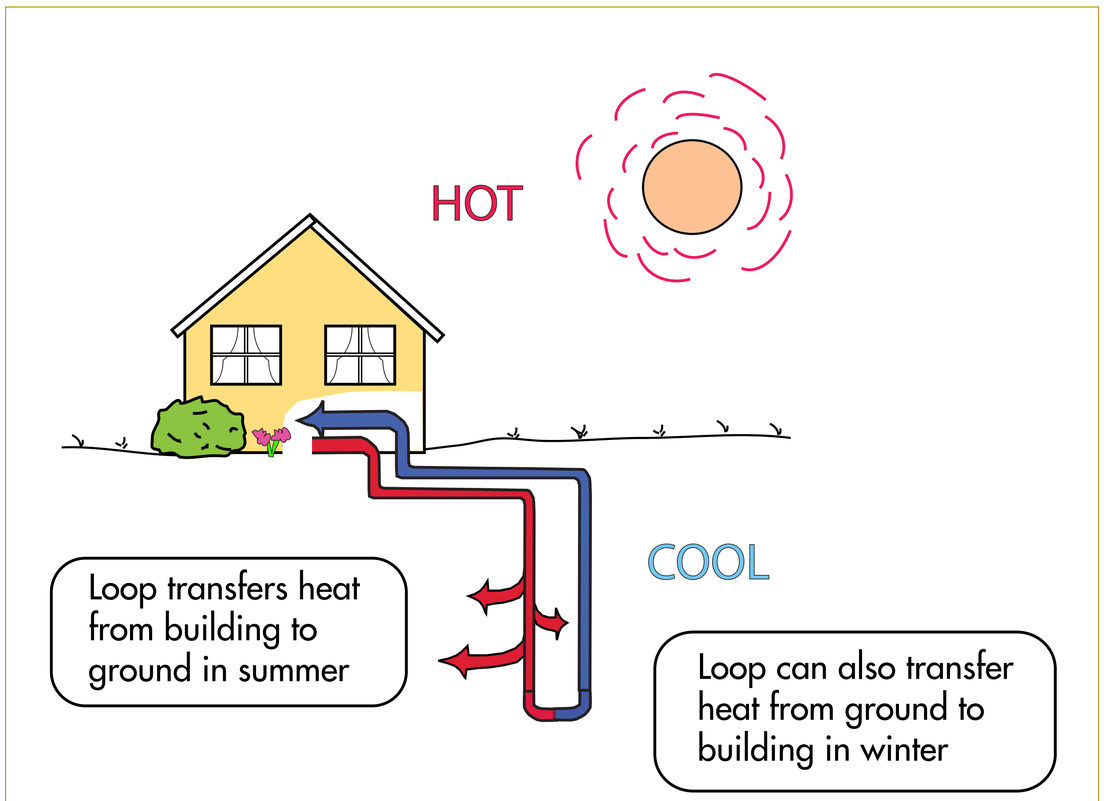
Ground Source Heat Pumps

Using the Earth's geothermal heat, we can heat and cool buildings while reducing energy use and greenhouse gas emissions.

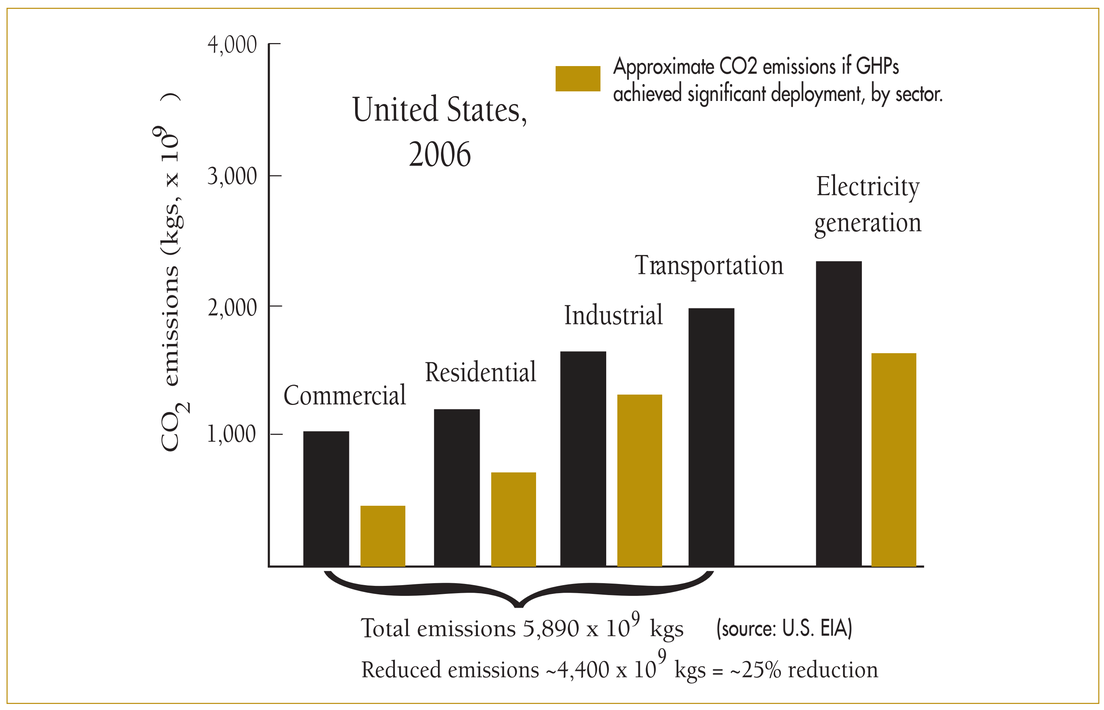
ALTHOUGH MANY PARTS OF THE COUNTRY experience seasonal temperature extremes—from scorching heat in the summer to sub-zero cold in the winter—a few feet below the earth's surface the ground remains at a relatively constant temperature. Geothermal heat pumps (GHPs) heat and cool buildings by using the subsurface as a heat source in winter and a heat sink in summer.

