# AE-Street Specifications

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The existing Thomsen House installation in Kingston serves as the model and the test bed for the first generation of AE-Street stations that will provide heat and cooling for up to 50 homes each. The energy storage capability of an AE-Street station will make it possible to generate an extra 55 kW of sustained daytime electric power from renewable or nuclear power stations, and to store 500 kW bursts of excess power. It will in addition achieve substantial energy conservation by utilizing waste heat from energy-intensive buildings.

This first AE-Street generation can use the same components as the prototype, but with modifications that are sufficiently predictable to ensure that they can be used without risk. Most notable is an increase in the depth of the boreholes to 130 metres. That is well within the range of depths that is normally used for ground heat exchange systems. To ensure that there is adequate fluid flow a pair of push-pull pumps will be used on each of the eight boreholes, for a total of 16 pumps instead of 1.

The number of central boreholes is increased from two to four. The injection boreholes do not interfere with one another so this increase doubles the injection capacity for a start. Each injection hole will have its own air-source heat injector, raising the total from one to four, and the total number of air heat exchangers will will be raised to 16 instead of 2. The ground heat exchange power will be increased by using higher conductivity (graphite) grout to enhance the heat exchange.

The ground heat exchangers will be unchanged, other than in their greater length. Their current 1 inch diameter is suitable for the deeper boreholes. With the increased air heat exchange capacity and the improved ground heat exchange capacity they will raise the temperature of the storage volume by an average of 8 degrees, slightly more than double that for the existing (one home) system.

The existing system incorporates a feature that is unique – the ability to store large amounts of energy. The energy can be drawn from the air, can be waste heat from large buildings that generate a lot of internal heat, or can be energy drawn at night from the power grid. Historically, the potential for using $CO_2$-free sources of energy for power generation has been limited by the problem of what to do with the excess energy that they generate at night when there is little demand for power. At that time of day the value of the electricity is almost zero so it doesn't matter if it is converted to heat The stored energy will be used for heating buildings. The key point is that three times as much incremental energy can be generated because there is no longer a problem re. what to do with the third that is generated at night, so if 80 MWh goes to storage there is an extra 160 MWh that becomes avail\able for daytime use.

Note that for more than half the year the heat from the grid requires only short term storage, not seasonal storage. By using the same heat store for both types of storage the total winter heat delivery capacity is increased without any need for increasing the physical size of the heat store. Moreover, if groundwater flow compromises the long term storage at any particular site that site can instead be fed by electric power in the winter, redirecting its quota of electric energy to normal sites in the summer.

The energy storage feature is immediately useful in Ontario because there are frequent occasions on which the nuclear power stations generate more power than is needed, but they cannot be shut down or reduced in power. Note that by basing the design on an existing, tested system it becomes possible to build such systems immediately, achieving large and immediate reductions in GHG generation, and creating immediate jobs.

The cost of incorporating the energy storage feature is very small, and if the AE-Street system is managed by the local municipality or by the provincial government then the implementation and management requirements are minor. The benefits are mutual because such storage increases the AE delivery capacity at very little cost and it makes the system more flexible. It takes only a matter of of days to build an AE-Street store because it consists of little more than 8 holes in the ground into which the plastic heat exchange tubes are inserted.

AE-Street systems are invisible, inherently ling lived and reliable, silent, clean and they take up almost no space. If policies are developed to reward their potential to reduce GHG then the offset revenues could cover most of the construction and operating costs. That leaves the homeowners with just the costs of the heat pump and the power to run it, so their capital and the operating expenses should be lower than those of conventional heating and cooling systems.

***The overall result is that for each AE-Street site up to 500 kW of extra electric power from clean (renewable or nuclear) sources can be made available on top of providing the heat for the homes. Since there will be a large number of such sites this capacity can be expanded to match the local demand for energy, with little or no need to expand the grid capacity.***