NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Pollution Prevention

Case Study in Refrigeration at Breweries

ABOUT REFRIGERATION AT BREWERIES AND RESTAURANTS

Relevant NAICS Codes:

- 312120 (breweries)
- 722511 (full-service restaurants)

FUN FACTS:

Prior to modern refrigeration, brewing was generally limited to cooler climates and seasons. Traditional lagering came from Germany before modern refrigeration, when they would keep beer in deep caves to keep from spoiling.[5]

MORE INFORMATION

[ASHRAE Guide for Sustainable Refrigerated Facilities and Refrigeration Systems]

This case study demonstrates a pollution prevention (P2) approach to increase the energy efficiency of refrigeration units at a brewery. The study shows how identifying key energy-saving opportunities through energy audits provide a framework for significant cost saving including upgrading commercial refrigeration systems.

Function: At 35%, refrigeration makes up the largest component of electricity end uses for breweries. Therefore, optimizing cooling systems could lead to significant savings.[1] At breweries these cooling systems are used throughout the process, not only to keep ingredients such as grain and hops fresh for the brewing process or to maintain a stable temperature for a longer product shelf life, but also within production itself. Processes such as cold fermentation reduce the byproducts of lager yeast such as fusel alcohols and esters, which affect flavor. Lagering requires the beer to age for about a month at lower temperatures to increase flocculation and allow proteins and polyphenols to precipitate out, creating a clean taste.[2,3] These processes have important effects on the flavor profile of the beer and many brewers use refrigeration for other styles of beer including lager, altbier and kölsch.[4]

P2 Goal: Because refrigeration makes up a large component of energy usage as it is vital to the production process and shelf life of the product and technological innovations can cut energy usage by more than 20%, refrigeration is a great target for breweries and restaurants to reduce their energy demand.[1]

P2 Innovation: Upgrading evaporator fan motors to use Electronically Commutated (EC) motors, which are significantly more efficient than traditional motors used in refrigeration systems, reduces energy use. Evaporator fan controls reduce the speed of the fans when the compressor is off, ultimately reducing energy consumption and heat from the motor that would then need to be cooled. Anti-sweat door heater controls set the heaters to run when needed, generally only during business hours, instead of running continually.

CoolTrol System

P2 Results: Benefits of these upgrades include:

- Decreasing energy costs.
- Increasing motor life due to variability in speed.
- The potential for green marketing.
- Decreasing energy consumption and reducing climate change and pollutants.

NEW HAMPSHIRE POLLUTION PREVENTION PROGRAM

New Hampshire Pollution Prevention Program | (603) 271-6460 | nhppp@des.nh.gov. October 2022

Upgrading Refrigeration Systems at Breweries and Restaurants

The Motivation: An energy audit at a 15-barrel brewery recommended retrofitting an ingredient walk-in cooler and a keg cooler to reduce the amount of energy used.

P2 Project Description: The audit identified opportunities for optimizing refrigeration through evaporator fan controls, anti-sweat door heater controls, and upgrading evaporator fan motors to energy efficient EC motors for the brewery's two walk-in coolers. Manufacturers design coolers to handle the hottest day of the year, so the fans run continuously at full load, day and night. The brewery's eight walk-in evaporator motors were found to be low efficiency and there was one refrigerated door that had anti-sweat heaters running continuously.

The energy efficiency upgrades included replacing the eight evaporator motors with (EC) motors and installing CoolTrol controllers to efficiently run the compressors and evaporator fans. These controllers are networked to optimize the efficiency and effectiveness of the refrigeration system. They cycle the fans off when not needed to reduce energy usage and reduce the runtime of anti-sweat heaters. It is estimated that by integrating these controls, the facility's compressors will run up to 46% less.

Project Results:

- Produced annual cost savings of $1,637 and 10,912 kWh per year saved. [7]
- Reduced wear on fan motors.

Keys to Success: Typically, there would be a 50% incentive from the energy provider, but due to COVID-19 there was a 70% incentive available. With this incentive, the brewery received $4,592 in product and services with the cost to the brewery being just under $2,000. Payback for the project is anticipated to be 1.2 years. The average annual savings is estimated to be approximately $1,600.[7]

Applicability Within the Brewery and Restaurant Sectors: This case study clearly demonstrates the cost and energy savings associated with these refrigeration upgrades. An energy audit is a vital first step in identifying the most suitable upgrades for these systems. The upgrades depend on size and scale of operations, production processes and products produced, upfront capital available and energy incentives.

While refrigeration is only one small piece of the energy puzzle, these systems are so prolific that they are estimated to consume 30×10^9 kWh of site energy for central commercial refrigeration, which is approximately $3.2 billion.[6] On the sector scale these calculations show the impact of higher efficiency motors and for the small-scale restaurants and breweries this case study demonstrates the value of these upgrades for their bottom line.

Future P2 Considerations: While EC motors are 66% efficient and shaded-pole motors traditionally used in refrigeration equipment are 20% efficient, a permanent magnet synchronous (PMS) motor with a variable frequency drive technology is approximately 34% more efficient than EC motors and nearly 79% more efficient than shaded-pole motors. One of the main reasons for PMS motors' efficiency is because they do not need to convert AC current to DC. PMS motors had been prohibitively expensive, but new technological advances have made them much more economically viable.[6]

REFERENCES

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For more information:
Sustainable Craft Beverage Website
Or email: nhppp@des.nh.gov