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Geothermal Power

Fort Knox's Buried Treasure

Christopher Helman, 10.09.06, 6:00 AM ET

Col. Mark Needham is the garrison commander of Fort Knox, one of the Army's biggest bases and home, of course, to the U.S. Treasury Department's stash of gold bullion. He's accustomed to the rigors of keeping tanks and armored vehicles ready for deployment to Iraq.

But there's one thing the Army doesn't train its officers in: energy efficiency. "We're mandated to reduce the fort's energy use 20% by 2015, and with the projects we have in place, we're on the glide path to making it happen," says the colonel.

A far cry from the sorry state that was Fort Knox's energy infrastructure a few years back. The 109,000-acre base ranks as the sixth largest in Kentucky, with 22,000 people working there during the day. It's biggest energy expense was in heating and cooling its 450 buildings, but the systems were outdated, and commanders had put off $100 million in maintenance and infrastructure upgrading costs over recent years because, says Needham, they didn't have the money or manpower available to do it right. "We would run the systems until they broke down, then fix them. This reduces their lifespan."

Fort Knox began talking about solutions with Nolin Rural Electric Cooperative, which maintains the high-voltage lines bringing power to the base. Nolin brought in energy engineers from **Trane**, the big subsidiary of publicly traded American Standard. With power prices on the rise in recent years, Trane, along with competitors like Honeywell and Siemens, have seen a rush of new business auditing and overhauling energy systems for corporate and government clients.

But few jobs were as big as Fort Knox, where since 2002 Trane has installed $90 million of new heating and cooling equipment and monitoring systems. Best of all, the upgrades are quickly paying for themselves, having already cut base energy expenditures by 20% or $8 million a year.

The core of the Fort Knox upgrade: installation of the world's biggest geothermal heating and cooling system. First of all, there is no molten lava or volcanic force being tapped in this geothermal project. Rather, the system takes advantage of the fact that the earth underneath Fort Knox (like many places across the country) maintains a more or less constant temperature of 57 degrees year around. By tapping that temperature, Fort Knox can keep cool on hot summer days and warm up in the dead of winter.

It works like this: Trane bored holes up to 500 feet underground and installed dozens of loops of pipe. A pumping system sends water through the pipes down into the earth, then back up to the surface. In the summertime the pumped water starts off warmer than the earth, but the warmth is absorbed by the earth, and the water comes back up at 57 degrees and is used as an air-conditioning refrigerant. In the winter the water pumped down is cooler than the earth, which warms it up for help in heating. Says Trane representative Brandon Marcum, "You can get a lot of heat out of 57-degree water."

So far, 685 geothermal holes with 64 miles of pipe below Fort Knox provide heating and cooling for nearly one-third of its 8.5 million square feet of nonresidential building space. (That doesn't include the gold depository, which is overseen separately by the Department of Treasury.) Needham is sold on geothermal and says that any new facilities built at Fort Knox will be tied into a geothermal system. "Other installations have been asking us how we did it," he says, crediting the base's partnership with Trane and the local power co-op in making it work.

The system has a guaranteed lifespan of 50 years and is endlessly sustainable--the underground temperature is determined mainly by the earth-absorbing solar energy. "It has reduced our natural gas consumption to zero and cut emissions by a third," says Needham. "And we didn't need any air permits." The Fort Knox project has won numerous sustainable energy awards.

One drawback: Geothermal systems, on an Army base or at a home, cost some 25% more to install than traditional HVAC equipment. But the local power co-op financed the base's entire $90 million upgrade, including the $60 million geothermal installation. Why so charitable? The co-op isn't in the business of power generation, just electricity transmission. By helping the base use existing juice supply more efficiently, the co-op can hold off on costly and more complicated investments in new high-

voltage lines.

At current electricity prices, an investment in a geothermal heat pump system can be paid off in less than eight years, says Trane, which like other energy service providers has seen a big uptick in interest for geothermal systems in recent years, from the military, schools, corporations and even residential customers. Hundreds of systems are installed each year. Not bad for a technique that last got attention after the energy crisis of the 1970s.

The average cost to install a geothermal heat pump in a home runs to $15,000. The Geothermal Heat Pump Consortium (geoexchange.org) explains that federal and state tax incentives can pay for as much as 25% of installation costs and boasts that geothermal can reduce the average home's energy bills by 25% to 50%.

Before you rush out and order a geothermal system, remember that furnace and air-conditioning technology has advanced as well, with new units 20% more efficient than a decade ago. Trane director Dane Taival explains that after installing new control systems and equipment for a new medical center client, Trane will guarantee that the center will use 50% less energy for $1 million in energy savings a year. By financing the new gear over several years, the improvements immediately reduce monthly expenses.

Practically every home can benefit from a regular regimen of new weatherstripping and insulation. Before winter sets in, rent an infrared camera to take pictures of your house and find heat leaks that need insulating. New window films can reduce heat lost through windows by more than 50%. And it's time to give a second thought to swapping out old incandescent bulbs for new compact fluorescents--new electronic ballasts have finally gotten rid of the migraine-inducing florescent flicker.

What to do with all that money you'll save on an energy overhaul? How about a trip to see a geothermal system at work? At the new Intercontinental Hotels resort at Bora Bora, air conditioning for its 80 villas on a pristine lagoon comes from a system of pipes extending 1.5 miles offshore and 3,000 feet deep, tapping the cooling power of 41-degree seawater.