Application Notes for Energy Saving Lighting Efficiency

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

Lighting uses a high portion of electricity in hospitals (approximately 30%), and by their nature many light sources are inefficient. This makes improving lighting efficiency an attractive energy saving measure, as good returns on investment can be made.

Hospitals can reduce electricity bills by making their lighting system more efficient, in the following ways:

- Selection of efficient light sources (using fluorescent light fittings where possible).
- Appropriate lighting levels (for example not overlighting in non-critical areas).
- Use of daylight

Background

Hospitals have particular lighting requirements to suit the nature of tasks being performed including a need to determine the condition of a patient by 'clinical observation'. Some hospitals are reluctant to alter lighting levels in any area because of this issue.

Rather than lighting the entire hospital to meet the most stringent requirements, it would be more efficient (and beneficial) to reconsider the actual lighting requirements of individual areas. The following, in accordance with Australian Standards for lighting; including AS1680.2.5 'Hospital and medical tasks' are the most important features of the lighting in different areas of the hospital:

- In areas where procedures and examinations are performed, lighting levels need to be higher.
- In areas where hospital staff need to perform 'clinical observation', good colour rendering is required such that the light source does not skew the appearance of a patient's skin.
- In areas of rest and waiting rooms, an atmosphere of well being and comfort should be created, which is often achieved with lower artificial lighting levels, or natural daylight.
- In areas such as storerooms and circulation spaces, adequate lighting levels to allow safe movement.

By understanding, which of the above criteria is the most appropriate for each type of lighting system, and auditing their existing installation, most hospitals will find that they may be 'overlit' in many areas. Not only does this waste energy, but also can create a 'sterile' environment that would be less comfortable for patients and their visitors. Due to the age of the building, older hospitals may find that a lot of their light sources are inefficient (for example incandescent lighting), which could be costing the hospital a significant amount in electricity costs each year.

Opportunities and Constraints

A lighting audit is the first step in reviewing lighting system in an existing hospital, and may need to be staged to ensure minimum disruption to patients and staff. However, it is more cost effective to ensure that the lighting system is efficient when building a new facility.

The following are some general guides for selecting efficient light sources:

- Fluorescent light fittings should use electronic ballasts and tri-phosphor lamps.
- High pressure sodium or metal halide lighting should be used where possible for exterior/carpark lighting.
- Daylight should be used where possible.

When reviewing light sources in hospitals its important to ensure that the colour rendering characteristics are adequate. This even applies to daylight entering a room. It is important that the transmission characteristics of window and skylight glazing do not skew the colour of the light entering the space, if 'clinical observation' of patients is to be performed in the area.

If it is determined that some areas are overlit, this can be addressed by the following methods:

- De-lamping (for example removing the middle lamp from a 3 lamp fitting)
- Voltage reduction at the switchboard (that is by reducing the voltage at the switchboard the lights run at a lower level, energy is saved and the life of the lamp is extended).

All hospitals can improve the efficiency of their lighting system by ensuring that the fittings are clean and that any worn out reflectors or diffusers are replaced.

It may be appropriate to consider implementing lighting control energy saving measurers (refer Lighting Control Application Note) at the same time as a lighting efficiency audit.

Impact of Implementation

Once lighting changes are implemented, staff may notice a decrease in lighting levels. It is important that staff are made aware of the changes, so they are assured that there are no OH&S or operational implications. This could be achieved using a trial area of lighting changes, before proceeding with an entire facility change.

It is likely that patients and their visitors will have an increased feeling of well being with reduced lighting levels, as it generally gives a less 'sterile' atmosphere.

The costs of implementing a more efficient lighting system are much less for a new building. In existing hospitals the costs consist of the following:

- Lighting audit
- Cost of changing light fittings/lamps
- Cost of installing voltage reduction equipment at the switchboard.

Analysis

The following example illustrates possible savings to be made by upgrading from standard to tri-phosphor lamps (which increases lighting levels by 15%) in ward areas, and using voltage regulators to reduce the lighting level (by 15%) back to original values. Actual savings due to lighting upgrades will depend on the hospital's particular circumstances.

Assume a hospital has an annual electricity bill of $365 000, 30% of which is due to lighting. If the wards in this hospital had floor areas of 4500m^2 (30% of total) and one 2 x 36W lighting fitting per 6m^2, the following are costs and savings that might be expected:

- Cost approx. $15 000 (ie. approx. $9000 for voltage regulating equipment and $6000 for lamp upgrades to tri-phosphor).
- Savings $4 927 per annum (based on 15% reduction in lighting levels result in 30% energy savings)

Hence, the payback period in this case would be little over 3 years.

Conclusions

Clearly, it is important to define the different functional areas of a hospital, and to determine their different lighting requirements. In new buildings it is most cost effective to implement an efficient lighting system from the beginning. However it is still cost effective to retrofit in existing hospitals. The following are the main items for consideration when reviewing the efficiency of the lighting system:

- A lighting audit should be conducted. Are any areas overlit? What light sources are used?
- Are fluorescent light fittings used where possible? Do they have electronic low loss ballasts? Are the lamps tri-phosphor?
- Is exterior lighting high pressure sodium or metal halide?
- In areas that are overlit, can fittings be de-lamped without disturbing the lighting uniformity? Is the switchboard capable of housing voltage reduction equipment to reduce lighting levels?

References and Sources for Further Information

- The SEAV have published information sheets on their website www.seav.vic.gov.au
- SEAV 'Model Technical specifications.
- Australian Standards AS1680 series on interior lighting including 1680.2.5 'Hospital and medical tasks', which provides assistance in classifying lighting requirements for different areas in the hospital