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ELECTRICITY SAVING POTENTIAL THROUGH OPTIMIZING CONDENSER WATER & CHILLED WATER SYSTEMS: CASE OF WORLD TRADE CENTER AIR CONDITIONING SYSTEM

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DECLARATION

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Abstract

Major energy consumer of the World Trade Center building is the air conditioning system and it is more than 50% of the total energy consumption. Considering overall energy consumption of the building, air conditioning system plays an important role. This thesis provides a survey of World Trade Center, central air conditioning system and possibility of energy saving through the new technology. Through my preliminary studies it has been observed that condenser water pumps, chilled water pumps and cooling towers in central air conditioning system do not require operating at the design speed all the time. Considering complexity of the central air conditioning system further detailed process studies have to be done to optimize the condenser water and chilled water systems.

Equipment of the central air conditioning system is studied here and check the energy saving potential. Established new parameter measuring points of the central air conditioning system includes pressure, temperature and flow measurements. Evaluated periodical logged data, machines designed parameters, related theories & new methodologies and by that mathematical models of the parameters of the main facilities are established. For the electricity power saving through optimization purpose system operation simulation modules of the central air conditioning system are set up by using the Matlab/Simulink tool. Through the evaluations of simulated test run results concluded central air conditioning system optimization process, and also evaluated the measured building air quality parameters (both existing and simulated test run periods) and confirmed that the building air condition is maintaining according to the international quality standards. Finally, through the analysis to the simulated results, the optimal installation and operation scheme of air conditioning system are proposed.

After the research, simulation of the proposed solutions it was observed that the condenser pump motors, chilled water pump motor and cooling towers were operating at a reduced speed at most of the time during the operation(day and night). Research study was successful, and it was established that the installation of extra two 132kW, 110kW and 40kW VSDs will enhance the energy performance of the AC system. Also can be introduced and establish a procedure for the daily plant operation.

VSD technology is applied here and save energy without effecting building smooth operation. By taking parameters measurements of identified equipments, air conditioning equipments operate in an efficient range. To achieve 3.5% reduction in energy consumption, and get 4% of electricity bill, optimize the flow rates and temperatures of condenser water through pumps, chillers & cooling towers to save energy.

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