



Paragon Centre Allentown, Pennsylvania



The Paragon Centre, an 80,000-sq.-ft. Office condominium in Allentown, Pa., represents a showcase of innovative energy-efficient technologies. It's the largest commercial office project in the region to employ a GeoExchange system for space conditioning. Completed in January 1994, the four-story complex also incorporates such energy-saving strategies as variable-speed pump drives, exhaust air/heat recovery, occupancy sensors to control lighting, and low emissivity windows. Saved energy translates into lower operating costs and diminished emissions, aiding the environment.

Background

Winchester Road Limited Partnership built the Paragon Centre as an office condominium. Space within the building is sold, not leased. Executive parking and climate-controlled storage occupies 20,000 sq. ft. of basement space.

Don Frederick, a principal in the Winchester Road Limited Partnership and President of the Frederick Group, views the building's GeoExchange (or geothermal) system as a primary attraction for prospective office condo owners. The Frederick Group, a leading real estate and development firm in the Lehigh Valley, maintains its offices within the Centre.

“The attraction of geothermal systems centers on low operating costs for heating and cooling.” says Frederick. “For example, our total energy consumption for the year ending August 1996 amounted to \$0.69 per sq. ft. This compares well with the Department of Energy's national figure of \$1.20 (1992 dollars) per sq. ft. For commercial buildings in the Mid-Atlantic region. Additionally, our system is friendly to the environment, reducing emissions. We're very happy that we installed a geothermal system.”

The building's original design called for a 100% ground-coupled heating/cooling system with a cooling load capacity of 200 tons. In this case, the ground loops would be installed in 55 bores, each 480 ft. deep. But initial drilling of the well field revealed that the ground structure below 150 ft. looked like Swiss cheese – full of holes and caverns caused by unstable limestone. Costs for drilling the number of shallower bore holes required to match the original 200-ton design would be prohibitive.

Hybrid Design

To overcome this obstacle, the design team switched to a hybrid GeoExchange system. Calculations showed that ground coupling loops installed in 88 125-ft. deep bores could transfer enough heat to satisfy all the building's heating load and about 40% of its peak cooling load. The design team added an economical closed-circuit fluid cooler to handle the remaining 120 tons of capacity, making it a hybrid system. The total circulating water loop is 520 gallons per minute (gpm), of which 300 gpm run through the closed loop in the ground.

The heat pumps associated with the ground-loop water system, numbering about 80, are extended range, high-efficiency water-to-air and water-to-water units. Heat pump capacities installed in the Paragon Centre range from 1 to 4 tons, but most are 2.5 to 3-ton units. Office condo owners install the individual heat pump units required to meet their specific needs as they fit-up their space.

The high efficiency of GeoExchange systems originates from the relatively stable temperature of the heat source and sink – the ground. In Pennsylvania, the mean groundwater temperature is 55EF. In contrast, the ASHRAE design air temperatures for Allentown are 4EF in the winter and 92EFdb/73EFwb in the summer.

Pennsylvania Power & Light, along with other industry groups, will monitor the Paragon Centre's system into 1998 to generate useful data on hybrid GeoExchange systems.

The adaptability of GeoExchange technology ensures it remains an economical source of heating and cooling when incorporated into hybrid system designs.

Building Data

Location: Allentown, Pa.

Elevation: 387 ft.

ASHRAE design temperatures: winter, 4EF; summer 92E/73EF

Conditioned floor area: 80,000 sq. ft.

Insulation levels: R19 in walls, R24 in roof

Windows: double pane, argon-filled, low emissivity

Total cooling load: 200 tons

Hybrid GeoExchange System Data

77 units ranging from 1 to 4 tons; one 10-ton unit

Ground bores: 88 fully cased, 125 ft. deep, 11,000 lin. ft.

Maximum circulating-loop flow: 520 gpm

Wellfield water flow: 300 gpm

Closed-circuit cooler: 120 tons

Pump: variable speed, 15hp

Energy Use and Cost Data (August 1995 through July 1996)

Total annual energy cost: \$54,979

Total energy cost per sq. ft.: \$0.69

Total HVAC energy cost: \$28,185

Total HVAC energy cost per sq. ft.: \$0.35

Heating degree days: 6521

Cooling degree days: 703

Total building maximum summer demand: 199 KW

Total building maximum winter demand: 152 KW

Project Consultants

Developer: Winchester Road Limited Partnership, Allentown, Pa.

General Partner: Don Frederick

Architect Spillman Farmer Architects, Bethlehem, Pa.

Construction manager: North Star Construction, Allentown, Pa.

HVAC system: McClure Company, Harrisburg, Pa.

Loop contractor: Geothermal Services, Mays Landing, N.J.

Drilling contractor: Craig Test Boring Company, Mays Landing, N.J.

This case study courtesy of Pennsylvania Power & Light.