# 2.0 Executive Summary

Westinghouse Nuclear Engineering Headquarters is comprised of three buildings. The central building, Building 1, is the topic of this report. Building 1 is largely open office with conference rooms, computation laboratories, a Data Center, Fitness Center and cafeteria. The concentration of computer equipment is relatively high compared to a typical low-rise office building.

Of primary importance to the client are adequate thermal comfort and air quality. Both of these variables will allow the occupants to be more productive in the workplace. Also of importance is the cost of operation for the facility in the long-term.

The primary system for Building 1 is a Variable Air Volume (VAV) system supplemented by Computer Room Air Conditioning Units (CRAC Units) where the sensible load is too great for the VAV to handle—specifically in the Data Center. A VAV system was chosen because of its low maintenance costs, easy manageability, and efficiency. The system is supplied with chilled water from three centrifugal chillers and electric re-heat/gas-fired burners from the VAV boxes and AHUs.

In an effort to optimize the systems of Building 1, analyses were performed involving a study of a Dedicated Outdoor Air System with three different systems in the office space. An all Active Chilled Beam configuration, an All DOAS Fan Coil Unit (aka DOAS Fan Powered Terminal Unit) configuration, and a DOAS FCU on Perimeter and ACB in Core configuration were all explored. Once the Plant loads have been reduced with these systems, the three systems will be connected to both a Central Chiller & Boiler Plant and a Hybrid Ground-Source Heat Pump. The Hybrid Ground-Source Heat Pump was explored over a typical non-Hybrid system because of its initial cost savings as well as energy savings. Initially, both a Centralized and a De-Centralized GSHP Plant were explored, however the energy modeling program could not accurately model the De-Centralized Plant—thus only Centralized Plant was extensively analyzed.

Additionally, each of these combinations of system and plant was modeled with and without a Façade Redesign (Architectural Breadth). The intention of this Façade Redesign was to reduce the thermal loads within the space. As part of the Façade Redesign, a Daylighting study was done a south facing office area. The study examined the use of a Light Shelf system to reduce the usage of artificial light in the space as well as reduce the thermal load.

The Dedicated Outdoor Air System with the all DOAS Fan Coil Unit (DOAS Fan Powered Terminal Unit) configuration proved to be the best choice for the Westinghouse Headquarters. The plant analysis showed that the Hybrid Ground-Source Heat Pump Plant option was the most beneficial system, even though it did not have the lowest Initial Cost or Payback Period—the Central Plant had both. The Hybrid GSHP Plant had the lowest emissions, lowest energy use, and lowest Life Cycle Cost. The Façade Redesign had a very beneficial effect upon the Initial Cost, Life Cycle Cost, and Payback Period for all of the systems and plants.

Since the building is owned by a developer, their biggest priority with choosing a system and plant is Initial Cost. This is the reason why the current Mechanical system has a standard VAV system with a Chiller Plant and Electric Resistance. However, according to the results of this report, a Boiler Plant would actually be a lower first cost than the Electric Resistance.

The overall best option for the Westinghouse Headquarters is Dedicated Outdoor Air System with DOAS Fan Coil Unit (DOAS Fan Powered Terminal Box) configuration and a Centralized Hybrid Ground Source Heat Pump Plant.