Application Notes for Energy Saving
High Efficiency Motors

These application notes are for general guidance and information only. Users will need to undertake independent analysis for specific sites if any of these measures are to be implemented. Consideration should be given to engaging the services of a suitable consultant to assist with this task.

Summary

Within the hospital environment, there are a wide range of electric motors associated with plant and equipment. The majority of the larger motors tend to be associated with the fans and pumps within the heating, ventilation and air conditioning (HVAC) systems. Where fitted, lifts and escalators also have substantial motors which all operate for extended periods during the day.

Improvements in design and manufacture of motors have allowed for the development of "high efficiency" motors. Government regulation (MEPS Scheme) now requires the use of high efficiency motors. Although these motors attract a small price premium over conventional motors, this may be rapidly offset against the energy savings, particularly when the systems operate for many hours a day.

It is expected that upgrading to high efficiency motors is suitable for new equipment or replacement of failed motors.

Background

Motors used in HVAC systems generally range from under a kilowatt up to around 50 kW. Within HVAC systems, there tends to be many smaller motors, with fewer large motors associated with the central plant pumps and chillers or large fans.

Improvements in the design, materials and manufacture of motor components have enabled the development of higher efficiency motors (HEM). The improvements have reduced the losses in the magnetic fields, resistance through the windings and aerodynamic losses.

Opportunities and Constraints

Replacing existing motors may provide a suitable investment returns. However, where existing motors need to be rebuilt or replaced, installation of high efficiency motors would provide a sound investment returns.

High efficiency motors are suitable for: -

- New equipment
- Replacing existing motors which have failed
- Standard motors that require a major overhaul, rewinding and the like

Impact of Implementation

Except for reducing energy consumption, high efficiency motor would not be expected to impact system operations.

There is a cost premium of around 25-30% for high efficiency motors above standard motors. This is offset by reductions in operating costs due to improvements in motor efficiencies. This leads to around 3% reduction in energy use.

General maintenance would be effectively the same as those for a standard motor, although manufacturers claim that there is a reduced frequency of breakdowns with high efficiency motors due to improved design and construction.

Analysis

Within the hospital environment, the majority of fan motors fall in the 0.75 kW to 11 kW size range. Pumps associated with central plant are typically in the range of 15 kW to 45kW while chiller motors may be 50kW or greater.

Within the expected fan and pump motor sizes, it is expected that a 2% improvement in motor efficiency is achievable, depending on the initial motor selection, a greater improvement could be expected.

Taking a 5.5 kW motor operating at 75% full load, with the following characteristics, as a basis of the following analysis: -

Motor	Motor Cost	75% load efficiency
Standard efficiency	$ 470	88.1%
High efficiency	$ 520	90.0%
Rewind existing motor	$ 400	87.0%

	Simple Payback operating 12 hr/day	Simple Payback operating 24 hr/day
Replace operating motor with high efficiency motor	14*	7*
Replace failed motor with high efficiency motor in lieu of standard efficiency motor	2	1
Replace failed motor high efficiency motor in lieu of rewinding existing motor	3	2

* This has been based on motor cost alone without a labor component. Other comparisons have been made on the difference in costs for replacing an existing motor.

Air conditioning electrical energy use is substantially due to electric motors.

Conclusions

The use of high efficiency motors is an effective energy saving measure particularly where associated plant is required to operate for extended periods. The cost premium is low when compared with overall system costs and their use should be considered on the basis of good practice irrespective detailed analysis. Replacement of existing motors which are currently operational are not expected to provide a suitable economic return.

References and Sources for Further Information

- The Sustainable Energy Authority Victoria have published energy and green house management toolkit, HEM's are discussed under Module 5: Best practice design, technology and management. This toolkit is available through the SEAV website www.seav.vic.gov.au/advice/business/EGMToolkit.html
- SEAV "Model Technical Specification"
- The Department of Industry, Tourism & Resources have published motor selection information sheets on their website www.isr.gov.au/motors.