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UNDER THE THEME

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**2030 Vision for Updating the Current HVAC
System at AlMasjid AlNabawi in Madinah,
Saudi Arabia to improve on energy savings**

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4.0



1.Introduction



- a) An over look at the current **HVAC** system that service **AlMasjid AlNabawai** since almost three decades.
- b) It is necessary to understand the need of **upgrading** any **large open public** used facility and develop a comprehensive proposal to the actual operational costs versus the operational cost of an upgraded system in addition to other miscellaneous costs that could be saved through this study.
- c) We need to add all the additional occupational requirements that have been changed since the initial system designed and implemented.
- d) The desired system will be more functional and a better performance on both zone control cooling and power savings.
- e) If this study is implemented then a wholesome of economical savings will be achieved. An important parameter is the cost of upgrade and the time it takes for the system to be upgraded as we need to keep in mind the sensitivity of AlMasjid AlNabawi's being visited year round and throughout the upgrading process has to be scheduled carefully.

2. The current system in operation



- a) The current HVAC system of AlMasjid AlNabawi is about 7 KM away from it and that by itself is a draw back and makes losing energy a big factor as chilled water has to travel all of that distance to reach the air handling units.
- b) The current thermal stat sensor is nothing but that of the thermometer installed in the Zamzam tank which if it drops to less than 6 degrees C the operational team at the chiller facility decides to turn on a chiller in operation and during hot summer days up to two chillers will operate at once.
- c) There are a total of six chillers available at the facility made by York and it operates at 3400 Watts per hour which is equivalent to 819,000 cubic meters per hour.
- d) There are 151 air handling units at AlMasjid AlNabawi which are distributed underneath the new expansion pillars all around the complex building which pumps air through ventilation diffusers set around the circular pillar with an attractive decorative design. Each air handling unit consumes 11,900 KW per hour.

3. The new proposed design



- a) New spot chillers are now used in so many facilities today which both are very efficient and at the same time produces a better and more effective cooling with an intelligent zone control which uses infrared sensors to know the required cooling pre occupancy.
- b) The proposal starts with removing all current chiller water supplied from the chillers facility and dismantling it from its current operation and we would replace it with 151 spot chillers at the capacity of 10 tons each all connected through the current air handling system which will continue use the same diffusers used currently.

3. The new proposed design (cont.)

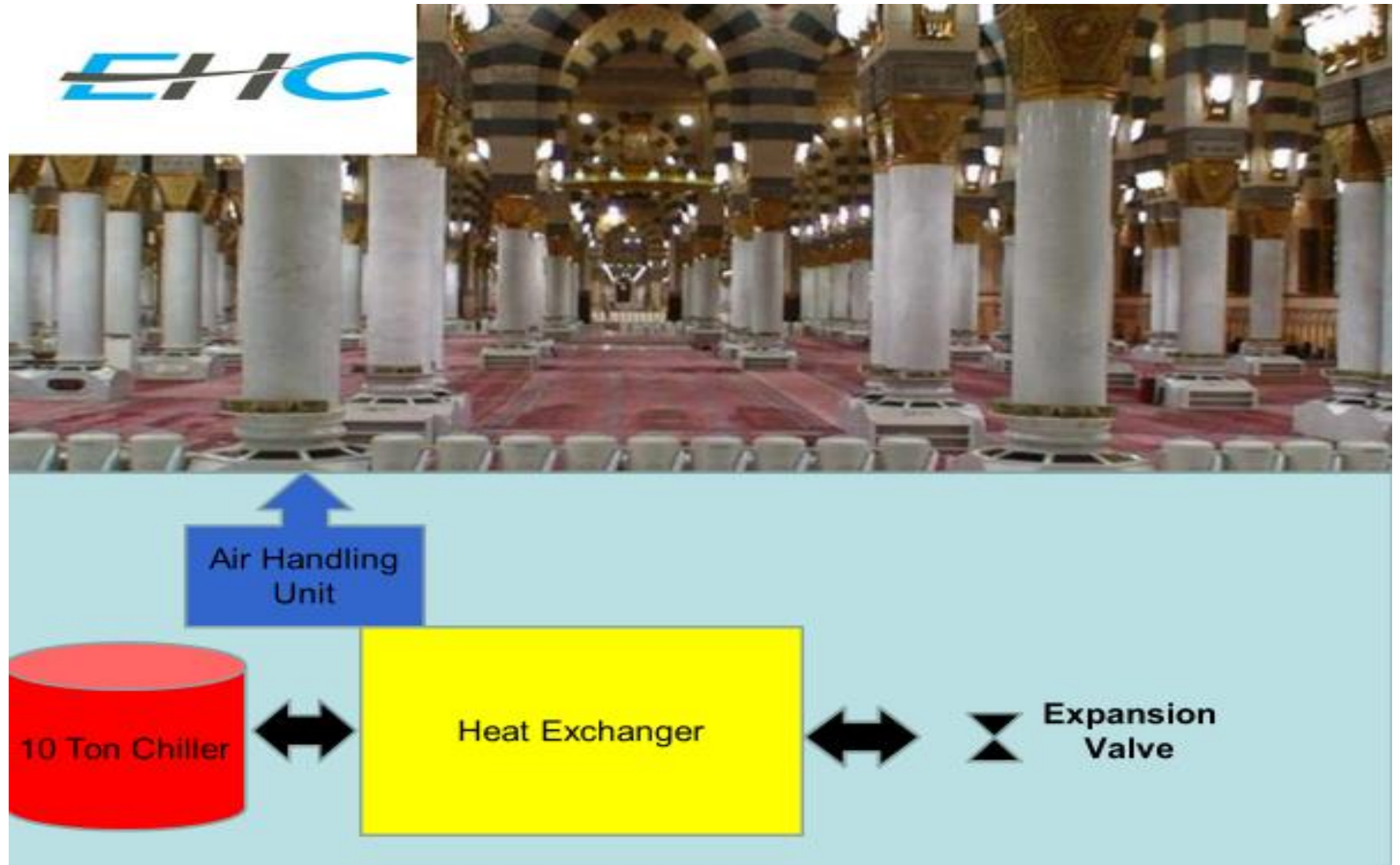


c) The intelligent zone controller will introduce a new power saving method that was never been used at such an important facility. This controller will allow the FM controls to reduce operation when the occupancy is reduced or even at no occupancy which allows to shut down the HVAC for that particular zone which is one of 151 air handled zones.

d) The expected cost per spot chiller is about 100 K SAR which includes installation, testing, and commissioning. In general the total cost for replacing the current system is about 15 Million SAR which can change according to different desired needs and requirements.

e) This new proposed idea and design will save so much energy and at the same time increase the effectiveness of the cooling zones which will cause a comfort distribution according to infrared temperature intelligent sensors.

Figure 1: A schematic of the proposed new HVAC system



4. Conclusions and recommendations



- a) It is expected that the power consumption will be reduced more than half of its current operation capacity.
- b) The new HVAC system can be installed in conjunction to that which will not disturb the operation of the current HVAC system which will allow comfort for the visitors of AlMasjid AlNabawi and with less noise of removal and installation since the whole system is underneath the building complex which is currently in the basement.
- c) It is recommended that a prototype system be tested first and operated before execution of the whole proposal and dismantling the current HVAC system.

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