

1.0 Executive Summary

The West Virginia Alumni Center was originally designed with a central plant mechanical system that included dual fuel (natural gas primary) hot water boilers for heating water and air-cooled chillers for chilled water. The heating water was distributed to each of 9 rooftop AHU's for heating and to VAV boxes for reheat. The chilled water was also distributed to each of the rooftop AHU's. When this design went out to bid the price estimates were much higher than expected and a cheaper design had to be implemented.

The resulting design was a low first-cost, higher annual energy cost system when compared with the central plant design. The new design utilized packaged rooftop AHU's with direct expansion cooling and natural gas furnace heating. Because the new design emphasized first-cost considerations, the benefits of higher first-cost, lower annual energy cost alternatives were not readily explored.

To explore the impact of the installation of a system with a potentially higher first cost and potentially lower annual energy cost an analysis of a ground source heat pump system with a dedicated outdoor air system will be conducted. The current packaged rooftop AHU system will be replaced with water-to-air heat pumps that reject/gain heat from the earth and a parallel system that provides ventilation air.

The system will be optimized to use appropriately sized ground loops that minimize construction cost and do not significantly add to the construction schedule. Additionally the impact of removing existing mechanical equipment and replacing it with new mechanical equipment on the electrical distribution system will be analyzed.

Trane Trace 700 will be used to determine the annual and monthly energy use of the original design, existing design and the new proposed heat pump design. Mean's CostWorks and contractors will be used to determine the monetary and scheduling impact of the borehole drilling. Calculations and methods learned in required Architectural Engineering courses will be used to determine the impact of the new equipment on the electrical distribution system.