NARRATIVE

The New Middle School in Blount Co., Tennessee is approximately 106,000 square feet in area. Ventilation requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) were utilized in this study.

The Base Case concept for the heating, ventilating, and air conditioning (HVAC) system is a 4-pipe system utilizing a circulating water loop, natural gas-fired boiler and closed circuit cooler for heat addition and rejection. The system would be controlled by thermostats located in respective zones.

The geothermal system utilizes very similar heat pump equipment as the water source heat pump system except heat is rejected and added via heat exchangers configured vertically in the ground. Each heat exchanger is located in a vertical bore about 300 feet deep. The building interior water loop is circulated via pumps to the "borefield" located outside, underground. Each bore contains a 1-inch supply and return pipe. The extent or number of bores determines the overall capability to reject heat or absorb heat from the constant temperature ground soil. Thus, no boiler or cooler is needed for the water loop. All of the heat exchange is confined to the borefield.

The geothermal units are capable of handling water loop temperature ranges lower than the usual water source heat pumps. This feature usually allows the heat pumps to operate at cooler refrigerant temperature which allow greater mechanical efficiencies and extended equipment life. Therefore, energy and maintenance costs are significantly less than other concepts. Also, the statistical service life of this equipment is twenty years.

We selected high efficiency water source heat pumps as manufactured by Florida Heat pump manufacturing with a C.O.P. of 3.8 and EER at 17.0 for use in the geothermal system scenario. Use of lower efficiency products would drastically affect utility cost savings.

A test bore was prepared and tested at the Blount Co. project site to determine the actual ground temperature and thermal conductivity. The following results were found:

Thermal Conductivity	2.2 btu/hr-ft-f
Ground Temperature	62.1 Degrees F

The above values are favorable. The computed length of bores is about 55,500 feet, requiring about 185 bores, three hundred feet deep and 20 feet on centers.

The computed data for the geothermal concept indicates an annual operating cost savings of $59,256.00 in utilities, as compared to the 4-pipe system. The comparison on a building basis is as follows:

Standard 4-Pipe System	$1.48 per sq. ft.
Geothermal System:	$0.92 per sq. ft.

Thermal Conductivity Calculation

Project Blount co. Middle School

Location Blount Co. , tn

Hole depth:

Hole depth 200

Test date: 8/27/99

Ground Te 62.1

OSAT: 80

Test began @ 7:00 PM 0.5208 Days

Terminated @ 7:30 AM

Final Temp

To bore: 92.8

From bore: 76.6

Heat Input (watts) 4300

Pump Watts: 200

t: 0.5208

d 0.15 3/4" Pipe size

Kg= 2.2

Highland Drilling Company

P.O. Box 160

Kingston, Tennessee 37763

(423) 376-6533

Fax 376-8908

CUSTOMER: TVA
LOCATION: MARYVILLE, TN
DATES: 08/25/99-08/26/99

WELL #1- DRILLED TO 20' SET 21' OF 7" TEMPORARY SURFACE CASING

ROD	DEPTH	FORMATION
1	25	DIRT & SHALE
2	50	SHALE - WATER 30' APPROX. 4 GPM
3	75	SHALE
4	100	SHALE - WATER 80' 5-6 GPM
5	125	SHALE & HARD LIME STK. 115-125
6	150	SHALE
7	175	SHALE & LIME STK.
8	200	SHALE - WATER 190' 6-8 GPM
		TOTAL DEPTH 200'

INSTALLED LOOP 6-8 TON GRAVEL REMOVED CASING

WELL #2- DRILLED TO 20' 8 1/2" HOLE SET 21' OF 7" TEMPORARY SURFACE CASING

ROD	DEPTH	FORMATION
1	25	SHALE
2	50	SHALE - WATER 45' 5 GPM
3	75	SHALE
4	100	SHALE - WATER 86-80' 2-3 GPM
5	125	SHALE
6	150	SHALE
7	175	SHALE - WATER 185' 6-8 GPM
8	200	SHALE
		TOTAL DEPTH 200'

INSTALLED LOOP 6-8 TON GRAVEL REMOVED CASING