

Conclusions and Recommendations

The Hilton Hotel at BWI Airport is a project that has many areas where the possibility exists for mechanical systems design. The main area chosen for this thesis design project is related to the design of a central chilled water plant for the building. The original design involved a boiler and condenser water system serving various air handling units, rooftop units, and water-source heat pumps. The original design first had chillers in the design, but after value engineering, the chillers were eliminated, and the air handling units were designed to operate like air-to-water heat pumps. All the ventilation air provided directly to the guest rooms was also eliminated during value engineering stage.

In order to achieve this goal of energy efficiency, the mechanical systems of the BWI Hilton needed to be improved. All the main mechanical equipment served by the condenser water was replaced with ones using chilled water, including the air handling units, rooftop units, dedicated outdoor air units, and fan coil units. The guest rooms were also provided with a continuous 60 cfm of ventilation air from the dedicated outdoor air units. Water-side free cooling was also studied and implemented to further increase the energy efficiency of the chilled water system.

This thesis report compared the energy consumption of the original design to the new design with the central chilled water plant. As was evident throughout the project, energy was saved in nearly every area, except for natural gas. However, the increase in natural gas consumption was offset by the larger reduction in electric usage. Electric energy usage was reduced by 82%, but the natural gas consumption increased by 127%. However, the total energy costs for the BWI Hilton were reduced by 62%. The overall emissions from the natural gas used on site were also reduced by about 64%.

Other goals of this thesis include decreasing life cycle costs, promoting sustainability, design innovation, and indoor environmental quality improvement. Many of these goals were also accomplished by means of improving the overall energy efficiency of the building. The more energy efficient mechanical systems designed had a much lower operating cost than the original design, were more environmentally-friendly with reduced emissions, and involved more creativity in the design process. Despite increasing the first costs by about \$685,000, the operating costs were decreased by over \$750,000, and a life cycle cost analysis for the BWI Hilton resulted in a one year payback period and a net present worth savings of almost \$8 million.

Overall, the new mechanical systems design involving the new central chilled water plant was an improvement in every area studied. Therefore, it is recommended to use a chilled water system in place of a boiler and condenser water system. The benefits can be tremendous.