Executive Summary

An extensive analysis was performed on the current energy recovery system and a possible substitute. The current system is a propylene glycol runaround loop which harvests energy from the exhaust air and transfers it to the incoming ventilation air. It was proven that this system only covered 7 Tons of cooling load and a little over 5,400 MBH of heating. This reducing heating costs in half, but barely affects the cooling load. The runaround propylene glycol system saves around $53,000 a year in natural gas costs, but costs around $1.3 million to install. This payback of 23 years is unpractical for most situations, but because of the simplicity of the system and the fact that this is for a hospital I would recommend it.

The proposed alternative had a higher reduction of onsite energy but did not pay off. Saving around $55,000 a year in natural gas costs is good, but the additional capital investment of around $6.4 million creates a payback of 115 years. This is unacceptable for any building investment. The equipment would need replaced multiple times during this period and would greatly increase the payback period. Therefore, I would not recommend this alternative.

One of the design objectives of Princeton Healthcare Systems is to be environmentally conscious. Microsteam Turbines make use of wasted energy. The savings of 461 kw of peak electricity during on season peak months could save up to $7,634 and $4,219 during off peak months. This is an interesting technology that I feel will continue to grow in applications where a large constant supply of steam is required such as hospitals.

Electrical power distribution is a necessity for any building, because without power nothing would work. Therefore it is important that a building's power system be properly design and given room for growth. Adding the 13 heat pumps increased the electrical demand by about 800 amps. If the heat pumps were being integrated as part of the original design it is very possible that the substation and emergency switchgear would have been sized larger.

Building acoustics is a very complicated subject. Being able to accurately predict how a room will perform acoustically is not straight forward and not reliable. Therefore AudioComfort panels from DuPont were selected as the means to quiet noisy rooms. By taking actual sound recordings and analyzing them through Matlab, an analytical solution was made. By calculating the T_{60} time within the patient rooms, it was possible to estimate the square footage of panels is needed. The values varied from 100 to over 300 square feet. This is almost the area of the entire wall. Therefore it is recommended to complete an analysis of the duct attenuator design to make further improvements.