Lange Transportation

CASE STUDY

Geoexchange Series

Lange transportation borehole digging for geothermal exchange via www.langeshow.com/green.htm

SITE PROFILE

Building owner	Lange Transportation
Building location	Mississauga, ON
Building type and use	Office-warehouse constructed in mid-1970s
Net floor area (ft^2)	~70,000 (10,000 for office space and 60,000 for warehouse)
System type	Vertical closed loop
Ground loop	28 boreholes, 360 ft deep
Number of GSHPs	9 (3 in the office space, 6 in the warehouse)
Distribution system	Forced-air
Year installed	2006

ABOUT THE SITE

Lange Transportation is a transportation and logistical management company based in Toronto, Ontario. Founded in 1986, the company specializes in the trade-show and special events market. The Lange head office is located at 3965 Nashua Drive in Mississauga, Ontario.

RATIONALE AND PLANNING

When Lange headquarters was relocated to a 30 year old building in 2006, utility costs were much higher than anticipated. Before staff had even moved into the facility, monthly electricity costs were $3,800 and the natural gas bill totaled $5,600. In order to reduce long term operating costs, the existing HVAC system was replaced with a geoexchange system and several upgrades to the building were performed in order to improve energy performance. The expected payback of the geoexchange project was 8 years.

GEOEXCHANGE SYSTEM DESIGN

Installed in 2006, the geoexchange system was designed to serve 10,000 square feet of office space as well as Lange's 60,000 square foot warehouse. It is a closed loop vertical system that contains 28 boreholes extending 360 feet into the earth

and 9 ground source heat pumps. A forced-air system distributes heat and cooling throughout the building. To optimize geoexchange system performance, a highly insulated roof was installed and the building's duct work was upgraded. In the warehouse, duct work was perforated to distribute the air over a larger area and fans were installed to bring heat down to the floor. In order to further limit heat loss, the warehouse was fitted with insulated, air cushioned steel doors that contain Plexiglas windows so that the exterior was visible without having to open the door. Energy efficiency of the building was improved significantly by installing thermal glass windows, T5 and T8 fluorescent lights, and solar tubes to increase natural lighting. To further enhance energy efficiency, motion sensors were installed on lighting in the washrooms and kitchen, and the number of light fixtures operated by a switch was reduced from 20 to 5.

Figure 1. A manifold in the Lange Transportation geoexchange system via http://www.langeshow.com/green.htm

PROJECT IMPLEMENTATION

To perform the work, Lange procured a design-build contract with a municipal utility company. The design-build contract was subsequently transferred to a different firm that completed the work. The primary contract holder procured all of the subcontractors and retained a project manager, resulting in very little time spent on project management by Lange management. Lange President Eric Lange was highly satisfied with the service provided by the project team.

OPERATION AND MAINTENANCE

Management claims that the effort and associated costs required to maintain the geoexchange system are less than for a conventional HVAC system. To date, there have been no significant operation and maintenance challenges.

COSTS

The cost of the geoexchange retrofit was $530, 000, which was considerably higher than the $180,000 required to install a natural gas system. Initially, it was a challenge for management to obtain financing for the geoexchange project because the technology was not well understood within the financial sector. The project was funded through: (i) a government incentive, (ii) waived provincial sales tax on equipment, (iii) a three year loan from the federal government, and (iv) a small additional mortgage on the building. The geoexchange project achieved a payback of 6 years, which is 2 years less than expected. This was due, in part, to the high price of natural gas at the time and lower than expected system maintenance costs.

SUCCESSES

As well as achieving a short payback, management reports that the geoexchange system has contributed to increased employee productivity and satisfaction. Employees are permitted to set thermostats according to their preferences because the owner claims that it is relatively inexpensive to heat and cool the building using geoexchange. Employees who work in the warehouse are especially pleased because the area now receives air conditioning, which had been prohibitively expensive using a conventional HVAC system. The system owner reported that he would be enthusiastic about installing geoexchange in other buildings.

Unlike conventional HVAC systems, the cost of a geoexchange system is more proportional to the system capacity. Reductions in heating load can then have a notable impact at reducing the capital cost of a geoexchange system. This means that energy efficiency measures, such as improvements in the building envelope or windows, in combination with a geoexchange system can often be a more cost-effective solution than geoexchange alone.

LESSONS LEARNED

Some of the duct sizing in the warehouse area needed to be redone after the installation. They discovered that the best way to heat and cool the warehouse evenly with forced air was via long ducts perforated with holes.

In hindsight, management regretted the decision to wait on upgrading the roof insulation until a year after the geoexchange system was installed. During the first year the system had difficulty keeping up with higher heating and cooling loads created by the poorly insulated roof (for which the system was not designed).

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