Assessing the Impact of Geothermal Heat Pump Deployment

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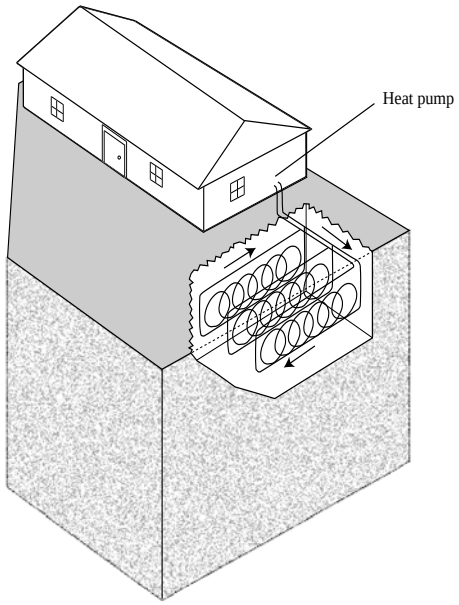
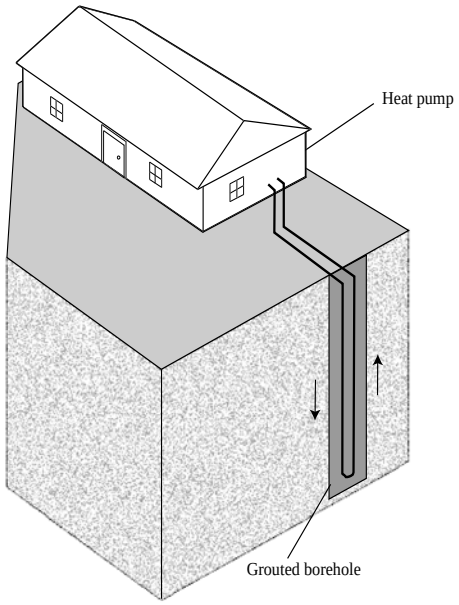
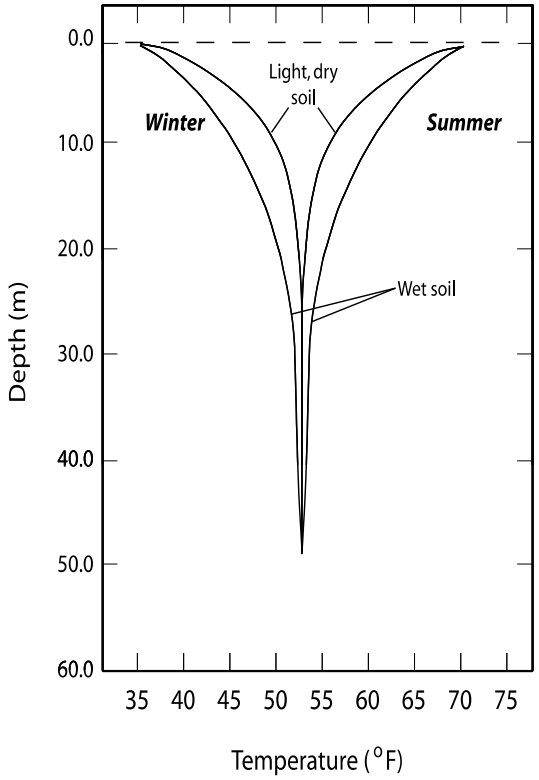
Geothermal Heat Pumps

Geothermal heat pumps (GHPs) are heat transfer devices that move heat between a building and the ground.







Project Objective

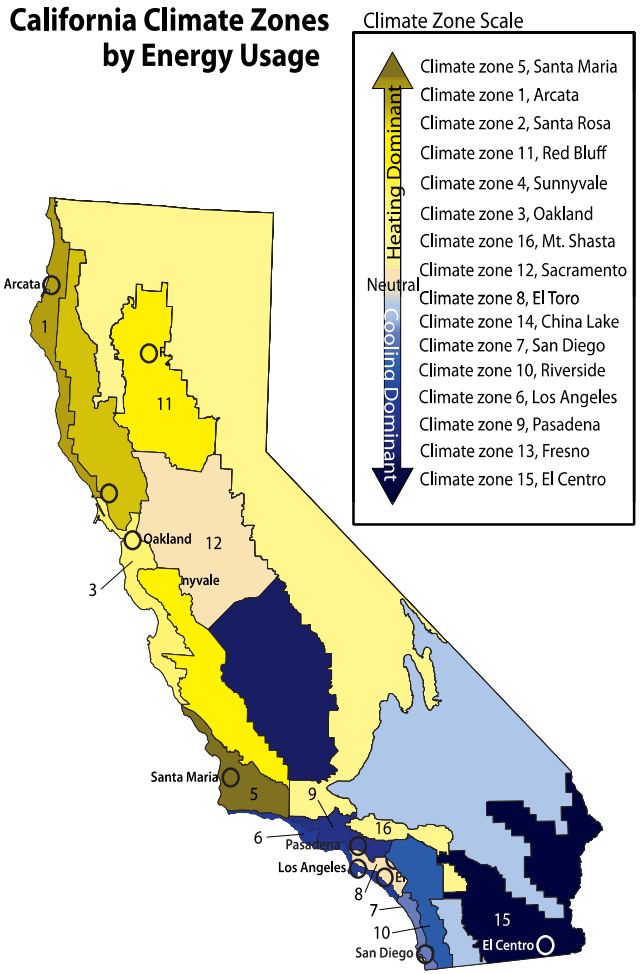
Geothermal heat pumps (GHPs) are the most energy efficient means for heating and cooling buildings, according to the EERE (COP of 4 to 6). Even so, California ranks 19 in tonnage installed per year, and near the bottom of all the states in terms of per capita installations.

