

## Executive Summary

Des Places Residence Hall is a 130,438 ft<sup>2</sup> building currently being constructed on the campus of Duquesne University in Pittsburgh, Pennsylvania. The building primarily consists of private dormitory rooms, with some office and conference space as well. The budget for Des Places is approximately \$28,000,000 and Duquesne University required that the building achieve a minimum of LEED certification by its completion.

The existing mechanical system in Des Places Residence Hall is a dedicated outdoor air system with individual fan coil units in every conditioned room. One energy recovery unit in the penthouse delivers the required amount of outdoor air to the building and meets the latent loads of each space. The sensible heating and cooling loads of the building are met by Whalen fan coil units in each room.

In this report alternatives and additions to the existing mechanical system in Des Places were proposed and analyzed. The redesigned mechanical system for Des Places should not be viewed as superior or inferior to the existing design. The suggested changes are instead meant to examine the possible benefits and disadvantages of using alternative systems in Des Places. Many of the external requirements placed upon the mechanical design team such as a fixed budget and specific owner requirements were not considered in this report. The primary alterations analyzed in this report were the redesign of the existing DOAS system to a dedicated outdoor air system that uses radiant chilled ceilings and baseboard radiators, adding a solar hot water system and changing the building envelope.

The proposed dedicated outdoor air system ended up costing \$186,528 less than the original system but it consumes more energy than the fan coil unit DOAS system, which would result in an approximate increase of \$7,370 in yearly operational costs for the building. The DOAS system should increase the comfort and productivity of the students living in Des Places because it would eliminate fan noise and produce a more uniform temperature distribution in each room.

The solar hot water system designed for Des Places would save Duquesne's central steam plant approximately 2,350 therms of energy every year. The system has a relatively high initial cost of \$94,500 but it still has a payback period under 10 years if federal and state financial incentives are factored into the life-cycle cost analysis.

The building envelope redesign involved doubling the size of every bedroom and living room window in Des Places Residence Hall. These larger windows are meant to allow more natural daylight into the student's rooms. A daylighting analysis showed that the windows did allow a good amount of additional light into each room throughout the year, but the redesigned building envelope cost \$203,312 more than the original design and resulted in an increase of \$2,137 in annual energy costs for the building.