

### Design Alternate 1: All Electric Centrifugal Chiller Plant

The existing mechanical system is designed to use steam generated by boilers to meet building thermal load, process equipment load, and drive steam turbine chiller(s). Trace assumed steam turbine chiller to provide primary chilled water production, and electric centrifugal chiller(s) compensate remaining chilled water load. Actual sequence of operation may vary. Steam turbine chiller(s) specified for the project consume 11.2 pound of steam per hour-ton, an efficiency equivalent of 13,365 Btu/hr-ton (340°F, 120 psig). Electric centrifugal chiller(s), rated 0.598 kW/ton, have efficiency equivalent of 2,041 Btu/hr-ton. Therefore, electric centrifugal chiller is 84.7% more efficient than steam turbine chiller. An all electric centrifugal chiller plant will have a much higher efficiency than the current steam turbine/electric chiller plant, operation cost and maintenance cost will be lower. Capital cost for an all electric centrifugal chiller plant will be less than the current configuration as well.

Energy usage of the existing system and an all electric centrifugal chiller plant is converted into common unit of million British thermal units (MMBtu) for comparison. The existing system consumes 172,983 MMBtu of natural gas and 78,194 MMBtu of electricity annually. An all electric chiller plant uses 87,325 MMBtu of natural gas and 85,662 MMBtu of electricity. Even though natural gas does not have a demand charge like electricity, and relatively less expensive per MMBtu, annual utility cost of an all electric centrifugal chiller plant cost \$4.07 million (*Appendix ii*) compared to \$4.33 million of the existing design (*Appendix i*) in energy expenditure. An all electric centrifugal chiller plant can save City Hospital Phase 1&2 \$274,000 annually in energy cost by increasing efficiency.

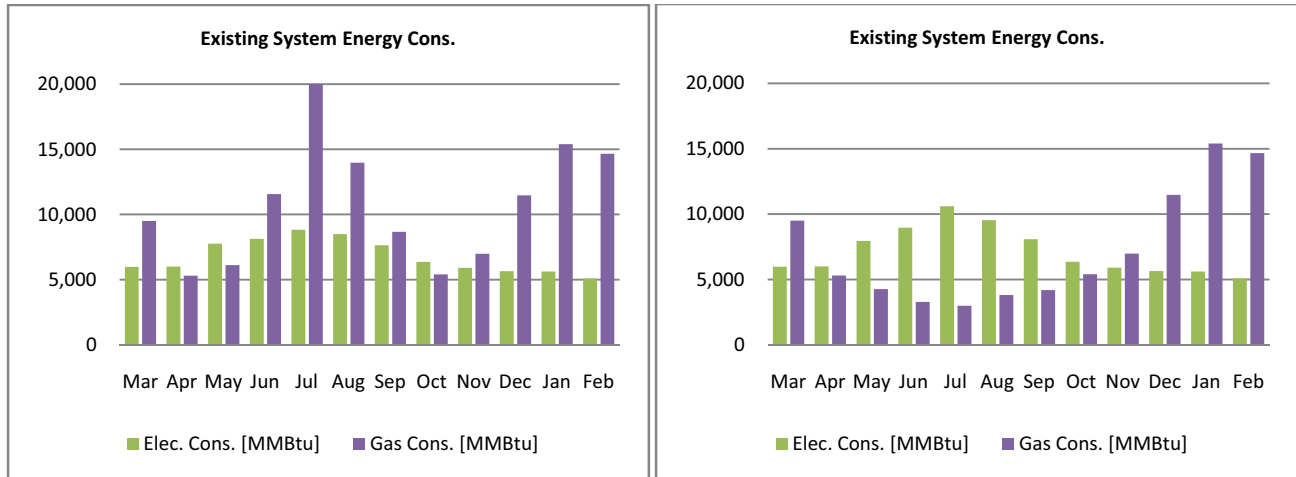


Figure 11: Energy Usage of Existing Chiller Plant and All Electric Centrifugal Chiller Plant

All though an electric centrifugal chiller is much more efficient than a steam turbine chiller, there are disadvantages to such efficiency. Current chiller plant configuration considered to be fail-safe due to chiller plant’s flexible energy source, steam or electricity. Flexibility is essential to critical environments such as vivarium and laboratory spaces on the campus. Thus, an all electric centrifugal chiller plant will not be considered further as an alternate mechanical design.