

Executive Summary

The South Tower Vertical Expansion is a three-story addition under construction at Sinai Hospital of Baltimore, planned for completion and occupancy by the end of 2010. The addition adds space for over 120 more beds in an intensive care unit, traumatic brain injury care, and an intermediate care unit. The construction also links the South Tower to the North Tower, and a helipad has been added. With over 120,000 square feet of additional floor space, the demand in capacity for several mechanical systems increased substantially. Because hospitals are one of the greatest energy consumers, attempts were made to find alternatives to existing mechanical system designs which would reduce life-cycle costs as well as emissions of pollutants and greenhouse gases. The chilled water and domestic water systems were evaluated.

The primary objective of redesigning the chilled water plant was to reduce electric utility costs. By having the future chiller generate cooling capacity through an added thermal energy storage system, demand could be shifted from peak hours to off-peak hours, allowing the hospital to take advantage of time-of-use rates from Baltimore Gas & Electric. As a result of the redesign, the annual electric utility savings was over \$51,000. This was equivalent to an electric utility rate savings of almost \$0.03 per kilowatt-hour or an average savings of approximately \$0.43 per square foot. However, a high initial cost of about \$100 per ton-hour to install a storage tanks resulted in a simple payback period of 14.8 years. Although the length of time is fairly long, the system could prove viable.

Like the chilled water plant redesign, the proposal of using solar water heating in the domestic hot water system was in an effort to reduce electric utility costs. By utilizing renewable energy to heat domestic water, the existing steam-to-hot water converter would operate less, reducing the energy demand substantially. Following the study, it was determined that over \$48,000 would be saved each year by using solar energy to provide all of the domestic hot water for the South Tower Vertical Expansion. However, with an average installed cost of \$75 per square foot of solar collection area, the simple payback period was more than 22 years, a period too long to provide cost certainty in a volatile economic climate. In addition, another goal was to measure the amount of pollutants caused indirectly by the existing system. By installing a solar hot water heating system, up to 1.5 million pounds of carbon dioxide would be removed from the environment annually, an equivalent of 157 passenger vehicles driving 1,000 miles each month.

Overall, the alternative designs were feasible but required many years before a return on the investment was achieved. As energy costs continue to soar, these design methods will be explored more often, and economies of scale will allow them to become viable, cheaper, and cleaner options.