

EXECUTIVE SUMMARY

The Montgomery College New Science Center is a direct expansion to the East Science Center located in Rockville, Maryland, a mixed-humid environment, consisting of laboratories, offices, and classrooms on every floor. In a mixed environment, both heating and cooling must be designed and integrated into the HVAC system.

Although the engineer's design accomplished all the design goals, an alternative system for this report was developed with improving the energy efficiency as the main design goal. The existing mechanical system consists of a central air handling system, central hot water system, central chilled water system, and a laboratory exhaust system. This HVAC system is a fairly typical system for laboratory buildings. Overall the New Science Center HVAC design fulfills the university's design needs and requests, but leaves room to increase the performance of the system to potentially further the energy reductions, decrease the emissions, and reduce the mechanical space needed.

This report develops and compares an open loop geothermal system coupled with chilled beams with the original design. The new design replaces the boilers, chillers, cooling tower, and air handling units, with various heat pumps. Three types of heat pumps were used. DOAS heat pumps are used to condition the laboratory and classroom ventilation air to room neutral, while water-to-water heat pumps serve chilled beams to provide space cooling and heating. The remaining heat pumps condition and supply the air to the offices.

In addition to the mechanical system redesign, both the lighting and acoustics were assessed for this report. The lighting was developed with the same energy efficiency goal as the mechanical system. Earth-Friendly-Troffers were chosen for their energy efficiency. The new lights saved 12.96% of the energy attributed to the lights. The light schedules were also altered from the original design by anticipating occupancy, maintained by occupancy schedules. The acoustics of a typical laboratory, classroom, and office were analysis based on the reverberation times, and the new active chilled beams were acoustically evaluated.

As a result of the system redesign, the energy was reduced another 27.75%, obtained two additional energy and atmosphere LEED credits, and improved the room acoustics. The new system increased in complexity and therefore increased the initial cost \$2 million. With the decreased energy costs and increased initial system cost.