Final Report

Chapter 1: Executive Summary

This report is focused on analyzing the feasibility of implementing a geothermal system into the current design of the Gaige Building. First, a Trace 700 model of the Gaige Building is validated against actual utility consumption information. From this model and the peak loads that resulted, both a vertical loop and a horizontal loop geothermal system were sized and designed.

Figure 1: The Gaige Building

Once the geothermal loop systems were designed, initial costs for each system were calculated using RS Means costs estimating guides, and annual energy savings were estimated by comparing the previously validated model with a geothermal model of the Gaige Building in Trace 700. From this data, annual emissions were calculated and a life cycle cost estimate was performed. For the new geothermal system, a 2.0% reduction in annual emissions was realized, and for the horizontal and vertical geothermal systems, a discounted payback period of 6.13 and 12.7 years was found, respectively. An additional study was conducted to determine the potential of a campus-wide, centralized geothermal system into the design of the Gaige Building. A block load Trace 700 model was created, and annual energy savings, initial first costs, annual emission, and a payback period were calculated. Overall, the campus wide system caused a 27% decrease in annual emissions, but no feasible payback period was found.

Finally, an acoustic analysis of the performance of the classrooms within the Gaige Building against the classroom acoustics standard was performed. It met all of the standards requirements, except for standard transmission coefficient ratings for a few partitions between classrooms on the second floor. Also, an analysis to determine optimal heat pump placement around noise sensitive spaces such as classrooms and offices was conducted.