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## CONCLUSIONS AND RECOMMENDATIONS

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As I had initially surmised, the geothermal system currently being installed at the new dormitory at the Mount St. Mary's University proved to be worth the additional mechanical design and upfront costs. Not only does the system save thousands of dollars in energy usage costs annually, but in an application such as this one where the building could potentially be in operation for 50 years or longer, the life cycle savings are going to be substantial. Also, should electricity rates increase dramatically in the coming years, the annual savings over comparable systems will also increase in turn.

The analyses of the mechanical systems also offer a realistic comparison of how air-source split DX heat pump systems, conventional boiler/cooling tower water-source heat pump systems, and geothermal heat pump systems actually perform from an energy usage perspective. The HAP model is able to show which pieces of equipment actually draw the most power, and the effects of the differing efficiencies between the heat pumps can clearly be distinguished from the results. Because of this, the geothermal is seen to back up the claims of energy savings made by proponents of the technology.

A photovoltaic system, on the other hand, would not be worth the cost of its installation. With a payback period of roughly 27 years as a best case scenario, the system is just too inefficient and costly upfront to warrant its inclusion in such a project. The Mount St. Mary's University may have been willing to spend a little extra money initially on the geothermal system in order to reap its potential benefits and promote environmentally friendly design, but unless the technology becomes drastically less expensive in the future, photovoltaic systems will continue to be difficult to justify on installations such as this one.

Therefore, it is the recommendation of the author of this report that the Mount St. Mary's University would have the most success building this dormitory if it merely keeps to its original plans and designs. The geothermal system really is the best choice of those mechanical alternatives analyzed, and the university has willingly accepted the inflated first costs in order to reap the benefits later on. The finished system will save money over time, continue to remain efficient where comparable systems would require maintenance or overhauls, and allow the university to further its goal of fostering environmental awareness through the application of green design.