



# Cambria County Prison Pennsylvania



The Cambria County Prison, completed in 1997, is located in a mountainous area of Western Pennsylvania. The extreme temperature range from 10 degrees below zero during the winter to 95 degrees during the summer. The initial HVAC option was an electric chiller and a gas boiler with a variable air volume (VAV) air distribution system. GPU Energy, the electric utility, suggested that the county consider a GeoExchangeK (geothermal heating and cooling) system for the new prison.

The prison is 126,780 square feet and is planned to accommodate 330 inmates. The design of the building was set up in a series of pods. The ASHRAE 62-1989 fresh air ventilation requirement accounted for 50% of the building heating and air conditioning requirements.

## Economics

Two test bores were initially drilled to 350 feet deep at each end of the proposed loop field to investigate subsurface conditions.

The installation cost for the geothermal system was \$20.99 per square foot. This installation cost included the loop field and the prison mechanical system with union prevailing wages. The original chiller and boiler was budgeted for \$19.50 per square

foot. The first cost premium for the geothermal system was \$235,900.

The annual energy savings were calculated to be \$52,800. Maintenance costs savings are similarly impressive. ASHRAE estimates costs for a boiler and a chiller at \$0.48 per square foot of \$60,954 annually for the building. The GeoExchange system has an annual maintenance cost of \$0.15 per square foot will cost \$19,017 annually. The geothermal system will result in \$41,837 in annual maintenance savings.

First Cost Premium	\$235,900
Annual Savings	
Energy	\$52,800
Maintenance	<u>41,837</u>
	<u>\$94,637</u>
Excludes electric utility grant, savings from smaller mechanical space, and elimination of gas main extension.	

GPU Energy provided a grant of \$60,000 or approximately \$0.50 per square foot. And there were secondary benefits to the GeoExchange system. The entire hot water requirements were met with the geothermal heat pumps. The system enabled the building designers to reduce the size of the mechanical space and convert the area to usable space. Also, the natural gas line was a considerable distance from the new prison site, and would have cost several hundred thousand dollars to extend.

## GeoExchange System

Since test bores revealed favorable drilling

conditions through 250 feet deep, a total of 134 bores drilled 250 feet deep were installed for the loop field. The ground loop consisted of 68,400 feet of 1.25" high density polyethylene (HDPE) pipe. Five vertical bores were circuited with 2" polyethylene pipe. A total of 25,840 feet of 2" pipe was installed in these boreholes and used in manifolds. All were connected to 145 feet of 10" header through a series of balancing and shutoff valves.

The system fluid, water in this case, is circulated through the buried piping system. During the winter, the fluid absorbs heat from the earth and carries it to geothermal heat pumps indoors. The heat pumps extract heat from the pipes, compress it to a higher temperature, and distribute to individual air handlers in the housing modules, administrative, and other areas.

Multiple 10 ton geothermal water to water heat pumps piped in parallel provided 120 degree hot water and 45 degree chilled water to the air handlers. A total of 520 tons of geothermal heat pumps were installed. The air handlers ranged in size from 12,000 CFM to 20,000 CFM. The air handlers include air-to-air plate heat exchangers, which pre-heat or pre-cool the outdoor ventilation air required by the ASHRAE standard.

With this system, heat may be drawn from one area of the building that is too hot, and used in another area that needs heating. During the summer, heat that is unneeded for producing hot water is returned to the earth through the piping network.

The nominal cooling load is 3565.2 MBH and the nominal heating load is 3776.2 MBH. The facility is fully controlled and monitored by a Direct Digital Control (DDC) system with graphics. All areas of the building can be reprogrammed to accommodate changing use or occupancy.

### **About GeoExchange**

Thousands of businesses and institutions and tens of thousands of homes already use GeoExchange

systems for heating and cooling. According to the U.S. Environmental Protection Agency, GeoExchange systems are the most energy efficient and environmentally friendly heating, cooling, and water heating option.

The Geothermal Heat Pump Consortium, Inc. (GHPC) was formed late in 1994 to increase the use of this important technology. GHPC is a non-profit organization with participation and support from the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the Nation's utilities.

#### **Key Players**

##### **Owner**

Cambria County, Pennsylvania

##### **Engineers**

L. Robert Kimball Associates  
Mr. Frank Albacete  
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Mancini & Saldan  
Etobicoke, Ontario, Canada

##### **Contractor**

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814-288-1151

##### **Loop Installer**

Geothermal Services  
Mr. Steve Rubin  
Mays Landing, NJ  
609-625-4862

Information courtesy Frank Albacete and Bob Dooley.