

Executive Summary

The St. John Student Center is being constructed on the existing campus of McDonogh School located in Owings Mills, Maryland. The Student Center is one of several new buildings being added to the campus. The Center is a 3 story, 68,000 square foot facility that houses a 3 story lobby/atrium, dining halls, commercial kitchens, a grand auditorium, a dance studio, and classrooms that range from art and photo to general seminar.

The mechanical system that was designed for the Center uses a combination of VAV and CAV technologies. The AHUs supply air to remote VAV and CAV boxes located throughout the building which provides occupancy control. The central plant located elsewhere on the campus produces both heating and chilled water. The chilled water in the plant is produced via electricity while the heating water is produced via natural gas.

Several alternatives were selected to be analyzed to meet the goals of reducing the peak energy consumption with a reasonable payback period. The alternative design options that were selected to be analyzed were implementing a geothermal well field, upgrading the glazing to Solarban 70XL glass, and adding a total energy wheel to the AHU that serves the art classrooms. A geothermal well field can reduce energy consumption by a great deal due to the consistency of the grounds temperature being held at 55°F. Improving the glazing of the building is a highly beneficial way to improve on the buildings overall energy consumption level. The improved glass offers a superior U-value and shading coefficient at a reasonable price. The addition of a total energy wheel on the art classrooms will be a great addition. With the amount of exhausted air produced by these classrooms it is expected to be able to recover a substantial amount of valuable air.

Due to the increased complexity with a ground source heat pump or (GSHP) a reallocation of the budget, time, and manpower must be made in order to accomplish a successful installation. The total energy wheels will increase the size of the AHU located in the attic. The attic will need to be tailored to fit a larger such unit. This tailoring would include possibly resizing the structural support members. In order to ensure proper support a full structural check was performed.

After the analysis was performed a combination of all three upgrades was selected due to its relatively low payback period of 12 years. If the owner was working with a tight budget and could not afford to initial upfront costs of the GSHP but still wanted be energy conscious they could elect to upgrade the glass and install a total energy wheel to yield a 2.5 year payback period. This combination does not save as much energy but is a very cheap upfront cost and still yields a substantial energy savings.