Executive Summary

Father O'Connell Hall is a four story office administrative building located on the campus of Catholic University in Washington, DC. The current mechanical system uses natural gas that feeds into two 500 MBH condensing boilers to heat the building in the winter months and a 97.7 ton air cooled scroll chiller for cooling in the winter months. In addition, all electrical power is generated off-site and distributed to the building. This report will focus on redesigning the separate heating and power system into a combined heat and power system. Also, absorption cooling will be added to reduce the air cooled chiller load in the summer months. Furthermore, an electrical breadth will analyze how on-site electricity production will affect the current power distribution and an acoustical analysis will be done on the current indoor air handling units located adjacent to office spaces.

A 30 KW microturbine is added to the basement of Father O'Connell Hall to produce 30 KW of power every day from the hours of 8am to 6pm. This arrangement was analyzed to be most cost effective solution, saving $7,300 dollars a year with a payback period of 14 years. With the addition of the microturbine and the useful exhaust heat, the two boilers were able to be replaced with one 600 MBH condensing boiler. Absorption cooling in the summer was proven to be unsuccessful because of low COP and low useful waste thermal exhaust. They were not able to reduce the electrical load as hoped. Father O'Connell Hall is not the most ideal building for a CHP system, but emissions were cut significantly. From an energy and environmental standpoint the CHP system was successful, but as an economic standpoint it is not recommended.

With the addition of on-site power generation, it is important to consider connecting the microturbine to the current electrical distribution system. A parallel switchgear needs to replace the current switchgear to appropriately sync the grid power and the microturbine power to be used in the building. This also requires appropriately sizing all wire and breaker sizes to ensure safety.

An acoustical analysis involves the study of indoor air handling units meeting appropriate sound emission codes. It was determined that AHU-4 located in the basement meets all standards, but the OAHU-1 on the fourth floor does not meet standards and the background noise is too loud in the adjacent executive office. The addition of duct lining or duct silencer can reduce the sound levels enough to comply with code.