

These application notes are for general guidance and information only. Users will need to undertake independent analysis for specific sites.

Summary

Air conditioning systems in buildings use considerable energy and may provide excellent potential for energy savings. In most cases, air conditioning systems were designed with only initial cost in mind. As a result, energy efficiency was seldom a design criterion. Moreover, some systems were designed with excessive capacity and with poor efficiency at part load. As extreme conditions seldom occur, these systems operate poorly most of the time.

Modifications to Operating Practice

- Turn off air conditioning systems in unoccupied areas such as meeting rooms, banquet rooms, auditoriums, halls, store rooms. Central air handling systems may need to be modified to achieve this by installing zone dampers. The air handling system should still perform satisfactorily. However, the air handling and the cooling systems may have to be modified to save energy by installing additional zone controls.
- Recommission controls, water flows and air quantities to the original specifications on a regular basis to ensure the original design intent is being met.
- Air conditioning plant that is not required continuously.

Heating Season - start pre-heating so that the building is at 18°C when occupants arrive, and complete the warm-up during the first hour of occupancy. Lighting, people, and use of equipment, will aid in warm-up. If the building takes more than an hour to achieve the set temperature, check the shortcomings of the system such as inadequate air circulation, too much outside air, inadequate equipment, capacity of faulty equipment. Where warm up is very slow and the system cannot be improved, consider programmable time switches which can be set earlier for Monday or can be reset by building space temperature.

Cooling Season - as there are very few, if any, parts of Victoria where the overnight temperature is above 27°C, the cooling can start after people arrive. In the few cases where very warm nights might occur, steps can be taken to start the cooling cycle earlier. In buildings where fan operating costs are not too high and the cooling system is inefficient, consideration can be given to flushing out the building with cool outside air at night or early morning as appropriate. This is often uneconomical and should be thoroughly investigated before adoption.

- In buildings that do not require continuous air conditioning, consideration should be given to using an outside air thermostat to adjust plant starting time according to ambient temperature. Turn off the heating and/or cooling system of the air conditioning plant before end of working hours, to make use of the thermal inertia or heat-storage effect of the building structure and envelope. Turn off the air handling at the end of working hours.
- Consideration should be given to widening the control band of thermostats in corridors, hallways, lobbies and other public spaces. Ensure thermostats are located at the correct height of approximately 1500 mm and away from draughts and heat sources.

- In Victoria, humidity will usually be maintained without humidity control (30 - 60% RH). Relative humidity, wet bulb and dew point controllers are all subject to malfunction which wastes energy and should be avoided. When humidity must be controlled, special care is needed to ensure that the equipment is installed correctly and well maintained. It is not uncommon for a control system to be calling for dehumidifying and humidifying at the same time. This can be overcome by installing high/low humidity lockouts.
- The installation of an economy cycle in the air conditioning system will make the most of cool outside air. In some systems, cooling energy is saved at the expense of more heating energy. Air-conditioning systems provide for continuous introduction of outside air into the building. Most of these systems have the capability of increasing the amount of outside air entering when the outside temperature is below the indoor temperature. Where such cycles exist, check that the dampers open and close properly and the controls are set up and working correctly.
- Reduce outside air to the minimum required (Australian Standard 1668.2) and balance the exhaust requirements to maintain a slight positive pressure where possible, to retard infiltration. (Note that minimum rates of fresh air are to be in accordance with relevant codes or guidelines).
- It is important that the correct zoning and zone control be achieved. Consider the addition of extra, or removal of unnecessary, zone controls. Installation of dampers, valves and thermostats for further zone control can prevent large sections of the building from being cooled, and/or heated, unnecessarily. Too many zone controls can be unworkable due to their unreliability.
- Where multiple installations exist, operate only sufficient compressors, chillers, condenser pumps, chilled and hot water pumps, to meet the load. Many systems require alteration to achieve this. The aim should be to run one chiller or boiler fully loaded in preference to two partly loaded. The control systems of these systems should be linked to allow efficient use of plant.
- Lower condensing water temperature control settings to the optimum practical limit, in order to reduce compressor power.
- Raise chilled or lower heating water temperatures to match anticipated demand. Most existing installations are usually set to meet the maximum cooling or heating requirements
- Install variable speed drives (VSD) on pumps and fans where practical. For example a VSD will enable turn down on AHU's supplying critical areas such as surgical suites requiring pressurisation to maintain sepsis control.

References

IHEA/VHA. Energy conservation guidelines. Vol 1. Design and management checklist for existing buildings. 1984.

Sustainable Energy Authority Victoria. Building energy brief for commercial and public buildings. 2003