



Executive Summary

The School District of Philadelphia Administration Headquarters (SDPAH) is an 848,000 square foot (SF) existing building located in downtown Philadelphia. The existing mechanical system is a variable air volume system with parallel fan powered boxes. It utilizes 17 self contained packaged direct expansion (DX) air handling units (each with a waterside economizer) located within the core of the building served by condenser water from a 1500 ton cooling tower located on the fifth floor roof. Each floor has a cooling load of about 300 tons and a heating load of 300 MBH. Due to the nature of the internal loads, the SDPAH requires cooling year round. The proposed idea is to recommend an alternative mechanical system that requires less energy consumption and less first cost compared to the existing system. The primary space analyzed was the office space (425,000SF).

Trace, a building system simulation program provided by Trane, was used to investigate the energy usage of the alternative designs. Three airside systems all with waterside economizers were analyzed within the office space: 1. The current VAV system, 2. A dedicated outdoor air system (DOAS) with VAV as a parallel system, and 3. A DOAS with radiant panels and baseboard heating as the parallel systems. The waterside part of the mechanical system compared the existing DX units to a central water plant with an electric chiller and a gas-fired boiler. The results are summarized in the following table.

	VAV		DOAS/VAV		DOAS/Radiant
	DX-Electric	CHW-HW	DX-Electric	CHW-HW	CHW-HW
Mechanical System Cost	\$3,530,000	\$4,362,000	\$3,565,000	\$4,370,000	\$4,220,000
Yearly Energy Consumption	\$1,849,812	\$1,641,585	\$1,963,834	\$1,676,231	\$1,329,330

These results show that in general a central water plant is more costly than packaged units using refrigerant as the primary coolant. Due to the nature of the DOAS/Radiant system, the required equipment size is smaller than that of the other options allowing for smaller first cost (with respect to other central water plant designs) and a lesser cost due to energy use. Because of this energy savings, it is recommended that when an owner wants a central water plant he or she uses DOAS/Radiant as the airside system.