AUSTRALIAN HOTELS ASSOCIATION

HEATING, VENTILATION & AIR CONDITIONING

Australian Government
Department of Industry

This Activity received funding from the Department of Industry as part of the Energy Efficiency Information Grants Program

HEATING, VENTILATION & AIR CONDITIONING ENERGY EFFICIENCY GUIDE

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Heating and cooling can account for approximately 23 % of energy use in pubs and hotels[1].

Reducing heating and cooling costs can be as simple as maintaining appropriate temperatures and ensuring that heating, ventilation and air conditioning (HVAC) equipment and controls are operated and managed correctly. This fact sheet explores the opportunities to significantly reduce your HVAC energy cost.

WHAT IS A HVAC SYSTEM?

A heating, ventilation and air conditioning (HVAC) system controls the temperature, humidity and quality of the air in a building.

Roof mounted HVAC system

The three main categories of building HVAC systems are as follows:

1. Centralised ducted air systems that include constant or variable air volume systems.
2. Centralised piped fluid systems that include fan-coil systems, hydronic systems and variable flow systems.
3. Decentralised systems that include heat pumps and evaporative coolers.

An example of a centralised piped fluid system is shown in Figure 1. The system consists of the following equipment: boiler, chiller, heat and cooling coils, pumps, fans and control systems. In some climates a system may also include humidifiers or dehumidifiers.

Heating

There are three approaches to providing heating:

- Heating coils that heat the air, which is then distributed via the heating system air ducts.
- A boiler or hot water heater that creates hot water that is pumped to radiators that heat the air – as shown in Figure 1.
- Heat pumps that heat the air directly using electricity as the main source of energy.

Cooling

There are three approaches to providing cooling:

- Chillers that chill water pumped to cooling coils drawing the heat out of the air as it is blown over them in the air ducts – as shown in Figure 1. A separate condenser or cooling tower removes the accumulated heat from the water as part of the refrigeration cycle in the chiller.
- Air-conditioners that cool refrigerant running through evaporator coils drawing heat out of the air as it is blown over the coils. A separate condenser releases the heat that builds up in the refrigerant. A compressor pumps the heat between the evaporator and the condenser. There may be one larger system or there may be several smaller, independent systems operating throughout the building. Air or water from cooling towers can also be used to draw the heat out of the refrigerant more effectively.
- Evaporative coolers that cool external air through evaporation. An additional system may also be required to manage the humidity of incoming air.

Pumps and fans

Pumps circulate hot and chilled water around the building HVAC system.

Fans expel stale air from the building and bring external air into the building.

Control systems

Controls switch the HVAC equipment on and off, and adjust the air and water flow rates, temperatures and pressures. The controllers will use temperature sensors through out the building to determine what pieces of the HVAC equipment to activate.

The key to an effective control system is the cooperative operation of each system, rather than having them fight against each other to balance the overall building environment.

[1] Energy Wise Hotels Toolkit (p9), City of Melbourne, December 2007

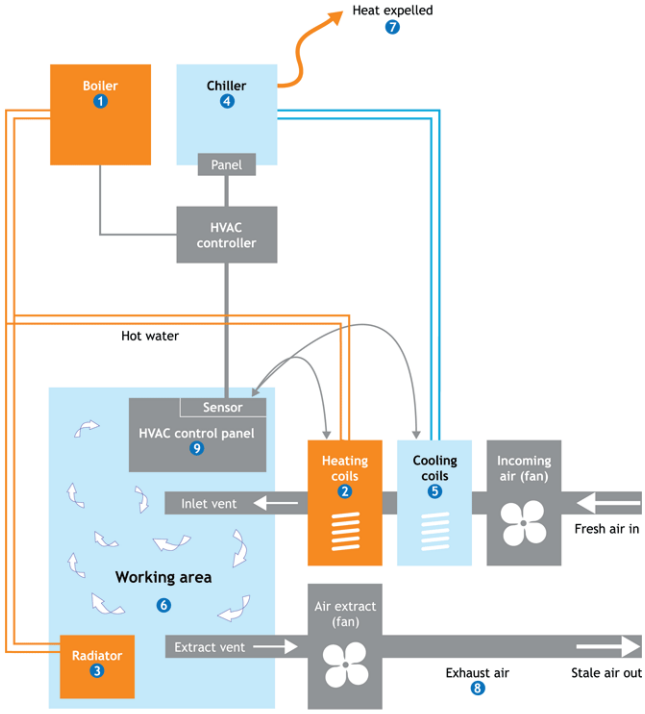


Figure 1: A centralised piped fluid HVAC system.
www.eex.gov.au, Australian Government, April 2013

WHAT AFFECTS HVAC RUNNING COSTS?

There are five factors that determine the energy consumption of an HVAC system:

1. External impacts
2. Indoor environmental requirements
3. Internal sources
4. System efficiency and effectiveness
5. Operational control

Reducing the impact of these factors will reduce the energy use of your HVAC system and save you money.

