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Total Solution for all your Control Needs

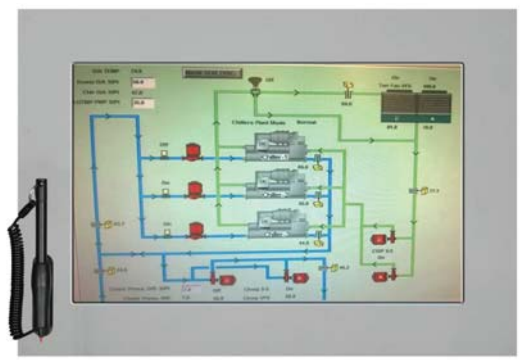
Case Study

Duke Realty Corporation

Clayton, Missouri

Site Location:

101 S. Hanley, Clayton, Missouri 63105



MCS-CONNECT monitoring Chillers

Concerns:

Originally all three of the chillers operated at constant speed thus relying on inlet guide vanes to modulate the capacity of the chillers.

Equipment:

Three 360 ton Trane Centravac chillers

Steps Taken:

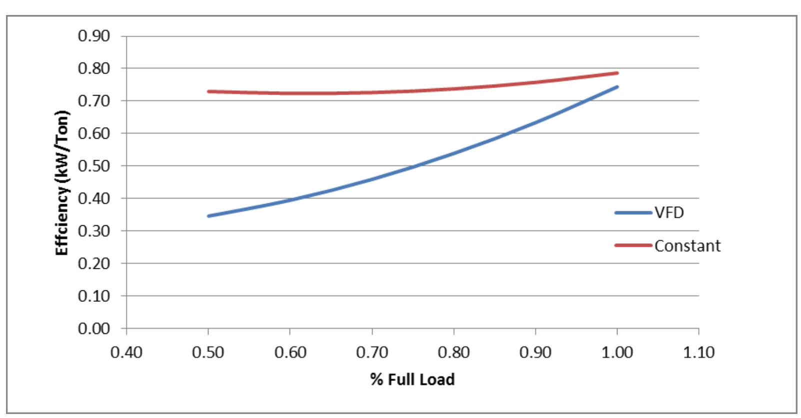
Variable frequency drives (VFDs) were installed on two of the three chillers.

Results:

Realized 36% more saving than the calculated savings.

The following graph illustrates the differences in chiller efficiency between constant speed and VFD equipped chiller, assuming a constant 85F condenser water temperature:

VFD vs Constant Speed Chiller Efficiency



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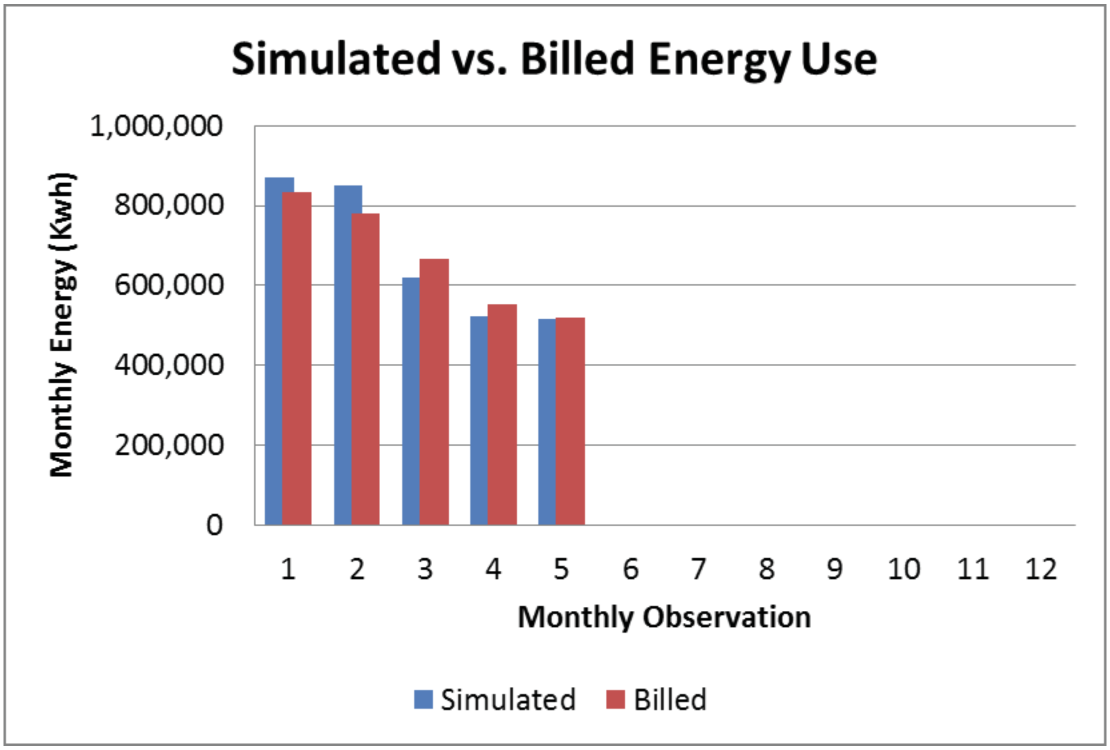
The addition of the VFDs on the chillers also allowed the facility to take advantage of a condenser water reset control strategy that was not originally being used. The benefit of allowing the condenser water to reset based on outside wet bulb temperature is it reduced the overall lift of the chiller therefore increasing chiller efficiency.

