Case Study: Refrigeration and HVAC Controls, Emergency Generator, Lighting Controls, Lighting Systems and Utility Rebate Programs

Overview

Dairyland, USA is a wholesale food distributor that teamed up with Energy Consulting Services to install energy conservation projects to control energy usage while improving the quality of Dairyland's products. Totaling 100,000 square feet and growing, this facility has 22,000 square feet of refrigeration/freezer storage space. The system paid for itself in less than two years while saving Dairyland, USA more than $1 Million over 10 years.

Electricity Profile

At the time this project began, Dairyland, USA had a peak load of approximately 500 kW and annual consumption of 2.5 million kWh. Refrigerated areas consume the bulk of the electricity at Dairyland, USA, although the electricity needed to recharge batteries in the electric forklifts is also significant. Business growth has resulted in the need for additional cooling, battery charging and lighting capacity. As a result, the facility load is now in excess of 600 kW.

Energy System

1st Rochdale and its partners, the New York State Energy Research and Development Authority (NYSERDA) and EnergyConsulting Services, installed a Danfoss electronic refrigeration control system at Dairyland, USA to more efficiently monitor the temperature as well as the operation of the compressors in the chilled spaces. Energy Consulting Services, Inc. also upgraded lighting systems and implemented a new management strategy for recharging electric fork lift batteries during off peak periods. The system cost of $165,000 was recouped in less than 2 years. Over 10 years, the system will save Dairyland, USA over $1,000,000 while improving grid reliability and reducing emissions from their operations. The system also provides Dairyland, USA management with the ability to monitor and control their refrigeration systems from remote locations and receive a security call if temperatures in the space are outside normal operating ranges. This reduces the likelihood of food spoilage, increasing the value of inventory and improving Dairyland, USA's bottom line.

The electronic monitoring and control system:

1. **Limits the amount of electricity being used in an electrical demand window and controls time of day based consumption.** The Danfoss system instantaneously measures the incoming electrical demand and predicts the electrical demand for that sliding 15 minutes to facilitate a pro-active response to rising electrical demand and usage in real time.
2. **Accurately controls refrigerated space temperature.** The electronic system provides digital temperature control which eliminates overcooling of the space and increases the refrigeration system efficiency. Mechanical refrigeration thermostats typically have a 'turn on/turn off' range of up to six degrees Fahrenheit. This wide spread in temperature causes the existing mechanical space thermostats to be set lower than the Danfoss electronic space temperature controller must be set at. This means that more energy is required to assure the same temperature, due to the fact that that the refrigeration system must operate longer than it needs to with a more precise means of establishing and regulating the required temperature that is provided by the Danfoss system. Furthermore, when the refrigeration system over cools a space, it accelerates the transfer of cool air to the outside spaces through the walls and ceiling. Finally, as the refrigerated space temperature decreases, so does the efficiency of the compressor(s), which cause(s) even greater, wasteful energy use.
3. **Limits the evaporator fan motor run time.** The evaporator fan motors consume large amounts of electricity in two ways. When the fans are operating, the motors use electricity to run. They also produce heat that the refrigeration system must ultimately remove. An electronic 'off delay' allows the Danfoss controller to take advantage of all of the refrigerated air within the evaporator before turning off the evaporator. Another Danfoss control program prevents stratification of the refrigerated box's temperature by monitoring the run time of the evaporators and turning on the fan motors to mix the box air every 30 minutes if the fans did not run in the previous 30 minute time period.
4. **Monitors compressor status.** This allows for the user to see the status of the compressor from at a central location.
5. **Monitors refrigeration compressor head pressure.** Higher than normal compressor head pressure causes the compressor to work harder, causing increased mechanical wear and increased electric energy consumption. The electronic head pressure transducers constantly monitor the refrigeration system. An alarm signal informs of minor refrigeration problems (e.g., condenser fan motor failure, dirty condenser coil) before it causes excessive compressor wear, increased electrical consumption, possible safety limit trips, and/or compressor failure. Any of these events could result in product loss.
6. **Controls HVAC start/stop and electric demand load.** The HVAC system has centralized monitoring and control. This reduces energy usage when the offices are not used and when peak electrical usage periods are detected by the system.
7. **Limits battery charger electrical demand and controls time based use.** This allows the forklift battery chargers to be automatically turned off during peak electrical usage periods when detected by the Danfoss system.
8. **Limits artificial lighting when the Danfoss system detects adequate natural sun light.** We also designed high efficiency lighting solutions for areas troubled by poor lighting design.
9. **Controls refrigeration system ventilation.** We designed and installed exhaust fans and supply air modulating dampers controlled by the Danfoss system that recovers heat for the winter warehouse heating while dumping heat during the summer for a more efficient compressor head pressure operating range.
10. **Controls the emergency generator and transfer switches.** We designed and installed the electrical back up system to automate the start, warm up of the 750Kw generator, transfer of loads to emergency power and cool down to stop and transfer back to normal utility power of building loads. Such a system allows automated participation in demand response programs, next day power purchasing and utility program payments for secure standby capacity.