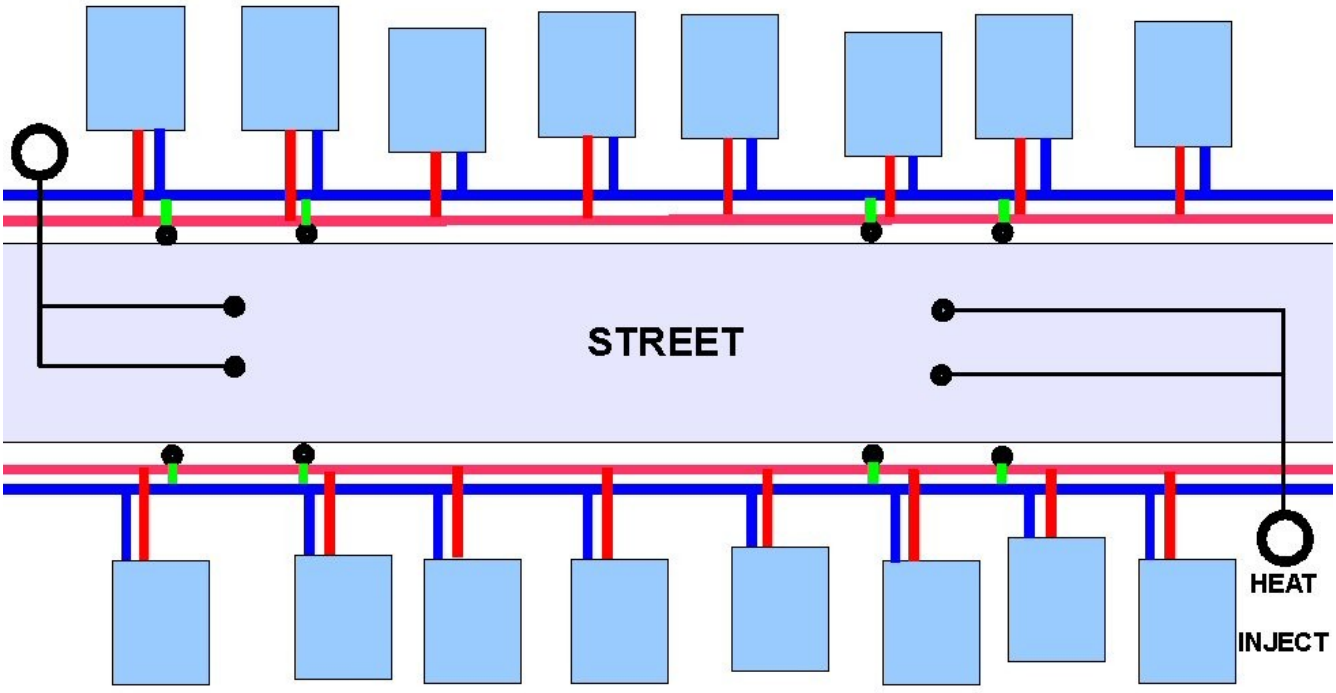
Heating and Cooling Whole Communities

AE systems can heat and cool many homes that share a just few ground heat stores. This eliminates the CO_2 produced by natural gas furnaces and both the capital and operating costs are much lower than gas+AC. Such systems are also simpler and more compact.

The heat pump provides both underfloor and forced air heating



A pair of two inch pipes carries the warm and return water from the ground heat stores (under the street) to all of the homes. Only the central heat injection holes need to be located under the pavement and there can be as few as one heat store per 20 homes.

Every second injector (shown as a black circle) is located on opposite sides of the street so that the central holes can be used to boost the heat output after mid winter. The principles are the same as for the single detached home system previously described except that the boreholes are deeper so they can handle multiple homes.

The pairs of pipes on both sides of the street can be of any length. Long lines do not need to be larger in diameter because they need only carry the water from the nearest heat store(s) to an individual house. The circulation pumps are in the homes so the street system is completely passive except for the injection pumps and fans, which operate at only a few watts of average annual power per house.

Such systems can be retrofitted to existing homes, in which case the city should provide the underground part of the system, or they can be installed by developers as a part of new housing developments, or can be installed by condominium corporations. The number of buildings per heat store can be adjusted for larger buildings, or multiple heat stores could be employed for very large buildings. A simple uniform design can thus be employed for a mixture of building types. The actual spacing and depth of the boreholes depends on the nature of the rock or soil deep under the streets.

Such systems can also provide most of the heat for domestic hot water and can air condition the homes via passive cooling so that the heat pump is not used for air conditioning. That could greatly reduce Ontario's primary peak demand for electricity. Such systems can directly or indirectly eliminate the use of fossil fuels for buildings, eliminating the local production of CO_2,.and utilizing their energy storage capability to flatten the diurnal power fluctuations. Such measures open up the potential to make more use of renewable energy sources like wind and solar power, which otherwise would need fossil fuel generators to handle their supply fluctuations..

Note that since you inject as much heat as will be needed to heat the homes this type of system does not change the ground temperature on an annual average basis. It can thus be used in dense urban areas, unlike ground source heat pumps. AE systems are very tolerant of annual variations in heating requirements because there is aways a surplus of energy available for extraction.

If there is an excess of flowing water in the ground then it may not be feasible to store heat in the ground, but in that case the flowing water will bring heat to the boreholes so the system will still function, but will not need the heat injectors. In that case the ground temperature may be too high for passive cooling, but the heat pump can instead be reversed to provide the air conditioning.

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