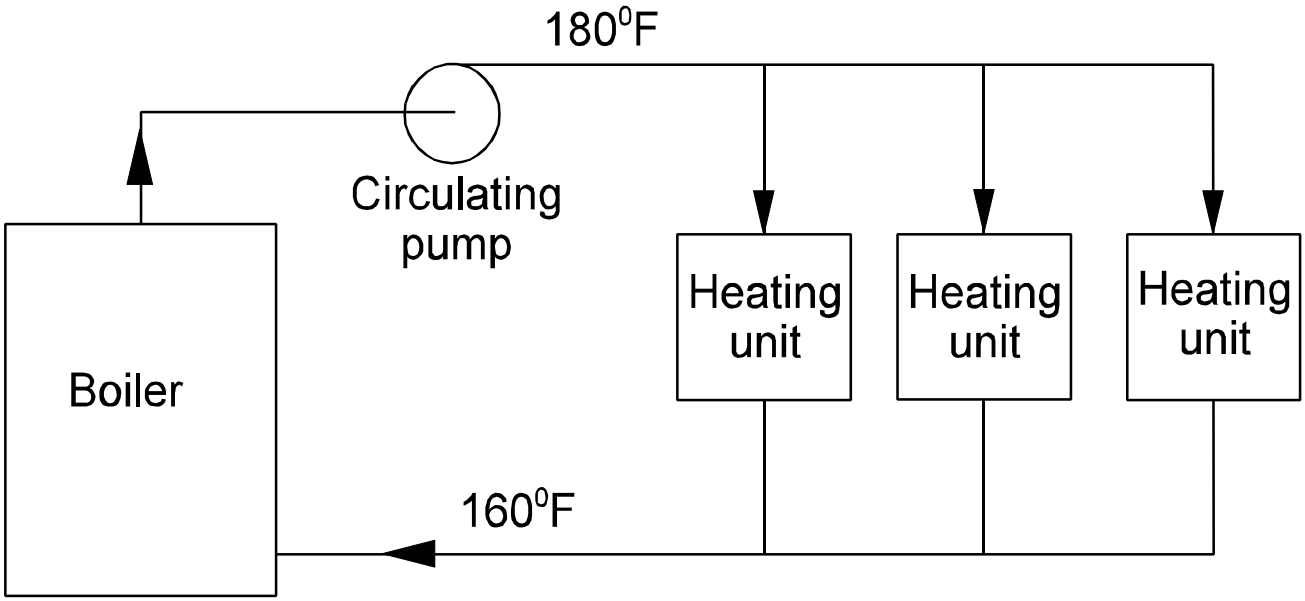

Figure 1.