



## California Earns an A+ for Geoexchange in Local Schools

When the subject is space conditioning, geoexchange, also known as geothermal or ground source heat pumps, earns high marks for energy efficiency, reliability, and operating and maintenance costs in school districts across the United States. Moreover, the technology, which relies on the earth's natural warmth to wrap buildings in comfort, deserves extra credit for competitive installation costs.

While geoexchange systems have occasionally been perceived as more expensive to install than conventional HVAC systems, experienced architects and engineers say this argument is nothing more than hot air.

“Generally speaking, we have found that a geothermal system can be installed for about the same cost as a conventional system,” said architect David Samokar of Clotfelter-Samokar of Bardstown, Kentucky, specialists in educational facilities.

Considering the substantial operating and maintenance cost savings of geoexchange, experts like Samokar, whose firm undertakes about 14 new and retrofit school projects each year, believe the technology is the most educated choice for heating and cooling schools. “I am sold on the benefits--the simplicity of the system, the environmental and economic advantages, and the ease

of maintenance and operation,” Samokar said.

### *Schools Give Geoexchange the Green Light*

In 1993, the Environmental Protection Agency (EPA) published a report, “Space Conditioning: The Next Frontier,” encouraging schools to consider geoexchange, the most environmentally friendly and energy-efficient technology available. Schools from Walla Walla, Washington to Chesapeake, Virginia have responded, trading in their boilers and air-conditioning units for the comfort, economy and efficiency of geoexchange systems.

In the Austin (Texas) Independent School District, for example, virtually every heating and cooling system installation has been geoexchange. Energy savings are estimated to be 25 percent. Even in the frigid climate of the Minnesota-Canadian border, where winter temperatures can dip below -50 degrees Fahrenheit, energy savings at the Onamia Elementary School are estimated at 20 percent.

Today, more than 650 schools in 39 states enjoy the benefits of geoexchange. In turn, so do over one million students and 50,000 teachers.

In California, school districts have begun to install geoexchange systems in their facilities. In Northern

California, the new Truckee Middle School will use a geexchange system to heat and cool its 87,000 sq. ft. facility with a capacity of 1,000 students. The school is expected to open in September, 2004. (Construction is slated only for summer months.) When it opens, the

school's geexchange system is expected to reduce its energy usage by 72% annually compared to a natural gas and chiller system. Its energy costs will drop by more than \$55,000 annually, a nearly 60% reduction in energy costs.

### ***Geexchange Systems in California Schools***

#### **John W. North High School, Riverside, CA**

- Retrofit of weight room/student store area
- 4,800 sq. ft.
- 20 tons
- vertical closed loop field – 16 boreholes, 360 ft. deep
- Installed in 2003

#### **Truckee Middle School, Truckee, CA**

- New Construction
- 87,000 sq. ft.
- 253 tons
- vertical closed loop system – 288 boreholes, 315 ft. deep
- Completion date - September, 2004

#### **Blue Oak School, Napa, CA**

- Retrofit of 96 year old building
- 18,900 sq. ft.
- 59 tons
- vertical closed loop system – 42 bore holes, 350 ft. deep
- Installed in 2002

#### **Colleges at LaRue, Davis, CA**

- New construction
- 218,000 sq. ft.
- 440 tons
- vertical closed loop system – 300 boreholes
- Installed in 2001

#### **Natomas High School, Sacramento, CA**

- New construction
- 235,000 sq. ft.
- 490 tons
- vertical closed loop system – 534 boreholes, 275 ft. deep
- Completion date - 2004

#### **Squaw Valley Children's World, Squaw Valley, CA**

- New construction
- 15,000 sq. ft. indoors, 8,000 sq. ft. snow melt outdoors

- 40 tons
- horizontal closed loop system
- Installed in 1992

#### **Weaverville Elementary School, Weaverville, CA**

- Retrofit
- 68,000 sq. ft.
- 90 tons
- vertical closed loop system – 119 boreholes, 500 ft. deep
- Installed in 2003

#### **Weaverville High School, Weaverville, CA**

- Retrofit
- 41,400 sq. ft.
- 75 tons
- vertical closed loop system – 83 boreholes, 312 ft. deep
- Installed in 2002

