Low-Cost Green Energy Solutions: Geothermal Heat Pump Systems Using Manually Drilled Wells

Kyla Semmendinger, Andrew Kelley, Joseph Dusseau, Monica Resto, Michael MacCarthy
Mercer University

Extended Abstract

Mercer University's Engineering for Development (E4D) program prepares students to become leaders in implementing sustainable solutions for people and the environment, with an emphasis on improving the lives of under-served populations. An ongoing initiative of the E4D program integrates research, service, and education to improve environmental practices at the household level in Macon, Georgia and surrounding areas, through water efficiency, re-use and recycling, energy efficiency, and the use of renewable energy sources. The presented project focuses on the use of manual drilling to significantly reduce the cost of installation of household geothermal heat pump (GHP) systems.

Environmentally friendly heating and cooling solutions are more available than ever; however, high initial costs for hardware and installation often dissuade low to medium-income families from pursuing these sustainable, cost-effective options. It is thus valuable to design systems that efficiently heat and cool homes with manageable installation costs. GHPs take advantage of near-constant ground temperatures at relatively shallow depths to transfer heat to cool or heat the interior of houses. GHP wells can be effectively installed using manual drilling practices that are innovative to the industry and can significantly reduce total system costs to the owner. The aim of this project is to design, build, and test an environmentally friendly, household geothermal heating and cooling system that employs low-cost manually drilled wells. The new system considers fundamental laws of thermodynamics, local climatic patterns, local geology and is being tested in a senior design course. These geothermal technologies and manual drilling techniques are key areas in Mercer University's environmental engineering curriculum and this project can be used as a valuable teaching example in green engineering and thermodynamics courses. This paper focuses on a senior design team's design and construction of a GHP incorporating manually drilled wells and the integration of research with classroom curriculum.