HY-VEE DISTRIBUTION CENTER

KEVIN KASSEL
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Hy-Vee is one of the nation's leading supermarket chains, with over 75,000 employees housed at their 235 stores, distribution centers, corporate office, and subsidiaries. The main distribution center located in Chariton, Iowa, operates two shifts per day to distribute products including dry goods, perishable goods, health and beauty items, and pharmaceuticals. This is the fourth year of participation in the Pollution Prevention Intern Program for Hy-Vee Distribution Center. Past projects have included solid waste reduction and recycling, and wastewater reuse. This year, the focus was on energy reduction in the perishable distribution building's refrigeration system.

PROJECT BACKGROUND

Hy-Vee's perishable distribution building houses all goods that require refrigeration. With the majority of refrigerated items passing through Hy-Vee's distribution center in Chariton, Iowa, the refrigerated space is relatively large at over 450,000 square feet. The space includes an industrial ice plant that consumes a fair amount of the refrigeration capacity to produce hundreds of thousands of pounds of ice a day.

INCENTIVES TO CHANGE

Hy-Vee seeks to continuously improve environmental performance while delivering a quality product to customers across the Midwest. The refrigeration process accounts for more than 70 percent of the energy consumption for the perishable distribution building. Increasing the efficiency of the refrigeration system would result in a significant reduction in electrical energy usage and associated emissions.

RESULTS

Doors and Windows: The perishable distribution building has more than 70 dock doors. Some of the trailers parked in the refrigerated dock area are not insulated. Keeping the dock doors closed whenever possible could prevent heat from the uninsulated trailers from moving into the building. About 75 percent of the dock doors do not have a window, which requires employees to open the doors to check occupancy. Future replacement doors should be ordered with windows to prevent heat loss from the door opening. Installing additional insulated doors to create temperature zones within the facility could increase system efficiency by reducing the transfer of hot and cold air between areas.

Signs: There are a few heated rooms within the building, and doors separating the heated and cooled spaces have been found propped open. The intern placed signs to discourage personnel from propping the doors open to maintain temperature set points.

Cleaning Coils, Defrost, and Compressors: Evaporators, devices used to cool the air, were found to be dirty, which reduces the efficiency. The intern recommended cleaning the evaporators to restore performance. The evaporators operating in the freezer portion of the building collect frost on them due to the physics of their operation. The frost reduces heat transfer and decreases efficiency. A defrost cycle is used to remove frost from the evaporators, but it can vaporize and refreeze on another evaporator nearby. Reprogramming the system to defrost units near each other at the same time could prevent the water vapor from refreezing instantly. Further programming to optimize the compressor sequence could increase system efficiency.

PROJECT	ANNUAL COST SAVINGS (DOLLARS)	ENVIRONMENTAL RESULTS	STATUS
DOORS AND WINDOWS	$26,600	492,592 KWH	RECOMMENDED
SIGNS	$340	6,296 KWH	IN PROGRESS
CLEANING COILS, DEFROST, AND COMPRESSORS	$15,500	287,037 KWH	RECOMMENDED
CLEANING TRAILERS	$1,000	18,519 KWH	RECOMMENDED
MAINTENANCE SCHEDULES AND PERSONNEL	$36,400	N/A	RECOMMENDED
LIGHTING	$60,000	1,111,111 KWH	RECOMMENDED
DISTRIBUTION AND PEAK HOURS	$53,000	981,481 KWH	RECOMMENDED

Cleaning Trailers: The trailers used to transport the products get dirty over time. Vacuuming the trailers instead of sweeping would reduce the amount of dust in the air to settle on the evaporator filters and could help increase system efficiency.

Maintenance Schedules and Personnel: A proactive preventative maintenance plan with checklists and completion dates to track equipment maintenance could extend the life of the equipment and avoid costly repairs and down time.

Lighting: The majority of the high bay lighting fixtures in the facility use fluorescent technology. Switching to LED lamps could result in energy reduction from the increased lighting efficiency and an energy reduction on the refrigeration system from the decreased heat load from the lights.

Distribution and Peak Hours: Some of the items currently distributed out of the perishable building do not require refrigeration. Moving these items and distributing them from the grocery warehouse could reduce the load on the refrigeration system and save energy. Also, the utility company charges higher rates for electricity used during daytime hours than during the nighttime hours, thus any processes that can be done at night, such as ice bagging, will cost substantially less in terms of electricity.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
3.19	0.00	0.01	0.00	0.00	0.01	0.00

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
3.58	0.12	0.02	0.02

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
1803.73	0.02	3.48	0.52	0.39	7.08	0.14

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
2,026.45	66.61	11.07	10.84