Executive Summary

The Xanadu Sports Complex Building A is comprised of a retail section and an indoor ski resort called the Snowdome. Through the analysis found in previous technical reports areas of design improvement were found. Through the analysis the main areas of concern were found to be in the ventilation systems of both the retail section and indoor ski resort and the large amount of energy needed to run such a building. The contributing factor to these concerns can be linked to the use of the Building Officials and Code Administrators (BOCA) 1996 code.

The goal of the mechanical redesign is to address concerns of proper ventilation and energy use while maintaining a reasonable payback period. Other methods will be explored that may be too expensive to consider, however, will be used for the educational value.

The ventilation system redesign will reevaluate the system using ASHRAE Standard 62.1-2007. New rooftop units, ductwork, and diffusers will be selected to maximize the efficiency of the system. To address the concern of energy use and the various problems that result from the use of large amounts of energy, a combined power generation and heating/cooling system will be installed. The use of microturbines will generate electricity on-site using environmentally friendly gasses. The waste heat from the micorturbine combustion process can then be put to good use in other parts of the building, thus increasing the overall efficiency.

The introduction of the new mechanical system equipment will affect other building systems. The changes required due to the redesign will be addressed to fully analyze the feasibility of the new mechanical system. A structural analysis of the building's roof will be used to determine whether or not reinforcing is needed to support the new equipment. The electrical system will also be analyzed to determine whether feeders, panel boards, and the main distribution lines need to be resized in order to provide the proper capacity to the new equipment.

Finally, the redesigned system's cost will be estimated to determine the economic feasibility of such a system.

Breadth Proposal

The redesign of the mechanical system will directly affect other aspects of the building's design. The goal of the breadth study proposal is to address the changes that will need to take place with other building systems to incorporate the changes to the mechanical system.

Structural Proposal

The introduction of new mechanical equipment on the roof will result in an increase in the dead load which will affect the roof's structural member size. Included in the redesign will be four resized roof top air handling units, multiple microturbines, and the possibility of a heating/cooling absorption chiller. Due to the increase of mechanical equipment weight on the roof the roof structural members will more than likely need to be increased in size. However, a study of proper equipment placement can reduce the overall reinforcement needed. For this reason the equipment location on the roof will be analyzed. If it is found that the structural members need to be increased in size, the price difference will be included in the mechanical redesign price to determine the overall feasibility.

Electrical Proposal

Similarly to the structural system, the changes in the mechanical system will directly affect the electrical system. The biggest change comes through the use of on-site electricity production. Research will be needed to determine how the electrical systems for a microturbine system are incorporated. The increase of mechanical equipment and replacement of existing equipment will greatly change the electrical design. With a change in electric load, new feeders, panels, and main distribution lines will need to be resized.