

Phillips 66 Service Station Prairie Village, Kansas



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An innovative GeoExchange (geothermal) heating and cooling system installed in a Phillips 66 service station and convenience store in Prairie Village, Kansas, followed by two similar successful installations in Dallas, Texas and Oklahoma City, Oklahoma, has prompted the Phillips Petroleum Company to adopt GeoExchange systems as a new design standard for all their company-owned service stations. The Prairie Village installation uses GeoExchange systems for driveway ice melting, warm water for car washes, and radiant heat for car wash bays. It also links the store's refrigerators, walk-in freezers, and icemakers to the GeoExchange system.

GeoExchange System Advantages

The heat pump used for space heating and cooling is coupled to a closed ground loop installed in ten 325-foot vertical wells around the station's perimeter. The convenience store appliances have their own separate water-cooled compressors, and waste heat from the appliances is discharged into the same ground loops used by the space conditioning system. The heat pumps are fitted between the roof and the ceiling, eliminating floor

space requirements for the system. The indoor location of the heat pumps also avoids energy inefficiencies that normally occur in conventional heating and cooling systems when exhaust from one rooftop unit interferes with the efficiency of other such units. Since this problem has been eliminated, the store can use smaller compressors for the coolers and freezers, further reducing electricity use. Coupling the GeoExchange system with the 4-ton walk-in cooler, freezer and icemaker utilizes heat that is usually wasted through air cooling the appliances. This installation has reduced electricity consumption by 40 percent compared to air-cooled equipment of the same size, and eliminated the need to purchase water to cool the icemakers. Cooler and freezer compressor sizes have been reduced from 5 hp and 3 hp to 3 hp and 1 hp, respectively. Locating the equipment inside the store has brought added advantages of reduced maintenance, a cleaner, more attractive look for the station, and reduced likelihood of vandalism to equipment.

Special Features

System Features

- C Vertical closed loop
- C 10 x 325 ft borholes around station
- C GeoExchange pipe: Phillips Driscopipe high-density polyethylene
- C GeoExchange capacity: 5 tons
- C Number of heat pumps: 1
- C GeoExchange COP: 3.0-3.5
- C GeoExchange EER: 11.6-13.5
- C GeoExchange manufacturer:
Florida Heat Pump

Project Participants

Owner Representative:

J.J. (Joe) Brown, 918.661.7013

Utility:

Dave Wagner, 816.556.2200

System design and construction:

Madison, Inc., 918.224.6990

Cooler and freezer system design:

Fortier, Inc.

Installation:

Rusco Refrigeration,
816.763.1797

Wintertime car wash operations are typically problematic because of the difficulty of keeping the equipment warm as overhead doors open and close continuously. In addition, spray from the car wash can cause entrances and exits to ice up. The Phillips Company has solved this problem by coupling the GeoExchange system with radiant floor heating in the car wash bays and placing ice melting equipment below the concrete at the car wash entrances and exits.

Two-year Payback

Although the GeoExchange systems add about \$25,000 to \$35,000 to the cost of each Phillips station over the cost of conventional technology, the high initial investment is expected to pay for itself in about two years when considering savings in both its electricity and water costs. The Prairie Village store saves about \$9,600 a year on electricity alone compared to a Phillips store of about the same size across town that uses a conventional system. Phillips 66 stations using the GeoExchange technology are expected to be able to lower their total utility bills by about \$250,000 over the 20-year life of the equipment,

with large stations saving even more. Over three-fourths of the savings are expected to come from reduced electricity consumption, but lower water bills will also contribute to the savings.

Superior Comfort

The Prairie Village system is reported to maintain a very comfortable temperature during extremely cold weather without any backup heating. According to Joe Brown, Phillips' senior supervisor for retail projects, "When the temperature in Kansas City dropped to below -30° F., the Prairie Village station was the only warm store in town, even though it has no supplemental, backup electric resistance heating." The GeoExchange system has benefited the Phillips 66 store beyond energy savings. "Because all of our equipment is located inside the store, we have fewer dirt-, debris- and weather-related maintenance problems. It's easier to get at the equipment for regular maintenance. Plus the store has a cleaner, more appealing look, with less potential for vandalism."

The first three stations to use the GeoExchange systems have been so successful that Phillips opened three more last year -- two in Amarillo, Texas and one in Denver, Colorado.