The objective of this study was to determine what the impact would be on energy use and atmospheric emissions for residential GHP deployment throughout California.

Project Design

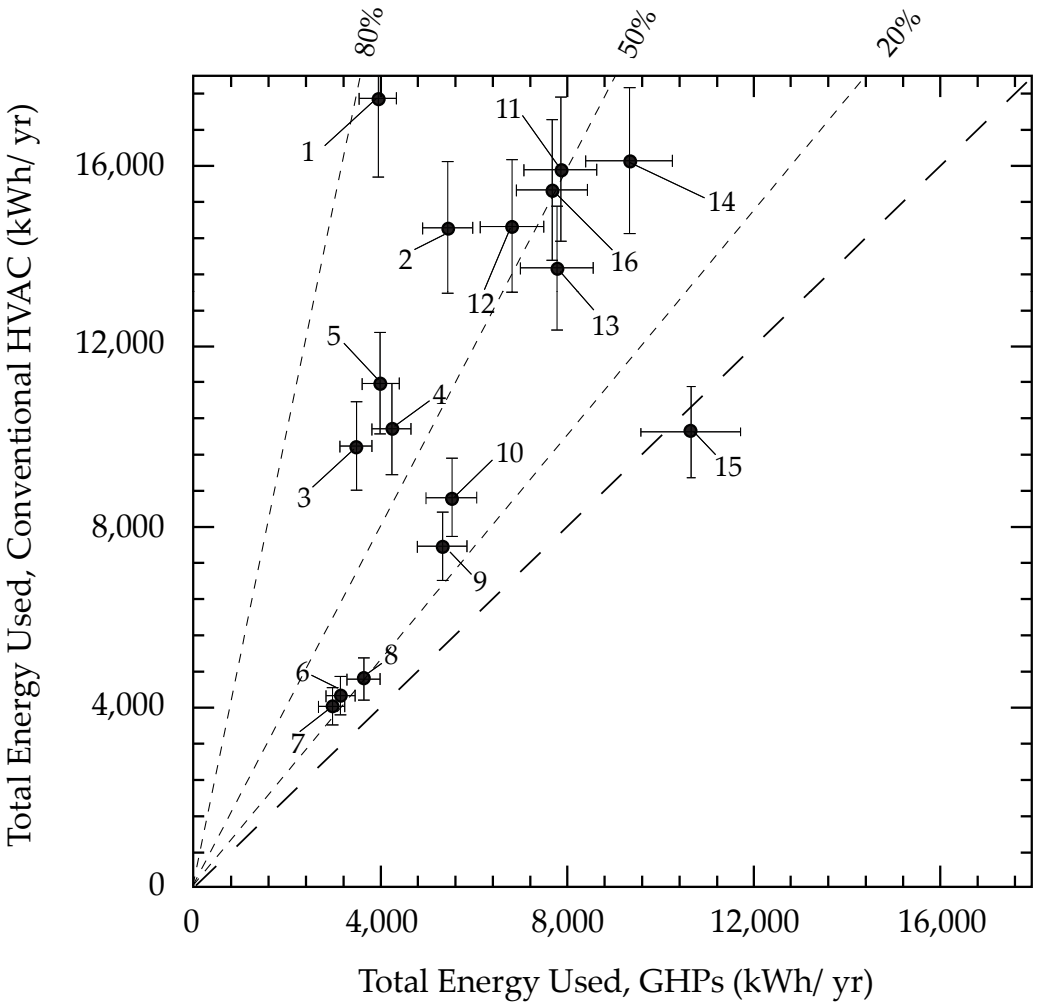
1. Develop a standard residential model building, based on U.S. census data.
2. Determine the heating and cooling load for the building.
3. Design a GHP system for the building that would meet the load demands
4. Quantify the impact on energy use and emissions such a system would have, on a per residence basis.

