1.0 – Executive Summary

This building is Franklin & Marshall's new laboratory, office, and classroom facility for the Biology, Psychology, and Philosophy departments and their associated education spaces. It is a 3-story building plus basement. This steel braced-frame structure encompasses 104,000 square feet.

The air distribution system for the main section of the building (floors 1-3) is a VAV system with hydronic reheat coils, fed by two air handlers on the roof (AHU-1 and AHU-2). These two units provide a great deal of outdoor air to the building to compensate for large amounts of exhaust air removed from the lab exhaust hoods. They serve a multitude of occupancy spaces, from faculty offices to anatomy/biology labs. These units are both sized at 50,000 cfm nominal.

The basement is home to the vivarium for animal housing and observation. This area is served by AHU-3, a 100% Outdoor Air unit located in the basement mechanical room. This unit provides 7,500-15,000 cfm of fresh conditioned air to the spaces 24/7 to keep the animals healthy.

The goal of this thesis study is to design a new mechanical system that costs less and takes less energy to operate, and finally cost less up front as well. Also included is a grid-tied Photovoltaic system to provide some energy generation on site throughout the year. The structural system was essentially checked, but no size reductions were found.

The new mechanical system consists of Dedicated Outdoor Air Units for ventilation air, and a Make-Up air handler for the lab spaces in the building. The remaining space loads will be handled by Water Loop Heat Pumps throughout the building. This new system will better ventilate the building, while consuming less energy through the year.

In total, the new mechanical system will cost 7% less up front (roughly $540k), and $35k less to operate each year. The 34.7kW PV system will generate almost 55,000 kWh per year, saving 80,000 pounds of Carbon Dioxide and roughly $5100 per year in electricity costs.

The 34.71kW PV system on the roof will generate roughly 55,000 kWh per year on average, having a payback with materials offset (net) of 42 years. This will offset 80,000 pounds of Carbon Dioxide yearly. If both systems (new mechanical and PVs) are adopted together, the total cost of the building will still be reduced; the new mechanical system saves over $500,000, and the PV system costs net $240,000.