

New York Police Academy

College Point, New York

Final Report

East Campus Ground Source Heat Pump Re-Design w/ Photovoltaic Array Analysis & Construction Evaluation

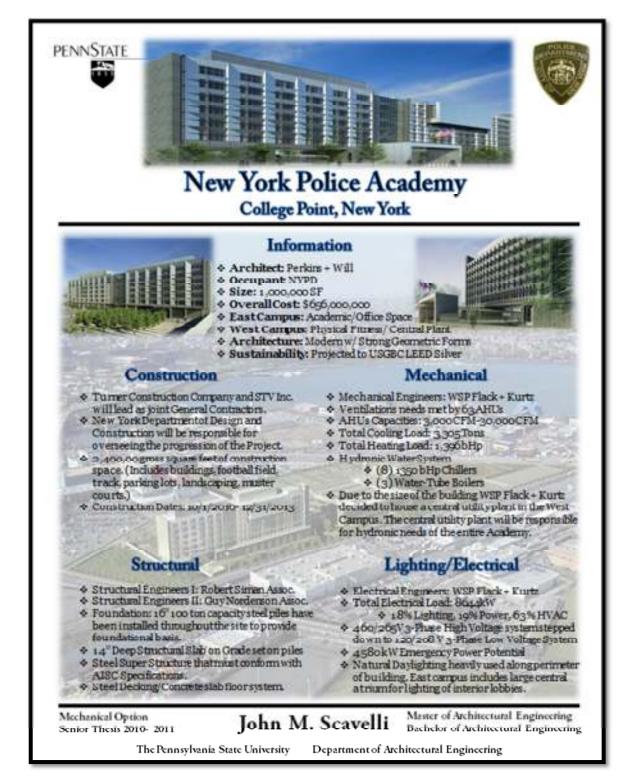
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Master of Architectural Engineering Bachelor of Architectural Engineering Technical Report 2: Energy Consumption, Emissions, & Economic Analysis

<u>Abstract</u>



Technical Report 2: Energy Consumption, Emissions, & Economic Analysis

Executive Summary

This report is a senior thesis capstone design project for The Pennsylvania State University's Architectural Engineering Department. This report is a culmination of a yearlong architectural engineering analysis of the New York Police Academy (NYPA). Specifically, this report focuses on the mechanical systems of NYPA. An analysis has been done regarding the designed mechanical system as well as a proposed redesign which consists of a ground source heat pump system along with an electrical photovoltaic array. The systems were also analyzed from a construction management standpoint.

The New York Police Academy is a building project which is to start construction in October of 2010 and be completed by the end of 2013. This Academy is intended to consolidate the New York Police Department's training and academic center into one campus. The NYPA is going to be built in College Point, New York, which is a subsection of Queens, New York. The total site consists of 2,400,000 gross square feet which will consist of an East Campus Building, West Campus Building, football field, outdoor track, muster court, parking lots, and landscaped areas. There will be an exposed drainage ditch that will symbolically and physically separate the East and West campus. The East Campus Building will house the academic and office spaces of the academy. The West Campus Building will house the athletic facilities, training facilities, and the central mechanical plant.

The air conditioning needs of the building will be met by 63 chilled water Air Handling Units (AHUs). The capacity of the AHUs range from 3,000 CFM to 30,000 CFM. The 63 Air Handling Units will be housed in different sections of the campus. A central utility plant located in the West Campus will serve the AHUs. There are five water tube boilers that are located in the central plant that will be responsible for introducing the hot water for the entire campus. Along with the boilers there will be six chillers that will supply all the cold water needs of the Academy. The central plant serves both the East and West Campus.

After analyzing the existing mechanical system, a proposed alternative mechanical system was explored. The major design proposal is to incorporate a ground source heat pump (GSHP) system to serve the East Campus building. The proposed design alternative will be compared to the actual designed systems in areas such as energy efficiency and cost. Aside from the mechanical system, there were other proposed systems. In regards to the electrical system, a photovoltaic array located on the roof of the West Campus was designed and evaluated. Also the construction and economic impacts of these proposed systems were analyzed.

Overall, it was discovered that implementing a GSHP system along with the photovoltaic array could help significantly reduce utility costs. Also it was estimated that the pay back period for these system would be 16 years. Implementing these system would increase the first costs of the building. However, it is believed that the benefits of reduced energy use, utility costs, and reduced emissions would suggest that these alternatives could be beneficial for the New York Police Academy.

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