

Case Study

Horizontal Closed Loop
140 ton Geothermal Installation

2003/04/09

Madran Tree Nursery Bathurst, NB

IN the fall of 2002 the owners of the Madran Tree Nursery decided to investigate alternate sources of heat energy for their rapidly expanding business located near Bathurst, New Brunswick. As for all greenhouse operations, fuel costs are one of the largest expenses of such an enterprise and therefore offers a great potential for savings when carefully addressed.

The engineering firm of Roy Consultants was engaged to examine the current oil boiler / hot water distribution system to determine if there was a more energy efficient manner in which to heat the greenhouse.

The engineer assigned to the job was Claude Cormier, P.Eng. who happened to have just completed

several geothermal heat pump jobs and therefore ran the numbers on the requirements of the nursery. The results in this case, indicated a technically feasible project however, with an unacceptably long payback period. The greenhouse required heating for only three months of the year at a cost of approximately \$10,000



Starting to clean up the frames

per month. The unusually short heating season did not allow for

much maneuvering in the selection of an alternative energy system which are normally capital cost intensive. Further investigation however, revealed that Government assistance was available to offset a large majority of these costs in order to establish a demonstration site for alternative renewable geothermal energy.

Payback on the equipment was reduced to 4 years and the project was given the OK to proceed.

Roy Consultants came up with a plan to replace the 1.7 m Btu boiler with (4) x 35 ton (400,000 Btu) heating / cooling W-400 NORDIC® liquid-to-water heat pumps with a combined capacity of 1.6 m Btu. The units selected featured tandem compressors so that a total of sixteen

Vertical Drilling & Pipe Installation

stages of heat capacity are available.

The output temperature of the heat pumps is lower than that of a



New hot water distribution Piping

boiler thus necessitating the addition of additional distribution radiation tubing as shown in the photo above. Nearly 100% more capability with only 50% more tubing was added to the radiation system by utilizing a high capacity fin design.

GROUNDLOOP

The ground loop consists of 15 km of 3/4" PE3408 plastic pipe bur-



Fusing the Branches of Loops

ied in trenches 6 ft deep and 4 ft wide.

Main piping from the header pit to the building is 6" in diameter.

Total encompassed area is 11.2 acres of land. Headers were installed in special accessible header pits where the loops can be balanced as required to maintain an even flow through each section. The entire system contains approximately 8000 litres of fluid of which 3500 litres is plumber's antifreeze (a non toxic antifreeze).

The ground loop installation and all fusion joints were done by Armlin Geothermal Drilling of Cape-Pele, New Brunswick.

"GREEN" SYSTEM

One of the main concerns of the Nursery owners was that all components used in this system be as "green" as possible. To reach this goal the heat pumps were constructed utilizing ozone friendly R-407-C refrigerant. Propylene glycol, a food grade anti-freeze, was used as the loop fluid freeze depressant.

There are no emissions from a geothermal system and no negative environmental impact of any manner. The energy extracted from the 10 acre piece of land will be replenished each year during the off cycle time of the heat pumps. Two thirds of all the energy used in the greenhouse operation will come from the owner's own land!

Carbon Dioxide emissions from the power plant will be reduced by 2/3 since the power consumed is reduced by the same factor.

CONTROL

The system is controlled by a single PLC (Programmable Logic



New plastic installed on frames

Controller) which stages the heat pumps on, operates the back-up boiler, pumps and control zone valves in the greenhouse.

A full monitoring system will be installed to record the electrical consumption during the coming 2004 heating season.

Total greenhouse area is 3.5



Installing propylene glycol

acres at present. Production is approximately 6 million trees annually.

Inside Installation

The 140 ton Madran Nursery project is the largest installation supplied by Maritime Geothermal Ltd. to date.



(4) 40 ton NORDIC® Heat Pumps

The heat pumps are located in the maintenance section of the shop. They are stacked into groups of 2 and each group has its own circulator pump on the ground loop side. Fluid flow requirement on the loop side is 100 USgpm per unit. Pumps are rated at 200 USgpm and are interlocked with the heat pumps controller to start with the heat pump. A single pump provides circulation on the hot side of the heat pumps.

All piping inside the building is of black iron construction with mechanical joints. The individual supply lines for each pair of units is 3" while



Inspection of Installation

the lines entering the HP units are 2".

The main hot water buffer tank is a 1200 USgpm tank. The heat pumps are staged in sequence to heat the water to 125°F. If this water temperature is not hot enough to maintain satisfactory conditions in the nursery frames then a three way mixing valve positions itself to allow boiler water to boost the output to a higher level.

MAINTENANCE FREE

The HP units designed with the same "maintenance free" con-



Insulating the Piping

struction as the rest of the NORDIC® product line. There are no routine maintenance requirements to keep the HP units in peak working condition. Loop fluid is maintained with an automatic injection system while pressure gauges have been installed on all parts of the system so that greenhouse personnel can monitor working pressures with a simple walk by.

SAVINGS

Scheduled to be operated from April through June of each year the heat pumps are projected to save



1200 Gal Hot Water Storage Tank

about \$ 20,000 in fuel oil while consuming approximately \$ 10,000 in electricity during the season.

Lifespan of the HP units is projected to be more than 20 years in greenhouse applications giving the operators savings which should pay for the initial capital mote than three times.



Electrical & thermostat wiring



Maritime Geothermal Ltd.

PO Box 2555

Petitcodiac, NB E4Z 6H4

www.nordicgph.com