Impact of Temperature Control

On Energy Costs

In

Controlled Temperature Warehouses & Refrigerated Coolers

Prepared by:

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Impact of Space Temperature Control on Energy Costs

Overview

This report analyzes the impact of space temperature control on energy costs for storage and distribution facilities in the beer industry.

The analysis shows there can be a significant opportunity to reduce energy costs by controlling space temperatures as close to the required set points as reasonably possible. The amount of savings is dependent on a number of factors as outlined in the following discussions. Each facility should evaluate its opportunity based on its own site specific factors.

The Analysis

Space temperature control affects energy consumption in two (2) important ways:

1. Losses through walls, roof, floors, as well as infiltration increase as the difference between indoor space temperatures and outdoor temperatures increases. If space temperatures are too cold, electric cooling energy increases. If space temperatures are too warm in the controlled temperature warehouses (CTWs), winter time gas heating energy increases. These losses are referred to as “envelope losses”.

2. When product and packaging are over-cooled and then shipped, the excess cooling energy required to lower the temperature leaves with the product. In effect, wasted electrical energy is shipped with the product.

This report quantifies these losses for two (2) types of facilities. These facilities are briefly described below.

Controlled Temperature Warehouse (CTW) – This facility is assumed to have a required maximum temperature set point of 70°F year round. Product is assumed to arrive at an average year round temperature of 75°F and to leave the facility at the current space temperature. For this analysis, a sample 100,000 sq. ft. facility located in Chicago, Illinois with an annual volume of 6,000,000 cases was assumed. For other facilities, ratioing of square footages and case volumes can be used to estimate similar energy consequences.

Refrigerated Cooler - This facility is assumed to have a required warehouse temperature set point of 38°F year round. Product is assumed to arrive at an average year round temperature of 60°F and to leave the facility at the current space temperature. The same 100,000 sq. ft., 6,000,000 case/year, Chicago location was assumed, to match the assumptions for the CTW.

Envelop Losses

Figure 1 shows the results of the analysis of the cost of increased envelope losses due to space temperatures being above or below the set point for a CTW. Figure 2 shows the results for a refrigerated cooler. These results are based on an 8760 hour model of the typical facility in Chicago, IL, using local historical weather data.

The figures show the excess electric and gas costs for various differences between the actual and required set points. For example, for the assumed CTW facility, a 5°F difference would cost the facility an additional $7,400/year. For the assumed refrigerated cooler facility, a 5°F difference would cost the facility approximately $29,000/year.

Ball park estimates for other size facilities (in Chicago) can reasonably be made by multiplying the Figure 1 & 2 values by the ratio of square footage. Ratioing can also be used for different utility rates. Extrapolation to other locations of the country is not so straight forward due to climate variations. The major assumptions used in the analysis are shown in Figures 1 and 2.

Excess Energy Shipped in Product

Figure 3 shows the results of the analysis of the cost of the excess cooling energy shipped from the sample CTW facility. Figure 4 shows the results for a refrigerated cooler. These figures show the annual cost for 1°F to 10°F over-cooling, due to lower than required space temperatures at various annual case volumes.

For example, in a CTW with a space set point that is 5°F lower than required, and 6,000,000 cases per year, the excess energy usage is $3,050/year. The figure can be used for other amounts of over-cooling and case volumes. In a refrigerated cooler, with a space set point that is 5°F lower than required, and 6,000,000 cases per year, the excess energy usage is $5,418/year. The major assumptions used in the analysis are shown in Figures 3 & 4.

Conclusions

This analysis has shown there is a significant opportunity to reduce energy costs by proper control of space temperatures. One of the most important tools in maintaining control of space temperatures is information. The information provided by the Balance Engineering monthly monitoring reports can serve as a guide to set point adjustments, revisions to operating practices, or changes to equipment and controls.

We encourage you to consider the Balance Engineering Monthly Monitoring Service and to use the information it provides as a guide to reducing your energy costs.

A sample report is attached to illustrate the information and detail available with the service.

Please contact Balance Engineering, Inc. if you have any questions, or are interested in arranging for monthly monitoring service.