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ADAPTATION OF GEOTHERMAL RESOURCES TO AIR CONDITIONING OR PROCESS COOLING

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There isn't much doubt that when geothermal energy is available geologically, it is a viable, useful form of energy which can be used for a multitude of functions including, but not limited to space heating, process heating including chemical processes, and space and process cooling. And, like any other form of energy, it must not be wasted but should be conserved by any means of practical control. Nor can it be viewed as "free" energy, since its proper use requires investment into capital equipment for energy control.

I will speak today of the equipment ARKLA has which could conceivably act as interface equipment by which to generate chilled water from geothermal energy through the absorption process.

Arkla produces 4 absorption machines which may be useful for generating chilled water from hot energy. These machines are, by model designation:

1. The WFB-300, capable of generating from 5.5 to 30 tons of A/C when given a hot water input of from 160°F to 205°F.
2. The WF-300, capable of generating from 17 to 25½ tons of A/C when supplied with hot water in the range of 190°F to 245°F.
3. The WF-36, capable of generating from ½ to 3½ tons A/C when supplied with hot water in the range of 170°F to 205°F.
4. The SF-300, capable of generating 5.6 to 25.5 tons A/C when supplied with steam in the range of 7-15 psig.

Each of the above mentioned machines produces chilled water in the range of 40°F to 45°F which can then be used for either process cooling directly, or for space cooling when pumped through a hydronic fan coil.

There is nothing really new or magical about the absorption process itself. The technology has been available for years and its principles of use depend upon the chemistry and physics of refrigerant pairs, the physical principles of the use of pressure differentials to induce rapid absorption of heat, and the chemical process of re-absorption of the refrigerant itself into a concentrated chemical solution, to reform the original paired refrigerant. Arkla has been using this refrigeration technology for over 50 years to produce a chilling affect. Back in 1929 the absorption refrigerator was first produced for residential use; this was known as the "Servel" refrigerator. (A detailed explanation of the absorption cycle follows using projected schematic)

While we are on the technical point of chilling I want to take a moment to review the use of the term "geothermal" energy.

The most notable form of geothermal energy is either hot water or steam. This is rather simple to convert to chilling. But like all energy forms "geothermal" energy may be viewed in"negative"form as well as positive forms. We will define the positive geothermal energy form as a hot fluid, while the negative geothermal form we will call "chilled" fluid. Note that each of the previously mentioned machines generate chilled water in the range of 40° F to 45°F. This energy level is sufficient for space cooling, including removal of latent heat by means of condensation. Therefore, the use of "chilled" geothermal energy, or negative geothermal energy, is implied. Where you gain access to chilled water of this temperature range from any geological source, its functional use can

be applied to space, or process cooling, if required. Let us not limit our thought process to positive, or hot, geothermal forms only, in view of this cooling requirement. Admittedly it may be a rare circumstance where cool geological energy forms exist along with a requirement for cooling, but the thought is interesting nevertheless.

This type of non-restrictive thinking is what prompted King Faisal to comment that perhaps the best method of cooling Saudi-Arabia would be to tow sevral iceburgs to the Gulf and use the melted water for two functions:

1st: The cooling function through use of the chilled water in a hydronic fan coil;
AND 2nd: For potable water.

But, if you let your mind wander a bit scientifically there are other practical avenues of the chilled water approach. One is simply the use of chilled water from mountain-top snows or ice forms. I ask you, is this such an incredible thought in view of other utility systems forms, such as natural gas pipelines, potable water systems, or electric wiring grids? If you haven't already done so you should evaluate chilled water sites as well as hot fluid sites, where chilling is a requirement.

Now let's get back to the more popular geothermal energy form - the hot fluid.

The use of hot geothermal energy forms pose two (2) major problems in practical use:

1. The first what we will call "surge" control. This represents a problem because most geothermal sources are erratic in terms of BTUH delivery, while the actual load use requirement is relatively constant. This implies that there will be a requirement for energy storage and controlled use, by means of storage media tanks, and subsequent temperature-controlled pumps by which to deliver the hot energy to the proper point at the proper time. However, the means to accomplish this task are commercially available, and must be considered in geothermal systems design.

The second major problem is a bit more evasive, erratic in nature, and requires more sophisticated control. That involves the chemical constitinency of the hot energy fluid. Hot, geologic energy forms typically contain one or all of the following chemical characteristics:

1. The characteristic of acidity.
2. Characteristic of alkalinity.
3. Minerals in solution, which means scale deposition onto metallic surfaces.
4. "Solids content" implies a concern for metallic erosion in consideration of fluid velocity.

All of the above chemical points imply a concern for heat exchanger requirement, in terms of life expectancy, transmission efficiency, and generally equipment durability. Some form of chemical treatment of the geothermal media is necessary.

As all these problems are given due consideration, it is readily seen that geothermal energy harnessing is not simple, but is at least as complex as a solar systems design in terms of equipment selection, durability, and controls; but then the first automobile and light bulb were difficult to design and produce also.

In addition to the existing geothermal heat sites created by nature there may be other man-made sites available in the not-too-distant future. Although I can't address the total realm of geothermal energy development I am aware of certain potential developments which may be under consideration in the near future as a result of our search for fossil fuels at deeper and deeper levels. Again, any resultant hot energy discovery should be investigated with some level of respect as the fossil fuel itself.