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AC Drives Cut Hospital Maintenance Costs

Like most providers in today s competitive and challenging health care market, Froedtert Memorial Lutheran Hospital in Milwaukee, WI. constantly strives to maintain low operating costs and improve efficiency throughout the physical plant.

A major teaching affiliate of the Medical College of Wisconsin, Froedtert encompasses nearly 635,000 square feet. With nearly 300 inpatient beds, the hospital admits more than 9,500 patients annually and serves an additional 122,000 outpatients.

Escalating Energy Costs in the years since the hospital s construction in 1978, coupled with extensive maintenance requirements on the original heating, ventilating and air conditioning system, convinced management to undertake a significant HVAC upgrade and retrofit program in 1992.

According to Tom O Connor, Project/Energy Controller in the hospital s Facility Development and Operations Division, Froedtert s goals for the upgrade were to achieve maximum utility cost savings through efficient energy use and to lower operating costs by eliminating high-maintenance components in the existing system.

Froedtert s HVAC system, like many installed in the 1970s and 80s, utilized a constant air volume approach, with pressure regulated by inlet guide vanes which mechanically restricted air flow to various areas of the hospital.

In a constant air volume system, fans and motors are sized to meet maximum load demand. Fan motors run at constant maximum speed while the volume of air is modified by a variety of highly-inefficient mechanical devices, including dampers and vanes.

In a typical building, however, maximum capacity is required only about ten percent of the time. Ninety percent of fan operating time requires only 40 to 70 percent of maximum volume.

At Froedtert, as in most facilities, applying 30 to 60 percent more energy to fan operation than was necessary was producing a significant waste of electricity and inflated utility bills.

Significant Vane and Damper Maintenance was a continuous and expensive operation, according to O Connor. A heavy portion of our maintenance dollar went for preventative maintenance and repair of these devices, as well as for repair of wear and tear to belts, pulleys and other mechanical components caused by hard starts and constant operation at 100 percent of capacity.

Retrofit Adds Variable Frequency Drives. Working with engineers from Yaskawa Electric, New Berlin, Wis., and Johnson Controls, Inc., Milwaukee, O Connor and his staff were able to design and install an energy control system which would provide significant savings in energy and utility costs while virtually eliminating maintenance problems.

The upgrade centered on installation of 34 Yaskawa variable frequency drives to control power to both supply and return air fans on a Johnson Controls Metasys facility management system.

In the final installation, the Metasys system acts as a monitoring, alert and control system, while the adjustable speed drives regulate fan speed and air volume to match flow requirements.

Substantial Energy Savings, Utility Rebates. The variable frequency drive delivers its savings by controlling the motor to drive the fan only fast enough to maintain the desired air volume. Their ability to adjust system air volume by changing fan and motor speed and, therefore, power consumption, produces significant energy savings, typically ranging from 10-75 percent.

According to O Connor, total utility costs have declined substantially since installation of the drives. For 1992 through 1994, utility expenses dropped by a total of $693,000, even though more than 225,000 square feet of ambulatory care space was added late in 1991. Additionally, Froedtert s utility costs remained level for 1994, despite a five percent rate increase in the local utility rate, said O Connor.

The savings are produced as a function of universally-accepted centrifugal fan laws: System volume varies directly with fan speed. System pressure varies with the square of fan speed. Power consumption, however, varies with the cube of fan speed. Therefore, a small reduction in speed produces a significant reduction in power consumption.

In other words, the same system that requires 100 % of full power to produce 100 % of volume needs only 28 % of full power to deliver 60% of volume. Obviously, significant savings are achieved by the drive s ability to reduce fan speed during the 90 % of the day when full system capability is not required.

Drives Integral Part of Upgrade. Installation of the drives as part of our retrofit was a given , according to O Connor. They were planned in from the beginning as an integral part of our system upgrade. The drives were very easy to justify through projected energy savings and short payback cycles alone, but that payback period was shortened even more by a rebate of nearly $100,000 from Wisconsin Electric Power Company s Smart Money program. The utility s Smart Money program is an example of the rebate schedules being offered for installation of energy-saving ac drives. Local rebate amounts vary from $20 to $200 per horsepower.

The drives have provided other advantages, including more accurate temperature control and the ability to easily reduce peak demand and usage charges, O Connor said. They have also helped us cut deeply into our maintenance costs because of their ability to deliver a soft start . Accelerating or decelerating the motors and mechanical equipment smoothly, cuts down on mechanical stress and wear and tear that normally occurs when you have to simply apply line power.

Along with their energy savings, the drives have contributed to increased motor life, reduced noise and maintenance savings in general. The drives themselves have proven to be virtually trouble-free, O Connor said. Their dependability, coupled with the elimination of vanes and dampers, has produced really meaningful savings on maintenance, both in terms of dollars and man-hours expended.