

## Executive Summary

The Duval County Unified Courthouse Facility is a current construction project located in Jacksonville, Florida. It is a 798,000 square foot city/county government building that houses 51 courtrooms, judicial offices, hearing spaces, and required detention areas. The facility is expected to be completed in May 2012.

The current mechanical system is a large Variable Air Volume system with terminal reheat VAV boxes for thermal conditioning. Ventilation air is brought in by three large Make-Up Air units, two of which are equipped with sensible energy wheels to reduce necessary ventilation air conditioning. Hot water for heating is generated by onsite natural gas boilers and chilled water for cooling is purchased from the local utility. The existing system is expected to achieve LEED Certification based on LEED V2.2 by the United State Green Building Council.

Alternatives were chosen in this study to achieve cooling load and necessary associated energy reduction. Alternatives were compared based on initial cost, life cycle cost, energy use & cost, simple payback, environmental impact, and LEED applicability. The alternative design options that were selected for analysis were solar load reduction via internal shading devices, a conversion to a decoupled Dedicated Outdoor Air System for ventilation and a hydronic Active Chilled Beam system for thermal conditioning, and the implementation of an onsite chiller plant. Internal shading proved to reduce the solar loads greatly and save energy on cooling. The decoupled Dedicated Outdoor Air System and Active Chilled Beams also reduced load and energy use through the reductions in airflow as well as ventilation air conditioning and an increase in cooling method efficiency. The chiller plant analyzed was a variable primary flow chiller plant with centrifugal chillers capable of handling the reduced loads. The chiller plant demonstrated more efficient means of supplying chilled water to the loads and required less total energy consumption than the system purchasing chilled water.

Additional topics such as a photovoltaic panel array analysis and a floor-to-floor height reduction analysis were also conducted. The solar panel array was sized in order to allow for an adequate simple payback period, yet still generate enough electricity to have an impact on the facility. Electricity generated by this array can be used to offset additional electrical uses from the motorized internal shading or chiller plant. It also assists in making the facility “greener” and applies to LEED. As a result of the system conversion to Dedicated Outdoor Air Systems and Active Chilled Beams, the required plenum space is reduced. The floor-to-floor height reduction saves both cost and construction time in the superstructure and building envelope.

After the analyses were performed, alternatives were compared based on the aforementioned criteria. The recommended alternative that had the best ratings in all categories was the conversion to a Dedicated Outdoor Air System with Active Chilled Beams and internal shading with the resulting floor-to-floor height reduction. This alternative with an additional chiller plant is considered the second most suitable alternative for the facility. This chiller plant alternative may prove to be a more feasible option if the purchased chilled water prices escalate.