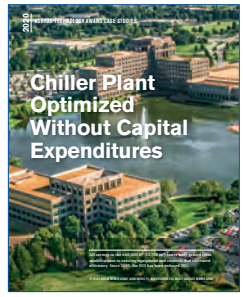
Chiller Plant Optimized Without Capital Expenditures

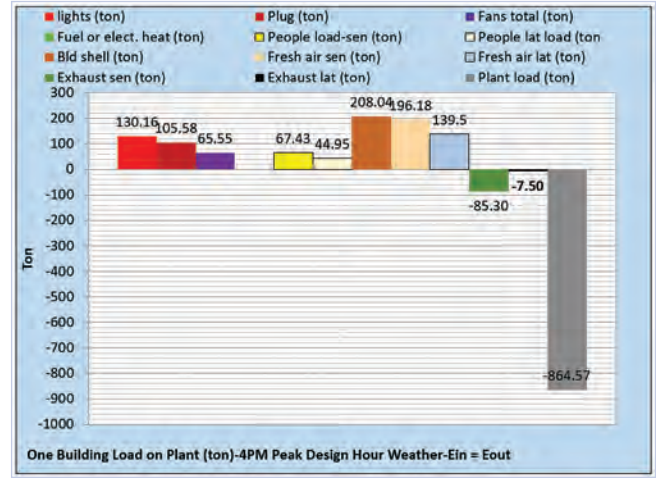


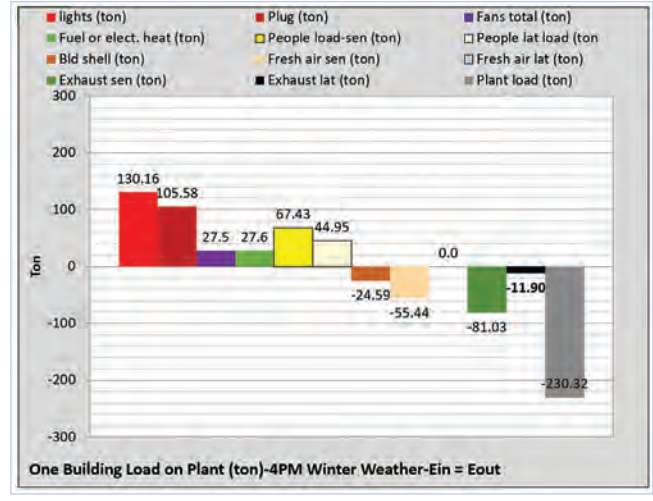
The September 2020 ASHRAE Journal article, "Chiller Plant Optimized Without Capital Expenditures," illustrates that an apparently well-designed building was inefficiently operated for about 13 years. Figure 1 of the article shows the EUI value was 134 kBtu/ft^2 in 2005 and was gradually decreased over the next 13 years to an EUI value of 82 kBtu/ft^2 in 2019—and without capital expenditures. Two obvious question are (1) Is the EUI value of 82 kBtu/ft^2 the best that can be achieved and (2) Why were these improvements to control and operation not done 12 years earlier?

One tool that might have identified the problems in 2006 is an energy balance analysis. Figure 2 of the article gives a peak load of about 320 tons and gives the building square feet as 640,000; therefore, we have (6.0 Btu/ft^2) chiller load on the day and hour this data was taken. The two charts I sent with this letter will be used to demonstrate energy balance analysis.

The top chart on this page is the energy balance of an ANSI/ASHRAE/IES Standard 90.1-2010 large office building at design hour conditions of 101°F dry bulb and 78°F wet bulb. The bottom chart is the same building at 42°F dry bulb and 42°F wet bulb, defining how much energy this design should be using at these winter conditions. Both charts are defined by a system energy equilibrium (SEE) model. The building square feet of this study is 565,000, so the plant load for the bottom chart at winter weather conditions is (4.9 Btu/ft^2). If the real building is using more energy than in the bottom chart, energy waste is probably occurring.

Perhaps the authors could give all relevant data available for the conditions of Figure 2 in their article, especially the date and/or the outside temperatures. The chiller load is known, so the other values of an energy balance must sum to the known. My appreciation to the authors for a well-written article, and I look forward to additional data.





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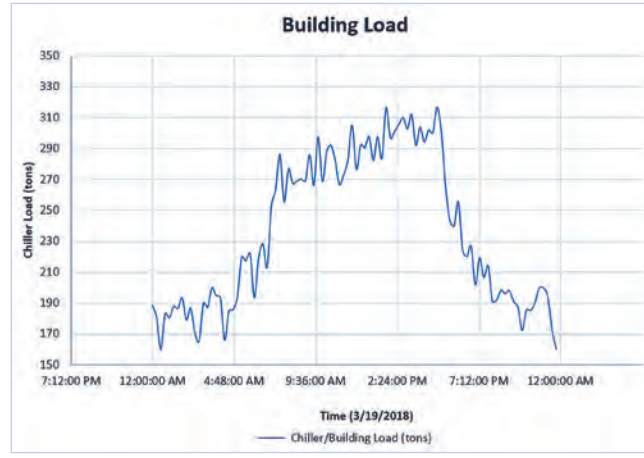
The Author Responds

Thanks for reading the article and sharing the SEE modeling example.

To address the first question, Figure 1 in our article represents the campus EUI and overall program success. The article mentions that since 2005 we have completed hundreds of energy conservation measures (ECMs) and many retrocommissioning (RCx) projects. The many projects from 2005 to 2018 did include capital expenditures. The East Tower Chiller



Plant project in 2018 is what was specifically completed without any capital expenditures.

To address the second question, 82 kBtu/ft^2 is not the best, and we are continuing to reduce our EUI, with our next goal being 65 kBtu/ft^2. We have been able to reduce as quickly as company culture and finances would allow. The 82 kBtu/ft^2 was achieved with a lot of effort and money over the 13 years of operation and was not the sole result of this project. It would be more accurate to attribute the difference between the 2018 EUI and the 2019 EUI to this project.

To address the question of energy balance, the chiller load was taken from a random day for illustration purposes of how the building load profile looks. The intent was to show how the building is loaded throughout the day, not the peak load for a given year or even the average load for a given year.

The chiller load chart (above) was from March 19, 2018. This date was chosen because it represents a typical load profile.

Again thanks for reading and inquiring about the article.

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Jason Brooks, P.E., Member ASHRAE, Birmingham, Ala.,
and Eric Mobley, Associate Member ASHRAE, Hoover, Ala.

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