Geothermal Study
at the
John C. Campbell Folk School
Brasstown, North Carolina

Performed For

Murphy Electric Power Board

by

Earth Energy
Construction, Inc.

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EARTH ENERGY

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Mr. John Carringer – Mgr.
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John,

Having been contacted by Mr. Ed Colucci of TVA in Chattanooga, Earth Energy met with Mr. Eric Townson, A.I.A. and Mr. Terry Townsend, P.E. for the purpose of developing a geothermal test program to determine the size of a loopfield necessary to heat and cool the new addition to the John C. Campbell Folk School at Brasstown, NC. Bill Nagel and Terry Allerton of Earth Energy met with the above architect and engineer on Monday, December 8, 1997 and determined a location for drilling two test boreholes on site. Miller Well Drilling, Inc. of Hayesville, NC was contracted to drill the holes for Earth Energy.

On December 10, Miller Well Drilling moved on site along with Earth Energy and commenced drilling the first hole. Bedrock was encountered at a depth of 96 feet and it was determined that 6-1/4" PVC casing would be set to keep the top of the hole open while drilling in the rock. Drilling continued to a depth of 400 feet that day and most of the next. Soft granite with a 20-foot marble seam was penetrated from the depth of 96 feet to 400 feet. The hole was making a minimal amount of water, approximately 1 gallon per minute, which was unusual for this location.

A high-density, 1-inch, SDR 11, polyethylene loop was placed in the borehole then filled with water. The borehole was then backfilled with #78M crushed stone and sealed from surface water with Bentonite hole plug.

The second hole was relocated 60 feet uphill from the first. Similar conditions were encountered. Only 61 feet of surface casing were needed as bedrock was encountered at a shallower depth. A little more water was made here than in the first hole. The loop

was inserted on the afternoon of the 12th, the hole backfilled and both loops pressure tested at 100 psi and flow tested for obstructions.

On Monday the 15th Earth Energy arrived back on site with a Ewbank portable test unit for the purpose of determining the thermal conductivity. The test was run for 10 hours during which time the water in the loop was heated with a calibrated source while supply and return temperatures were logged along with flow rates and energy inputs. This data was E-Mailed to Oklahoma, then analyzed from which they determined the thermal conductivity to be a value of **1.2 btu/degree F-hr-foot.** This is an average conductivity per foot for the borehole. This value represents the rate at which the borehole and soil will transfer heat. It is an important variable in determining the amount of ground heat exchanger required for a given system. The test equipment, methods, procedures, calculations, and interpretations is done in accordance with the recommendations and guidelines of the International Ground Source Heat Pump Association.

Recommendations:

The thermal conductivity value was given to Townsend Engineering, Inc. where they will use the number along with the building heat gain and heat loss numbers to optimally size the ground loop heat exchanger for this application.

Due to the integrity of the bedrock encountered on this site, hole depths could be extended beyond the 400-foot that we limited ourselves to, but a larger loop size such as 1-1/4" IPS would be required to overcome the frictional losses in the heat exchanger. Going to this larger loop size would void the possibility of using the two existing loops in the design of the heat exchanger and as such we would recommend only using 400-foot holes with 1" IPS loops.

The Folk School is an ideal setting for geothermal heating and cooling. Here owners, directors, instructors, and students alike all seem to be environmentally conscious. Geothermal heat pumps would fit right in as they:

1. Cut down greenhouse emissions by requiring up to half the energy requirements of typical air source equipment.
2. Need only a fraction of the ozone depleting hydrocarbons present in the Freon of typical equipment.
3. There are no noisy condenser units sitting around the perimeter of the building disrupting outdoor communications and taking away from the natural aesthetics of the location.