1.0 Executive Summary

The Defense Media Activity (DMA) building is a three story, 186,000 square foot facility designed for the Army Corps of Engineers. This building has a data center, television studios, media centers, offices, and editing suites. The DMA building will operate 24 hours a day which distinguishes it from a typical office building. It is designed to operate with redundancy in mind, as well as efficiency for LEED Certification.

Overall, the mechanical system of the DMA building is well planned out and implemented. The energy usage is kept to a minimum by utilizing efficient equipment. VAV systems combined with high efficiency chillers and boilers are very effective if implemented correctly. The data center uses high efficiency and high density APC cooling racks to take care of the data center loads.

The object of this report is to minimize costs spent on energy consumption, making the building less expensive and more efficient to operate. In order to optimize the building's energy use, several options have been proposed as alternatives. These options are: combined heat and power (CHP), thermal energy storage, CHP with thermal energy storage, and system optimization.

Two different prime movers were analyzed for the implementation in a combined heat and power system. Internal combustion engines were selected as the more economical option. CHP system E showed the best savings as well as the fastest payback. Annual savings from system E were around $368,273 and a simple payback period for this system was calculated to be around 8.8 years. An acoustical analysis was done on CHP systems to see the impact of noise they had on adjacent spaces. An electrical analysis was also performed on the selected CHP system E.

A peak shaving strategy was used to analyze two types of thermal storage systems. Ice storage had a range of results that ranged from negative benefits to very minimal benefits when it came to cost savings. Chilled water storage produced an average yearly savings of around $10,643, which included demand savings and on-peak kWh savings. An initial investment of $ 173,667 would have to be made for this system. The payback period for the chilled water storage system was around 16.32 years.

The third analysis performed was the integration of a chilled water storage system with a combined heat and power system. When incorporating a chilled water storage system with a CHP system, calculations showed yearly energy cost savings around $11,644. The initial investment for adding a chilled water storage system in was around $123,409. This led to a 10.6 year payback period to justify the additional investment in thermal storage.

The fourth analysis was separated into two sections. Section one dealt with energy cost savings due to a DOAS system as compared to a VAV system. When using DOAS in the DMA building, yearly cost savings from energy usage were around $46,494. Section two introduced a separate chiller for the data center that would run at different temperatures to optimize energy cost savings. Running the chiller at 55˚ F as compared to the original 44˚ F produced a yearly savings of about $28,155. The initial investment of a couple valves, piping and pumps was paid off in less than a year for this option.

CHP system E was recommended by this report. This system showed the largest energy cost savings, the fastest payback period, and a big reduction of the carbon dioxide footprint for the DMA building.