It is possible to save up to 20% on heating costs through the implementation of some simple energy saving measures.

Carbon Trust

INEFFICIENCIES COSTING YOU MONEY

Some common examples of heating and cooling inefficiencies include:

- Independent heating and cooling systems that are both operating at the same time because, for example, the heating set-point is set to 21°C and the cooling set-point is set to 20°C – the two systems are always operating as they fight each other to reach their set-point.

- It's been a while since the HVAC system maintenance has been undertaken and filters, evaporator and condenser coils/fins, and ventilation ducts are dirty. The ventilation ducts are leaking air and the refrigeration system coolant is not at full pressure. A poorly maintained system is an inefficient system that costs more to run and has a shorter service life.
- Your building doesn't have shading or energy efficient glass and is exposed to the north and west heats up in the afternoon resulting in a high load on your air conditioning system. Conversely, the south and east rooms get too cold and occupants use room heating to compensate.

SAVE MONEY NOW: SMARTER OPERATION AND MAINTENANCE

You can reduce the cost of operating your HVAC system and improve its performance by undertaking actions in the following areas:

Internal Temperatures – Assess the internal temperature needs of your premises rather than just operating at the highest possible setting, as this is often the most energy intensive

- It is recommended in customer areas to set heating temperatures to 18 oc and air-conditioning temperatures to 24 oc when occupied.[1]

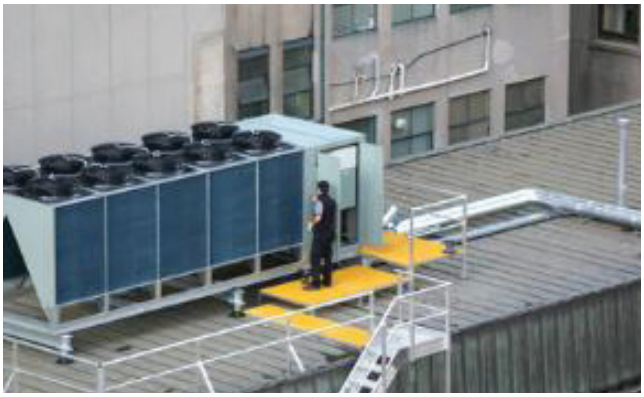
Increasing room temperatures when cooling or reducing temperature while heating can save around 5 to 10% of energy use.

Control Systems – Ensure your HVAC system is being controlled to operate as efficiently as possible.
Ensure:

- The system is only operating when customers and staff need it. Use programmable timer switches to switch off the system when areas are unoccupied.
- Thermostats are operating correctly as they can be affected by draughts, sunlight or heat sources (e.g. fireplace). *The location of thermostats can have a significant impact on the efficiency of an HVAC system.*

Control settings are a major contributor to HVAC system efficiency. Many systems operate inefficiently because someone has made a short-term adjustment and then forgotten about it.

- **Equipment Maintenance** – The present trend in many industries is to cut down maintenance costs allowing just enough to keep everything running smoothly. However, extending the maintenance from preventative or breakdown maintenance to energy efficient maintenance proves to be cheaper in the long-term. Ensure your HVAC equipment is operating as designed. Implement a preventative maintenance program to ensure it is operating efficiently.



Roof-mounted HVAC system showing ease of access for maintenance

Maintenance activities to ensure optimum energy efficiency include:

- Service boilers or hot water heaters
- Check for hot water pipe leaks
- Inspect ducting and hot/chilled water pipe insulation
- Clean air filters (monthly)
- Check for air ventilation duct leaks
- Check cooling tower performance
- Check that thermostats are working correctly

GREATER LONG TERM SAVINGS: IMPROVED CONTROL AND MORE EFFICIENT EQUIPMENT

There are a number of smart business investments that can be made to improve the performance and reduce the cost of your HVAC system:

- **Control Systems Upgrades** – It can be quite cost effective to upgrade a control system from old, inefficient timer-based controls to a new systems that compensates for changeable outside weather conditions, responds quickly to variations in temperature and is capable of managing elaborate zoning. These types of control systems can pay themselves back in just a couple of years[2].

- **Building Management Systems (BMS)** – A BMS is a networked control system that offers greater control of a variety of services in a building including HVAC. It is a real-time control system that has been shown to reduce total energy cost by 10% or more[3]. BMS are well worth considering in larger or more complex building applications.

- **Zoning** – Zoning enables different areas of a building to be set at different temperatures and switched at different times. Zoning typically provides for increased customer comfort, great efficiency and lower running costs. Zoning for hotels means unoccupied floors, restaurants or pool areas can be controlled separately. Zoning for pubs means unoccupied function rooms can be switched off.
- **Natural Ventilation** – Consider the use of ventilation as a more efficient method of cooling than air-conditioning. It may be possible to use mechanically controlled ventilation in parts of the building or at some times during the day. An example is 'night cooling' where the cool night air is used to flush the warm air built up over the day out of the building.

