

Executive Summary

City Hospital campus development included three (3) million square feet of research, clinical office, and support service spaces. Medical research laboratories and clinical offices required high ventilation rate to minimize the risk of contamination and other adverse effects. In recognition of substantial amount of energy required to condition such significant volume of space, the mechanical system must be design as energy efficient as practical.

The existing mechanical systems of City Hospital are designed with careful attention toward occupant health and thermal comfort, energy conservation, reliability, and expandability. The existing mechanical system is considered an excellent design for large intuition such as City Hospital campus.

The primary goal of the proposed mechanical system modification is to further reduce energy consumption and annual utility cost. It is also important to maintain occupant health and thermal comfort, system reliability in certain foreseeable events, the ability to expand as the campus grows, and the modification should consequently reduce emissions as well. Furthermore, the alternate solution should have a reasonable payback period to justify its application.

Depth: Mechanical Modification

After through assessment of the existing mechanical system, two proposals were developed; an all electric centrifugal chiller plant, and combined heat and power (CHP). After further evaluation, it is determined an all electric centrifugal chiller plant lacked energy redundancy of the existing plant. This proposal is eliminated from consideration for the thesis. CHP is a practicable alternate to the existing mechanical system for Phase 1 due to favorable condition of high and consistent electric and steam demand. It should further reduce energy consumption and cost, and lessen impact on the environment as well.

Breadth: Electrical System

The proposed mechanical redesign included the replacement of steam boilers with CHP generator(s). Demand from local grid will be reduced, and equipments for re-routing electrical source must be integrated as part of the new system. In addition, existing electrical equipments will be analyzed, and if necessary, resized to work with the alternate design. With on-site generation, elimination of existing emergency power generator set is a possibility.

Breadth: Acoustic Properties

CHP generator such as gas turbine has acoustic properties similar to a jet engine, and should be place outdoor. City Hospital campus is located in a dense urban area. Due to limitation of available space and future construction above “roof” of Phase 1, location of CHP generator(s) are limited to the boiler room. Noise and vibration generated by generator(s) might transmit to occupied spaces close to the boiler room. Noise criteria and control methods must be evaluated to ensure occupant comfort in these spaces.