



Cooling Down Electrical Use With New Efficient Chillers

Case Study: Farm Bureau Insurance Chiller Replacement

Location: Lansing, Michigan

The Farm Bureau Insurance building in Lansing, Michigan relied on aging equipment. The forty-year-old facility was designed to support two air handling units with peak cooling of 300 tons. Over time, actual output capacity had decreased by 200 tons. Similarly, the chilled water pumps were underperforming. Their original 1970 design had regular maintenance, including a motor replacement, but the pumps were past their useful life.

Synergy's team analyzed the energy efficiency of the chillers between the months of April and October in 2016. The purpose of the analysis was to show how the chiller replacement impacted the operational cost of the building. The electricity usage was compared to the operational cost of the Farm Bureau Insurance building before and after the chillers and pumps were replaced.

Energy consumption data was amassed from the years 2003 to 2016. Although a few days in November the chiller was turned on across the year range of 2003 to 2016, the month was ignored since the cooling load was negligible. The year of 2005 was also ignored due to incomplete data regarding the electricity consumption.

The cost of electricity drastically increased in the years analyzed so it was challenging to exclusively compare the electricity cost from one year to the next. The electricity usage, kilowatt hour (kWh), showed a better comparison because it eliminated the changing variable; cost. The problem, however, was that it failed to account for the cooling load on the building. Michigan weather varies from year to year which had to be considered. Cooling degree days quantitatively introduced the severity of the cooling season and was used in this analysis. A cooling degree day is defined as the number of degrees of a day's average temperature is above a given set point temperature when the air conditioner turns on in preparation to cool the building. For the case study, 60 degrees Fahrenheit was used as the set point temperature.



The electricity consumption over time between April and October is shown below in Figure 1.

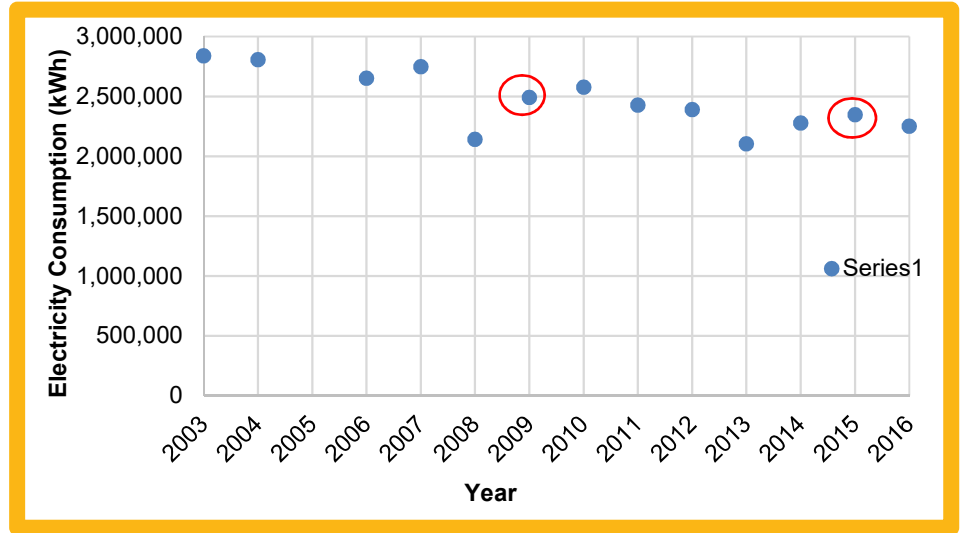


Figure 1: Electricity Consumption vs. Year

The cooling degree days versus year is shown in Figure 2. Notice the two warmest summers in 2010 and 2016. To show how the weather changed over the same time-frame, the variable cooling degree days was included.

