



Using Greenspace to Achieve Energy Sustainability

By Ron Tolmie - for the Ottawa Forest and Greenspace Advisory Committee, April 25, 2005
See <http://kanata-forum.ca> for further details

Heat pumps use the ground to store summer heat for use in the winter (and reverse the process in the summer for cooling). Although there are over one million ground source heat pumps in operation throughout the world (about 30,000 in Canada) the market penetration of that type of heating is extremely small. Normally, it is not an available option when purchasing an urban home, and even if it were the capital cost is a major deterrent in spite of the fact that the life cycle cost is very competitive.

HEAT networks could provide a solution to both of these deterrents. The capital cost of the expensive component, the ground heat exchanger, would be replaced by an annual fee paid to the city, and the HEAT networks would be widely available, replacing natural gas lines to provide for the heating and cooling needs of homes, offices and stores.

HEAT in this case stands for Heat Exchanger Access Terminals. The concept is that the City would drill the boreholes for the ground heat exchangers and install the piping to provide a terminal for each house, delivering the heat in much the same way as the City presently delivers water. A HEAT network would be a passive installation with no moving parts. The heat exchange fluid circulation pumps, the heat pumps and the heating/cooling delivery components would be in the homes, and would be owned by the homeowners.

From a physical point of view a system employing HEAT networks is no different from a conventional heat pump. The difference is that the ground heat exchange part of the system would be in land owned by the City, such as greenspace. A system that serves a whole housing development would be large so there are some detail differences in the designs. Active heat restoration would be used to pump heat back into the ground in the summer and the homes would incorporate built-in refrigerators, freezers and dryers along with water and space heating to maximize the efficiency.

For home heating and cooling HEAT networks can provide solutions to two concurrent problems – to find substitutes for diminishing energy sources like natural gas, for which the reserves have declined to less than an 8.6 year supply, and to reduce the levels of greenhouse gas and pollutants produced by fossil fuels.

In addition to home and office heating such systems can provide hot water and heat for dryers plus air conditioning and cooling for refrigeration and freezers. There is a need to refine the existing heat pump designs to achieve better efficiencies (present COP's are about 3.5 vs. the theoretical limit of 11.7) and to provide services like hot water and refrigeration throughout the year.

HEAT networks can most readily be installed in new housing developments. Roughly two million homes will be built in Canada in the coming decade, representing a peak power demand of about 20,000 megawatts that could be provided by this means. There is no upper limit to the amount of power that can be delivered provided sufficient greenspace is reserved to provide for the heat storage. This energy source is sustainable indefinitely.

Heat pumps do not produce any pollution, but they require mechanical power to operate. Where this power is produced by electric motors the pollution produced in the electric power generation must be considered, but it amounts to only about 6% of what is produced by natural gas heating. An efficient multi-purpose heat pump uses less electricity than a typical home heated with natural gas. That small residue could be eliminated by employing a non-polluting source of electricity such as a photovoltaic cell or a windmill (with a storage capability), making such systems entirely pollution free.

To achieve high efficiency the home utilities should be integrated into a single package that provides heating, air conditioning, hot water, refrigeration, dryer and freezer, at a cost that should be comparable to that presently incurred with separate utilities.