- **Reduce Heat Loads** – Reduce the impact of internal and external heat sources to reduce the load on the HVAC system. Opportunities to reduce heat loads include:
  - Installing more efficient lighting that doesn't produce excessive amounts of waste heat that must be balanced by the cooling system.
  - Reduced the heat gain through windows by installing external shading, tinting existing glazing (especially beneficial for north or west facing glass) or replacing existing glazing with double glazing or other energy efficient glass. Double-glazing also has the added benefit of reducing noise penetration.

- **Efficient Equipment** – When it comes time to upgrade equipment it is worthwhile comparing the cost effectiveness of energy efficient alternatives. Often any increased cost is offset quickly by the reduction in operating costs. HVAC equipment that is worth considering an upgrade on the basis of energy efficiency improvement include:
  - Economisers fitted to boilers to recover heat.
  - Chiller upgrades like variable speed drives (VSDs) on pumps and fans, and electronic expansion valves.
  - New chillers, e.g. with water cooled turbo compressors with VSD, can be up to 400% more efficient than old systems[4].
  - Installation of VSDs on ventilation system fans.
  - High efficiency motors on pumps and fans.

[2]Hospitality: Saving energy without compromising service (p9); Carbon Trust 2012.
[3]Hospitality: Saving energy without compromising service (p14); Carbon Trust 2012.
[4]Energy Wise Hotels Toolkit (p22); City of Melbourne 2007

- **Combined Heat and Power (CHP)** – A CHP plant produces heat and electricity from a machine driven by gas. Sites with high and constant heat demands throughout the year (e.g. hotels with swimming pools) may find it beneficial to operate a CHP plant although the economics of a CHP in Australia are generally not favourable.

CASE STUDY – Crowne Plaza, Alice Springs

The Crowne Plaza conducted a specialised HVAC energy audit that identified a number of energy efficiency projects including:

- Installation of variable speed drives saving $20,000 per year.
- Optimisation of HVAC controls to reduce unnecessary runtimes, utilise variable speed control and ensuring HVAC equipment is working together effectively.

To find out more about the changes to their HVAC system and other energy efficiency measures check out:

www.alicesolarcity.com.au/sites/default/files/CaseStudy-CrownePlaza-Nov2010-web.pdf

EVERYONE HAS A ROLE TO PLAY

Everyone in the building influences energy consumption and everyone can play a part in reducing energy use without it impacting customer service.

Management

Management should ensure that operational procedures are up-to-date and are followed, preventative maintenance programs are developed and implemented, that equipment upgrade pathways are researched and the return on investment is determined.

Staff

Staff should ensure that all operational procedures are followed and any issues or faults are identified and resolved. It is also critical that staff considers energy efficiency proactively and make suggestions to management as to how the systems can operate more efficiently.

Patrons & Guests

Patrons and guests should be encouraged to report any areas that are too hot, cold or draughty. Investigating problem areas can help to identify maintenance issues. If these issues are promptly resolved, people are less likely to waste energy by opening windows when heating or cooling is on or request portable electric heaters or fans or to make the space more comfortable. This improves the customer experience whilst saving energy and money.

Contractors

Contractors have an important role to play in identifying any areas where operational or maintenance procedures may be leading to energy inefficiency. They are also valuable sources of information when it comes to identifying areas where efficiency may be improved. It can be useful to ensure that Contractors understand the energy efficiency objectives of your business so that they can assist where relevant. Providing the relevant Contractors with a copy of these guides may be a useful first action.

MORE INFORMATION

1. Hospitality: Saving energy without compromising service; Carbon Trust 2012. http://www.carbontrust.com/media/39220/ctv013_hospitality.pdf
2. Energy Wise Hotels Toolkit; City of Melbourne 2007. http://www.melbourne.vic.gov.au/enterprisemelbourne/environment/Documents/EnergyWiseHotels.pdf
3. Heating Ventilation and Air-conditioning, EEX website, Australian Government 2013. http://eex.gov.au/technologies/heating-ventilation-and-air-conditioning

ABOUT THE PROGRAM

In response to rising energy costs the AHA has developed a range of targeted resources to assist small and medium businesses to improve energy efficiency and reduce energy costs.

These resources were developed with support in the form of an Energy Efficiency Information Grant from the Australian Government.

This program has been designed to assist small to medium businesses to understand where and how energy is used, carbon emissions that result from the use of energy, and to understand and communicate the opportunities for reduction and resource efficiencies.

The resources, tools and information available under the program identify energy efficiency improvements that can be incorporated into day-to-day operations and factored into future capital expenditure budget.

For more information please visit www.aha.org.au/energy