Application Notes for Energy Saving Control System / Maintenance

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

The control system is the 'driver' of the equipment in the hospital facility such as heating, cooling and ventilation plant. "Poor driving" and lack of maintenance can lead to substantial energy waste.

Background

Control systems, like all building services components also require maintenance. Over time the calibration of sensors within the control system suffer from "drift", where the sensor is either reading above or below the actual condition. This drift in the sensor calibration may not adversely affect the operation of the system, however it often may lead to increased energy usage. The cost of calibration of control system components is often well below that arising from the significant additional energy usage.

Whilst the air conditioning systems remain functional, and maintain space conditions within limits accepted by the occupants, the control system may be rarely reviewed. There are also instances where the commissioning of plant and controls has not been completed. Hence systems are not operating as intended from the moment of installation. Systems that operate satisfactorily in controlling the space conditions are rarely optimised. Significant energy savings may be achievable by ensuring that the controls are operating equipment in an optimal manner.

Short term "quick fixes" need to be removed from the control system. An example could be changing the temperature set point in an area due to occupant complaints, where the real problem was the installation of new equipment near to the sensor creating a false reading. Hence the sensor failed to accurately represent the room conditions.

Opportunities and Constraints

Opportunities generally exist in all mechanical services control systems for improvements in plant operation and optimal setup. The majority of the gains can initially be obtained by bringing operation of the control system back in line with the initial design intent including the balancing of air and water flows.

The maintenance of control components such as valves and dampers should also be addressed. Valves that do not provide tight shut-off allow fluid bypass through them, causes energy wastage. Additional energy is also required to correct the resultant temperature variation in the air stream.

Leaking dampers can also have a significant effect on the energy usage of air conditioning systems. Worn linkages and actuators prevent the dampers from closing fully. This situation can introduce excess volumes of outside air increasing the associated heating and cooling loads.

Other energy saving measures include:-

- increasing the control range (wider room temperature band)
- ensuring the sensor locations represent the space conditions. For example, ensure a temperature sensor is not affected by office equipment and is not located behind furniture or in drafts or sunlight.
- calibration of sensors (accuracy of the reading)
- identification of critical sensors, which have a major influence on the systems performance and ensure that these are regularly maintained
- supply air temperature reset strategies
- chilled water, heating hot water and condenser water temperature reset strategies
- optimized start routines

Impact of Implementation

Increasing the maintenance on control system components may have a positive impact on the staff and patients through improved performance outcomes. Like all maintenance activities, some equipment may need to be taken out of service for short periods of time to allow access. Works associated with the installation of new sensors, or relocating poorly positioned sensors may temporarily disrupt the activities local to the works (although no more than existing routine maintenance tasks in the occupied areas).

Analysis

The benefits and associated costs of properly setting up and maintaining a control system and its associated components can be very significant. For a hospital where the yearly energy cost for mechanical plant is $400,000, an annual saving of say 5% (conservative benefit) means that $100,000 spent in upgrade and "catch up" maintenance has a simple payback of 5 years.

Generally a sensor out of calibration by 1^{o}C is considered to equate to 5% increase in energy use.

Conclusions

Improvements in the operation of hospital building control systems can be one of the more substantial energy conservation opportunities and is often as simple as recalibrating existing sensors and actuators, maintaining dampers and valves and checking the set points and control strategies. Setting the system to operate as initially intended can improve plant efficiencies.

Strategies programmed into the system and refinement may see further benefit in service delivery and energy use.

References and Sources for Further Information

- www.seav.vic.gov.au
- www.greenhouse.gov.au
- SEAV "Model Technical Specification"