THESIS PROPOSAL

Executive Summary & Breadth Topics

Ann & Richard Barshinger Life Science & Philosophy Building

Franklin & Marshall College
Lancaster, PA

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Architectural Engineering
Mechanical Option

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January 11, 2008

Executive Summary

The Barshinger Life Science & Philosophy Building (LS&P) at Franklin & Marshall College (F&M) in Lancaster, PA is F&M'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 mechanical system depth redesign proposed in this report will focus on improving the ventilation and energy use of the building. The mechanical system currently utilizes a single network of supply ductwork with VAV system, hydronic reheat coils throughout. The building's airflow is driven by the amount of exhaust in the numerous labs. The building remains positively pressurized, and the exhaust is the primary variable in the system adjusted continuously throughout the day. The proposed solution will create two air distribution systems – a Dedicated Outdoor Air system to provide ventilation, and a Lab Make-Up air system to replace the air removed through the exhaust hoods in those spaces. There will be hydronic loop heat pump units to do the remaining conditioning in each space. This separation of airstreams will allow a better delivery of air for ventilation, and makeup air closer to the room conditions without the use of reheat. Plus, having separate ventilation-only air provides a great deal of control for ASHRAE standard ventilation rates for each space, not just an aggregate for the whole gross building.

Energy recovery is used in the existing VAV system, but it is simple runaround coils with glycol, operated only in heating season. The systems studied throughout the research process will focus on year-round energy recovery, with greater recovery effectiveness than a simple runaround coil, including latent energy recovery.

For the two required breadth studies, the impact on the building's structural system after modifications to the roofing materials will be studied (originally, asphalt shingles were specified; Vermont slate was used), along with the structural support of all the heat pump units, and multiple PV racks and shingles used on the roof. The electrical breadth will cover the distribution system redesign after the additional load with the heat pump units, plus the impact of all the possible Photovoltaic panels on the roof areas. Also included will be the decrease in service size with reduced central equipment.

The Carrier HAP model will be adjusted for accuracy with all actual design values, then used to model all system modifications after the redesign. If the HAP model cannot be made accurate, a new model will be built in eQuest. This could take a great deal of time, but should be done if the HAP model cannot be made accurate. An accurate model will be the only way to guarantee the new systems will consume less energy than the existing VAV system.