A Complication: California's 16 Climate Zones



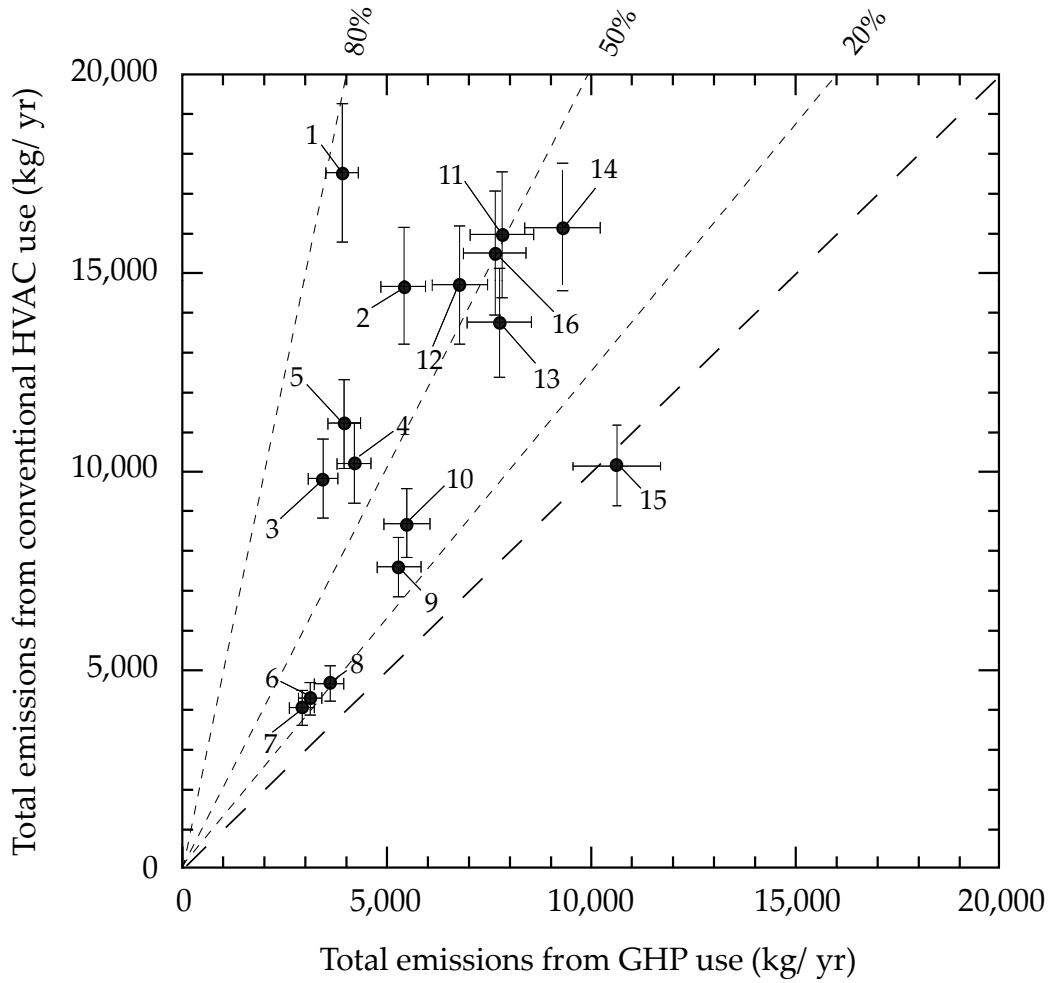
California is unusual in that it has many different climate zones. This requires designing GHP systems for each zone and assessing the respective energy and emissions outcomes.

Impact of GHP Deployment on Energy Use



Energy use, per residence, varies greatly between climate zones. If averaged together, the energy for HVAC per household would be reduced by 44%. Greatest savings in energy comes from climate zones dominated by heating loads.

Impact of GHP Deployment on Atmospheric Emissions



Total atmospheric emissions (CO_2, NOx and SO_2) correlate with energy use. If averaged together, the total emissions per household would be reduced by about 40%. Nearly all of this is from reduction in CO_2.

Concluding remarks

GHP systems reduce energy consumption in 15 of California's 16 climate zones. These reductions are, on average 44% of total energy consumption for HVAC purposes. As a consequence, similar reductions are achieved in atmospheric emissions.

By implication, widespread deployment of these systems, either in new construction or retrofits, could have a dramatic impact on meeting AB32 goals, as well as reducing energy demand.

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