



Park Chase Apartments A HUD Project, Oklahoma



Park Chase is a 64-building apartment complex on 27 acres in Tulsa, Oklahoma.

The complex consists of 348 apartments that vary in size from 650 to 962 square feet.

When the U.S. Department of Housing and Urban Development (HUD) acquired Park Chase in 1991, the property had fallen into disrepair. Infiltration through the large areas of single-pane, aluminum-framed windows made the apartments drafty in the winter and hard to cool in the summer. Unwanted heat gains and losses were especially problematic on top floor apartments due to the lack of attic insulation.

Falling occupancy rates at Park Chase in the late 1980s had resulted in a decision by the previous owners to defer maintenance on the chiller and boiler plant that served the property's two-pipe system. As a result, one 360-ton electric chiller had been inoperative for years, and its parts cannibalized to keep the other operational 360-ton chiller running. The leaky gas boilers also needed replacement. HUD repossessed the property in 1991 and began plans for renovation.

The GeoExchange Decision

The Park Chase renovation, like many government projects of its type, required input and buy-in from a number of individuals. From the start, there were proponents of ground-source technology within the electric utility, Public Service Company of Oklahoma (PSO), and HUD who lobbied to replace the defunct existing system with individually metered GeoExchange units. Convincing the conservative decision makers at HUD to go with GeoExchange was made difficult because installation problems with an earlier air-source heat pump project in the region had left HUD personnel reluctant to endorse any type of

heat pump technology.

Kevin Cahill of Ralph Jones Company, Inc. was the construction manager for the project. He explained that HUD was unfamiliar with the benefits of GeoExchange systems and had to be sold on the idea. "They wanted us to fix the heating and air conditioning, but didn't know how," he said. "So they explored several options and did cost and payback analysis for each."

In addition to the proposed water-to-air GeoExchange system, almost every possible type of more traditional HVAC systems was also evaluated including:

- Individual air conditioners and gas-fired furnaces;
- Individual air conditioners and gas hydronic systems;
- Individual air conditioners and electric furnaces;
- Water-to-water, ground-source heat pumps;
- Air-cooled heat pumps with gas back-up;
- Air-cooled heat pumps with electric back-up; and
- New central chiller and boiler, and new air handlers.

Thermal Improvements

GeoExchange advocates undertook a whole system approach to the project. They reasoned that, in a public housing project like Park Chase, the objective should not only be to provide affordable rents, but should also be to provide comfortable housing that is affordable in terms of total living costs.

Although the proposed ground-source system could meet the objective of lowered utility costs, it represented increased first costs compared to some of the other systems under consideration. The team concluded that to fully meet project objectives, thermal improvements would have to be made on all apartments including:

- Remove approximately 10,000 sq. ft. of glass;
- Install new double-pane windows;
- Add storms on remaining single-pane windows;
- Install metal, insulated doors;
- Install R-30 attic insulation on top-floor apartments;
- Apply of caulking and weather-stripping; and
- Require all apartments to pass blower door tests.

These improvements would serve not only to increase tenant comfort, they would decrease theoretical system load resulting in lower first costs. According to Bryan Henderson, Multifamily Representative of PSO, “The goal at Park Chase was to reduce the proposed size of equipment by ½ ton per system through the implementation of thermal improvements.”

With GeoExchange system costs of approximately \$2,200 per ton at the time of this project, a reduction of ½ ton per unit would bring the cost of GeoExchange in line with other systems proposed even after taking into account \$700 worth of improvements per apartment. Reducing the design load lowers the cost of GeoExchange systems more than conventional systems by minimizing the length of ground loop and depth of the boreholes, in addition to decreasing the heat pump equipment costs. By shaving 181 tons off total system load, \$398,200 could be saved in equipment costs. By comparison, the thermal improvements would only reduce the cost of the gas hydronic system by \$46,400.

Utility Assistance

As part of the GeoExchange package, HUD would receive incentives totaling \$133,650 through the PSO Good Cents (\$81,450) and Enerwise (\$52,200) Programs. PSO agreed to contribute all the trenching and backfill required for the conversion to individual meters and for wiring upgrades — services that would have cost about \$120,000. PSO also ran the energy simulations to determine heating and cooling loads.

Design

The team proposed a ground-source system designed by Jay Murphy of K & M Shillingford, Inc., the HVAC contractor for the project. Mr. Murphy is a pioneer in the design and installation of GeoExchange systems who has designed and installed commercial and

residential systems in Tulsa since 1978.

Murphy recommended individual systems built around ClimateMaster VE Series water-source heat pumps. Every apartment would have its own heat pump sized to meet the expected load requirements of the apartment (after thermal improvements). Each heat pump would be linked to a vertical ground loop in its own borehole to be located between the housing unit and the sidewalk. A 1/6-hp pump, rated at 5 gallons per minute at 30 feet of head, is matched with each GeoExchange.

Because each apartment is individually metered and has its own loop, PSO did 38 separate load calculations in order to size each loop and system to each apartment. “We wanted to match the well to the load,” said Mr. Murphy. “The loops are tailored to each apartment's size and location in the complex.” Two-bedroom apartments with a north or west exposure have greater loads and correspondingly longer loops: a 275-foot well bore as opposed to a 250-foot bore for apartments on the complex's interior. Similarly the bores for three-bedroom apartments vary from 275 to 340 feet deep.

Taken as a whole, it was an attractive package that stood up well against the runner up — a gas-fired hydronic system. The projected up-front savings of the GeoExchange system over the gas hydronic system was in excess of \$100,000 (including all incentives).