According to the U.S. Department of Energy's Energy Information Agency, these pumps are the most efficient means for heating and cooling buildings. Buildings account for about 40% of U.S. primary energy consumption and carbon emissions, 72% of electricity consumption, 55% of natural gas consumption, and significant oil consumption in the Northeastern U.S. (DOE, 2008).

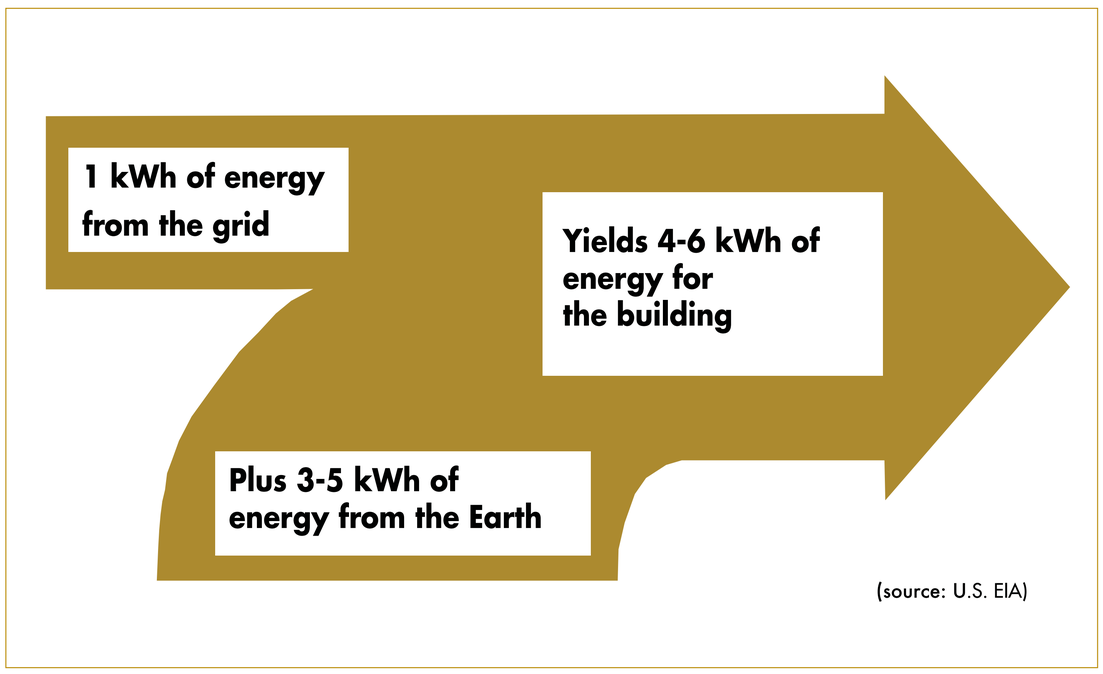
Our project is surveying the nation's 30 largest metropolitan regions to develop a cost/benefit analysis for GHP deployment. This evaluation will quantify, by region, the reduction in greenhouse gas emissions and energy use that could be achieved for various levels of market penetration by GHP systems.



GHP systems circulate a fluid through tubing in the ground. The fluid either obtains heat in the ground and then passes through a heat pump that extracts the heat and distributes it through a building, or removes heat from a building and deposits it in the subsurface. The figure above shows a cooling system for a residence.



This figure shows the amount of carbon dioxide emitted in the U.S. in 2006, by economic sector. The colored bars show the amount of CO2 emitted if GHP systems had been extensively used for heating and cooling building spaces in those same sectors



This figure shows the energy sources and resulting output for GHP systems. GHPs provide an efficiency of 400% to 600%. They consume 30% to 60% less energy than typical furnaces with air conditioners. GHPs produce no greenhouse gas emissions; the only emissions associated with them come from the electricity generating technology feeding the grid.

ENERGY

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