



## Geothermal heating to save money, energy at MAFB

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Geothermal heating has been used since the time of the Romans as a way of heating buildings; now, it has come to Minot AFB.

The 5th Bomb Wing headquarters building is currently undergoing construction to utilize geothermal heating by having 39 ground source heat pumps installed in the building along with 30 geothermal wells on the west side of the building.

Geothermal heating is the use of the earth's thermal energy to provide cooling or heating, according to Lawrence D. Johnson, 5th Civil Engineer Squadron, geothermal project designer and engineer here.

Johnson came upon the idea of using geothermal heating in select buildings on the base when he saw the amount of steam emanating from the base in the winter, which he considers wasted energy as it takes 1,000 British thermal units (BTUs) to turn one pound of water into steam. A BTU is the amount of heat required to raise the temperature of one pound of liquid water by one degree. He estimated that Minot AFB was wasting approximately \$4 million per year in natural gas.

According to Johnson, to heat or cool air using geothermal heat, water and antifreeze are pumped through pipes that extend to approximately 200 feet below the earth's surface. As the water circulates through the tubing, it is either heated or cooled depending on the desired output. For heating, the chilled water absorbs the heat from the ground and that heat passes through a ground source heat pump, which takes the heat from the water and heats the air flowing into the building.

"The savings are huge," Johnson said.

Geothermal heat pumps can transfer about four times as much energy as they use. To put a million BTUs into a building costs about \$10 using natural gas and about \$2.70 using geothermal and is virtually cost-free for cooling, said Johnson.

Johnson added that the new system will provide heat and cooling for an estimated \$1,800 dollars per year using the energy recovery on ventilation and heat pumps. The system will save the Air Force approximately \$16,200 per year, depending on the cost of natural gas.

The heat pumps require very little maintenance and will last about 25 years; the wells will last about 50 years, said Johnson.

The cost to install this system is about \$300,000 for a one story building and about \$850,000 for a two story building; however, the installation cost is about equal to the installation cost of a conventional heating/cooling system.

"It is nice to have a payback, but saving energy is not all about money either," Johnson added. "I believe geothermal heating will save Minot AFB a lot of money in the long run."



MINOT AIR FORCE BASE, N.D. -- A construction worker drills a hole through a floor in the 5th Bomb Wing headquarters building here Dec. 15, while installing a geothermal heat system. The 5th Bomb Wing headquarters building is currently undergoing construction to utilize geothermal heating by having 39 ground source heat pumps installed in the building along with 30 geothermal wells on the west side of the building. (U.S. Air Force photo by Staff Sgt. Keith Ballard)