Executive Summary

Duke Realty Corporation received incentives from Ameren Missouri for the installation of VFDs on two pre-existing chillers along with implementation of a condenser water reset control strategy. The combined realization rate for these projects is 136%.

Measurement and Verification Effort

ADM (third party company that audits the larger incentives that the utility company gives out) visited the facility and confirmed the installation of the VFDs and implementation of the condenser water reset



control. During the M&V visit, site specific construction details were collected to inform eQuest simulation. These details included typical building construction, window construction, floor layout, HVAC zoning, HVAC equipment nameplates, and building space utilization. ADM also interviewed facility staff to determine HVAC sequence of operation, temperature set points, and typical hours of operation.

The ex post electrical savings were calculated using a calibrated eQUEST (ver. 3-64) computer simulation model, which was compiled based upon the fore mention collected details. The simulation was first built using as-built parameters which included two of the three chillers being equipped with VFDs and condenser water reset controls. The model was then calibrated using billing data and 2014 weather data for the area. The results of the calibration effort are shown below:

In order to ensure that the chiller operation within the eQuest model reflected that of the facility, chiller log data was exported from the facility's energy management system. The provided data included; chiller tonnage, kW demand, and condenser/chilled water temperatures. Using the provided data in conjunction with corresponding local weather data obtained from NOAA, a regression was developed allowing for the determination of chiller runtime hours. Using TMY3 weather data it was determined that the two retrofitted chiller should operate approximately 5,815 and 1,725 hours per year, while ADM's eQuest model resulted in annual runtime hours of 5,695 and 1,721 hours. This suggests that the model accurate reflects the operation of the chillers.

The baseline model was created by removing the condenser water reset control and removing the VFDs from the two chillers. Parametric runs were used to make the appropriate changes within the model, in which the model was run using TMY3 weather.

The annual savings is the difference between the annual consumption of the baseline and as-built eQuest model, which can be seen in the following table:

Annual kWh Energy Savings

End Use	*Baseline*	*As-Built*	*Savings*
Lighting	3,053,558	3,053,558	0
Misc. Equipment	1,215,219	1,215,219	0
Heating	1,668,291	1,668,291	0
Cooling	1,427,011	790,528	636,483
Heat Rejection	50,146	53,537	-3,391
Pumps	315,374	315,374	0
Fans	149,416	149,416	0
DHW	152,328	152,328	0
Exterior	15,946	15,946	0
Total	8,047,285	7,414,193	633,092

Results

Verified Gross Savings/Realization Rates

Measure Category	*Gross kWh Savings*			*Gross Ex Post Peak kW Reduction*
	Ex Ante	*Ex Post*	*Realization Rate*	
Chiller VFDs	463,805	633,092	136%	120.85
Total	463,805	633,092	136%	120.85

The high realization rate can be attributed to the analytical methodology used in the exante calculations. Ex-ante savings estimates were determined through the use of a Temperature Bin calculator, which assumed a building cooling load for each temperature bin. ADM believes that the assumed cooling load for each of these bins contributed to the uncertainty of the analysis as there was no provided calculation for these cooling loads.

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