#### **Feather River College, Quincy, CA**

- Retrofit of four buildings
- 52,000 sq. ft.
- 135 tons
- two buildings have a horizontal loop system – 20 trenches, 295 ft. long; two buildings have a vertical closed loop system -- 56 boreholes, 120 ft. deep
- Installed in 1997

#### **San Joaquin School District, CA**

Tracy Community School - Tracy, CA  
 Lathrop Community School - Lathrop, CA  
 Kettleman Lane Community School - Lodi, CA  
 Durham Ferry Community School - Manteca, CA  
 Pock Lane Community School - Stockton, CA  
 Manteca Community School - Manteca, CA  
 Bianchi Community School - Stockton, CA  
 Hammer Lane Community School - Stockton, CA  
 Columbia Community School - Stockton, CA

- New construction
- Six schools – 10, 295 sq. ft.
- Three schools – 7,455 sq. ft.
- Slinky loop system – 90 500 ft. slinky coils per school
- Installed in 2003/2004

In 2003, the John W. North High School in Riverside installed a geexchange system in a retrofit project that included an existing building which houses a weight room and student store. The 20-ton system, installed in 2003, will be monitored to determine energy usage and indoor comfort levels.

In 1997, Feather River College retrofitted four buildings on its campus with geothermal heat pump systems. The college, located near Quincy, is saving more than \$50,000 annually. And in central California, the San Joaquin School District chose geexchange to save on energy costs in nine of its community schools.

### ***Straight A's for Geoexchange***

Geoexchange earns high marks across the board:

*Lower operating and maintenance costs.* Operating and maintenance costs are substantially lower with a geexchange system. A study in Austin, Texas, for example, determined that geexchange systems are the most financially beneficial heating and cooling choice for schools, resulting in a decision to convert 54 schools to the technology. Kentucky Utilities data estimate the operating and maintenance savings of geexchange systems to be 12 to 19 percent over 20 years. A study by Lincoln (Nebraska) Electric System yielded similar results. Moreover, the EPA suggests that, depending on a number of variables, savings of 40 percent or more on annual heating and cooling costs are not uncommon. Maintenance costs also are reduced because of the innate simplicity and

reliability of geexchange. Routine maintenance is primarily the replacement of air filters. Because these tasks can be done by the school custodial staff, geexchange requires no in-school HVAC technicians.

*Classroom comfort and user satisfaction.* Because geexchange systems use several relatively small heat pumps, each teacher can control the climate in his or her classroom. Larger spaces, such as gymnasiums and auditoriums, are conditioned by their own individual heat pumps. There is no need to heat or cool other areas of the school when only these spaces will be utilized for after-hours or weekend activities.

*Design flexibility "in"--rooftop repairs "out."* Because most geexchange systems eliminate the need for outdoor or rooftop equipment, schools are no longer limited to flat roof design, allowing for a broader range of architectural ideas and reducing the need for rooftop repairs. Moreover, geexchange systems occupy less physical building space than conventional heating and cooling equipment, leaving additional space for other uses.

*Safety.* Some combustion-based systems present a hazard if the storage or delivery of fuel is not carefully controlled. Since these systems require a flame to operate, a potential fire hazard exists. Furthermore, incorrectly installed combustion-based systems, blocked chimneys or back drafting can cause carbon monoxide to remain inside a building. Geoexchange uses no combustion, requires no fuel storage

and delivery, and produces no indoor pollutants. Additionally, since the earth connection is installed beneath the ground, children are not tempted to play on dangerous outdoor equipment.

*Environmental benefits, awareness--and action.* The more than 650 U.S. schools that have already adopted geoexchange have helped reduce annual emissions by close to 120 million pounds of carbon dioxide (CO<sub>2</sub>), more than 900,000 pounds of sulfur dioxide (SO<sub>2</sub>) and more than 425,000 pounds of nitric oxide (NO<sub>x</sub>).

And, as the most energy-efficient system available, geoexchange takes the important message of stewardship of the earth and puts it into action for students today--and for generations to come.