Proposal Comparison		
	GeoExchange System	Gas Hydronic System
724 tons, 416 units	\$1,592,800	\$1,093,248
Savings from Thermal Improvements	(\$398,200)	(\$46,400)
PSO Good Cents Incentive	(\$81,450)	N/A
PSO Enerwise Incentive	(\$52,200)	N/A
PSO Secondary Trenching	(\$120,000)	N/A
System Cost	\$940,950	\$1,046,848
Thermal Improvements	\$244,000	\$244,000
Individual Metering	\$382,800	\$382,800
Net System Cost	\$1,567,750	\$1,673,648
All data courtesy Bryan Henderson, PSO, 1993		

Field Testing

Before a final equipment selection could be made, however, the GeoExchange system had to be performance tested on-site against the gas hydronic system. Two types of GeoExchange systems were tested against the gas hydronic system — a water-to-air GeoExchange and a water-to-water GeoExchange. A prototype of each system was installed at the complex and monitored for a six-month period. The water-to-air GeoExchange system outperformed the gas hydronic system with an annual operating cost savings for heating and cooling of 45%.

On the basis of the test results (and other due diligence research undertaken by the HUD staff), the water-to-air GeoExchange system was approved by HUD in the autumn of 1992. Renovation began in November. By July 1993, the ground loops were in place and the ClimateMaster VE Series units were installed. The thermal improvements were completed in July, 1996.

Energy Savings

Bills for individual apartments in the renovated Park Chase Apartments average \$25-33 per month on utilities, a 50% savings over the old system, which ran \$62/month. HUD saved \$47,000 the first year on the complex's utilities. Even more impressive, these

savings were achieved without much of the R-30 attic insulation in place! Park Chase is projected to save even more now that the thermal improvements are complete.

Tenant Satisfaction

Long-term tenants are also pleased with the new system. Helen Colburn has lived at the Park Chase Apartments for 27 years, and says the individual temperature control has spoiled her. “You can just go and turn it up,” she said. “It’s right there at your fingertips.”

Maintenance Benefits

Maintenance advantages are also apparent as Jay Murphy explains: “Throughout the project, the maintenance personnel expressed some skepticism about GeoExchange, so before the project was complete, we set up a class to teach them about the equipment. Now that the system is in operation, the maintenance staff is very pleased with it.”

Joe Starks, a maintenance man for Park Chase both before and after the renovations, said there is “no comparison” between the old and new systems. “The maintenance on the boiler and chiller was an everyday chore,” he said. “The new system is a lot easier. We go weeks between calls.”

Problems Resolved

The road to this success was not completely smooth, however. Because of municipal ordinances which ban the use of plastic pipe inside of buildings, the polyethylene pipe for the ground heat exchangers was coupled to copper pipes inside the buildings. The anti-freeze used in the system, GS-4, caused corrosion in copper fittings. After two years, during which the performance of the system was excellent, leaks developed — first at the threads and then around valves. HUD had the system drained and flushed. The GS-4 was replaced with propylene glycol, solving the problem completely. There have been no problems since.

Other Benefits

Because ClimateMaster VE Series equipment is installed entirely within each apartment, there is no outdoor equipment which may be damaged by weather or vandalism. The heat pumps are also environmentally safer than the leaky, 27-year-old system because they are manufactured with factory-sealed refrigerant circuits that contain only a third of the refrigerant required by a high-efficiency split system.

Public Service Company of Oklahoma is also pleased with the system. In return for its investment in the system, PSO achieved a reduced peak summer demand of 208 kW, while it increased customer satisfaction.

A True Success Story

With the system installed and operating, tenants of the Park Chase public housing project benefit substantially, according to Kevin Cahill. He states, “There were occupancy rates as low as 50% at Park Chase at one time. Today, there’s a waiting list to get in.”

The Park Chase project is truly a government success story. HUD acquired the dilapidated property in 1991. At times, the occupancy rates were low. HUD made an investment in energy efficiency, reducing tenants’ energy bills by 50%. HUD recently sold the now-desirable property to the private sector.

Key Players	
Facility: Park Chase Apartments Tulsa, Oklahoma Carl Hall, General Manager American Management, Inc.	Consulting Engineer: Warren Smith & Associates 4817 East 34th Street Tulsa, Ok 74135 Wes Smith Phone: (918) 742-3385
HUD Representative U.S. Department of Housing and Urban Development 50 East 15th Street Tulsa, OK 74119-4030 Kenneth Beck, Contracting Officer Phone: (405) 553-7401	Manufacturer: ClimateMaster 7300 S.W. 44th Street Oklahoma City, OK 73125 Phone: (405) 745-6000
General Contractor: Ralph Jones Company, Inc. Kevin Cahill Construction Manager Phone: (918) 665-2700	Drilling Contractor and Loop Installer: Earth Energy Systems, Inc. Phone: (918) 438-6230
Mechanical Contractor: K&M Shillingford, Inc. 5004 E. Archer Tulsa, Oklahoma 74115 Jay Murphy Phone: (918) 834-7000	Electric Utility: Public Service Company of Oklahoma P.O. Box 21928 Tulsa, OK 74121 Bryan Henderson Phone: (918) 594-4009

Impact of Thermal Improvements							
Unit Type	Square Footage	No. of Apts	Original Design (tons)	BTUs w/ R-30 only	Final Design (BTUs)	Final Design (tons)	Total Tons Reduction
1 Bedroom	650	80	1.5	17,156	11,423	1.0	30
2 Bedroom Flat	740	152	2.0	20,420	14,417	1.5	76
2 Bedroom TH	740	48	3.0	24,619	18,823	2.0	43*
3 Bedroom Flat	961	48	2.0	23,754	17,122	1.5	12
3 Bedroom TH	962	20	3.0	25,843	22,052	2.0	20
Totals		348	724			543	181
All data courtesy Bryan Henderson, PSO, 1993				* Does not include townhouses used for performance testing			