5.0 MECHANICAL SYSTEM REDESIGN

The mechanical system redesign consists of two major parts, but the overall resulting system integrates as many building systems as possible for maximum energy usage optimization.

5.1 REDESIGN OBJECTIVES

The Milton Hershey School New Supply Center's mechanical systems are designed with careful attention towards energy conservation and thermal comfort. Overall, the combination of the HVAC system's ability to incorporate other building systems as well as its sophisticated control methods, used to minimize energy consumption while maintaining thermal comfort, classifies it as very good for this application. The design engineers at H.F. Lenz Company cut no corners in the design, however, there are still alternatives that need addressed. Adjustments to the current design or redesign of certain areas of the HVAC system can result in further optimization in first cost, construction cost, and operating cost.

The goal of this mechanical system redesign is to increase energy efficiency, decrease life cycle cost, and maintain or improve the level of thermal comfort that the existing systems set. The original design of the supply center achieves the status of LEED Certification. Any alterations to the mechanical system are not to lower this standard. The final goal of the redesign is to use unique or non-ordinary methods and systems for the study, and measure there performance in this situation. The results from the analyses will not only prove whether the redesign meets the project goals, but will serve as educational value to see how these different systems react with the given conditions.

The main goal of the ones listed above is to increase energy efficiency. Technical Assignment 2 looked at the supply center's annual energy usage. The results for the report indicate that the main source of energy to operate the refrigeration equipment and AHUs is electricity, and the heating equipment utilizes natural gas. Decreasing the amount of electricity consumed by the HVAC equipment will significantly lower the annual energy cost to operate the supply center. Lowering the annual energy cost will also create the potential for decreasing the life cycle cost of the HVAC systems.

Alterations to the HVAC system may result in significant differences in first cost compared to the existing system. The goal of this redesign is to recommend the most energy efficient, sustainable, and cost effective system. The recommended system must include a reasonable pay back period, about 3 years, when compared to the alternatives. Whether the existing system or the

alternatives are selected as the best, pay back periods longer than 2 to 4 years will not justify their use in this application.

5.2 REDESIGN SUMMARY

Integration of as many building systems as possible for total building energy optimization is the goal of the mechanical systems redesign for the Milton Hershey School New Supply Center. The air side mechanical systems as well as the chiller and boiler plants are all altered in the redesign. The walk-in freezers condenser water loop is also used in an effort to integrate more building systems as well as recover the waste heat. The mechanical redesign directly affects other building systems that need attention as well. The structural system and electrical service all will change due to the mechanical changes which paves the way for a variety of cost analyses that will prove whether or not the redesign beneficial.

The redesign of the air side mechanical system will comprise of the replacement of ten VAV or CAV air handling units with dedicated outdoor air systems (DOAS). The remaining four air handling units that are direct fired make-up air units that serve the kitchen, bakery, and loading dock spaces will remain. Since the DOAS can not meet the cooling load of the spaces they serve, a water source heat pump system will act as the parallel cooling scheme.

The chilled water plant redesign will eliminate the electric driven centrifugal chillers and replace them with direct fired absorption chiller-heaters. The chiller-heaters will utilize their simultaneous heating and cooling ability and meet the cooling loads while handling most (if not all) of the HVAC and domestic hot water demands.

The waste heat rejected from the walk-in freezers will pass through heat exchangers and account for the water source loop heat addition as well as pre-heat the domestic water. As in the original design of the supply center, if recovering this waste heat is not sufficient to cool the condenser water loop back to operating temperatures (65°F), chilled water from the plant will meet the remaining load.

6.0 BUILDING LOAD ANALYSIS

The chilled water plant at the supply center sees various load profile changes throughout the year. However, since the chilled water system also handles the walk-in freezers heat rejection, it forms a base load that is near constant for the existing system. Figure 6-1 illustrates a typical cooling load profile during cooling season. Carrier's Hourly Analysis Program (HAP) is used to generate the data.