

# **Advection-Enhanced Geothermal Heat Pump Loop Field Technology -- Results of Initial Field Tests**

**Jimmy Randolph**

**Darcy Solutions**

## **ABSTRACT**

Here, we describe an innovative, advective ground source heat pump (AGHP) that fundamentally changes the approach to subsurface heat exchange in GSHP systems. Rather than relying on heat conduction, the AGHP uses advection and convection. This technology explicitly considers and fully utilizes the thermal exchange properties of water, including advective and convective energy transfer as well as the additional heat capacity water provides relative to earth and sediment. Current ground source heat pumps (GSHP) applications do not harness this efficiency, resulting in designs with much higher costs and far more boreholes. Our objective behind this study is to effectively characterize, model and fully exploit these properties to greatly expand the adoption of GSHP and lower customer costs, expand the availability of heating and cooling in low-income neighborhoods, and simultaneously and dramatically reduce greenhouse gases.

In the present study, we have advanced numerical models of the AGHP system to incorporate real-world geologic systems, then manufactured and installed the first two AGHP systems at a demonstration site in Minnesota. Results of field studies, which show the efficacy and efficiency of the AGHP technology, will be presented.