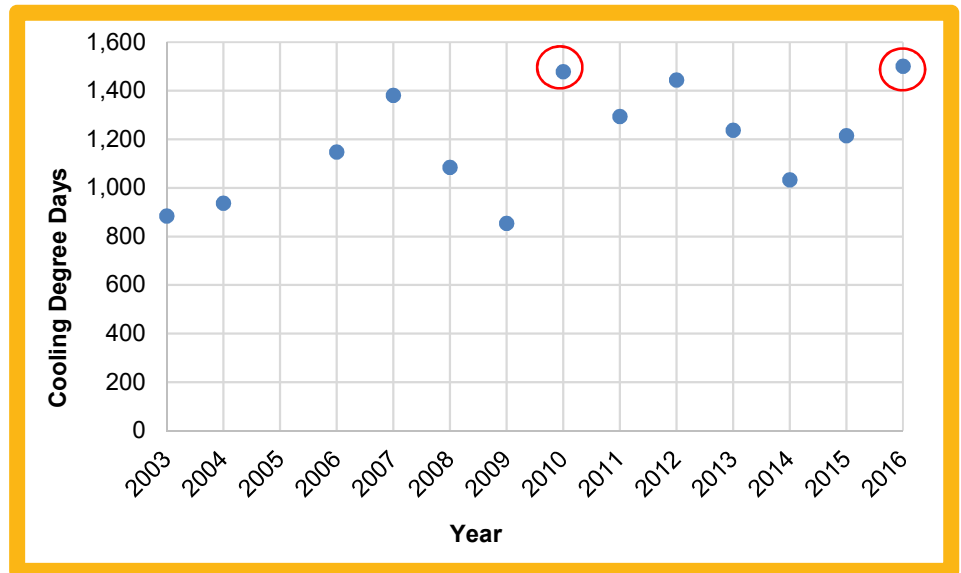


Figure 2: Cooling Degree Days vs. Year

To gain an understanding of how efficiently the system was operation, a graph was generated bringing electricity usage and weather together.

The electricity usage per cooling degree day is shown in Figure 3. The lower the electricity usage per degree day the more efficient the system performed.

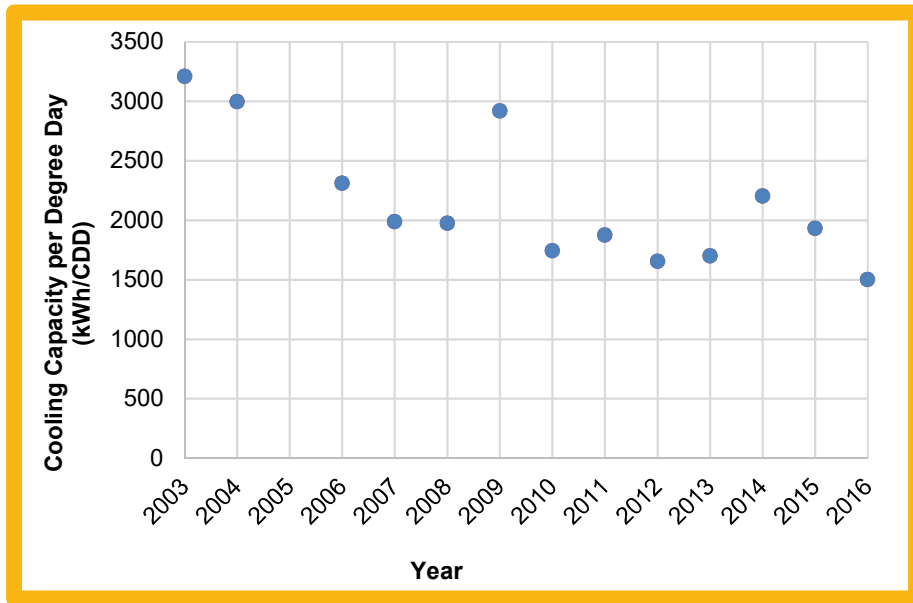


Figure 3: Electricity Usage per Degree Day vs. Year

Figure 1 shows 2016 had the third lowest electricity usage, even though it also had the largest cooling load from Figure 2. 2010 and 2016 reported the same number of cooling degree days. The difference being the amount of electricity consumed. The electricity used for the cooling season of 2010 and 2016 totaled 2,578,000 kWh and 2,252,000 kWh, respectively.

Overall, 2016 consumed 326,000 kWh hours less than 2010. Assuming the peak loads were the same and the cost of electricity was \$0.08 per kWh, this would project a savings of \$26,080.

Over the next several years Farm Bureau Insurance building is projected to consume far less electricity than in previous years. Investing in new chillers has helped the facility run more efficiently and provided significant energy savings.



Contact us at 616-726-5052 to request a consultation to discuss the specific needs of your facility or go to www.synergy-engineers.com to learn more.

