1.2 Executive Summary

The New Inpatient Tower at the Butler Memorial Hospital is a 209,000 square foot addition seated in Butler, Pennsylvania that was recently completed in July 2010. The eight story tower was built to house state of the art operating and recovery rooms as well as intensive care units.

This document is an assemblage of research, documentation, and data collected from the New Inpatient Tower specifically targeted to analyze the implementation of a redesigned mechanical system. The goal of this thesis project was to design the HVAC system to make it more energy efficient thereby decreasing utility costs and lowering the carbon footprint as well as providing a comfortable environment for patients and staff. It was also a primary goal to analyze the effects of the HVAC redesign on the life cycle cost and on other building components to evaluate the feasibility and the economic impact that the redesign would have on the building as a whole.

The original mechanical design was on a strict budget and performed well meeting the design criteria at minimal cost. Originally the hospital was designed to operate as a variable air volume system with reheat. The system was comprised of (2) 400 ton chillers and (2) 7,200 MBH boilers supplying chilled and heating water to (3) 62,000 CFM rooftop air handlers which make up a loop system delivering air to the entire hospital. The operating rooms and their support space were served by an independent VAV system consisting of (1) 120 ton chiller feeding (2) 18,500 CFM air handlers.

The redesigned system was designed to be a dedicated outside air system with supplemental active chilled beams. Due to a decreased amount of ventilation air, heat recovery via enthalpy wheels, and reduced heat from supply fans, the cooling and heating loads were reduced which allowed for the redesign of the central plant. The redesigned system will not affect the mechanical design of the operating rooms and their support spaces; however, the remainder of the inpatient tower will be served by (1) 40,000 CFM DOAS Pinnacle air handler and 476 chilled beams of assorted sizes. (3) 180 ton screw chillers will replace the original chillers: one supplying the rooftop air handler, one supplying the chilled beams, and the third acting as a redundant back-up capable of meeting either load.

A first cost comparison was done between the two systems and it was found that the redesigned system will save **$277,000** in construction and equipment costs. The redesigned system will also reduce annual operational costs by **$33,800/year** and energy consumption by **2,700 MMBtu/year.**

In order to analyze the effects of the redesigned mechanical system on other building components, a structural and electrical breadth was instituted. Due to the elimination of (2) 62,000 CFM rooftop air handlers and a reduction to the third, the overall amount of structural steel in the roof decreased by **6.4 tons** and **$18,000** in construction costs. Because the redesigned system decreases the size and quantity of the mechanical equipment requiring electricity, the overall power demand of the HVAC equipment was reduced by **426 KVA.**

It was found that the redesigned system will save money both in first costs and operational costs, lower annual energy consumption, decrease the carbon footprint, and provide patients and medical staff with a comfortable environment.