Cool Water Smart Water

Water efficiency for evaporative air coolers

This brochure provides information on how consumers can improve the water efficiency of their evaporative air cooling systems. It provides recommendations for purchasing new systems, improving existing systems, and ongoing system maintenance and management. These recommendations are intended for residential and light commercial applications. Information about larger scale commercial, industrial, and agricultural applications is available in a separate guide.

How evaporative air coolers work

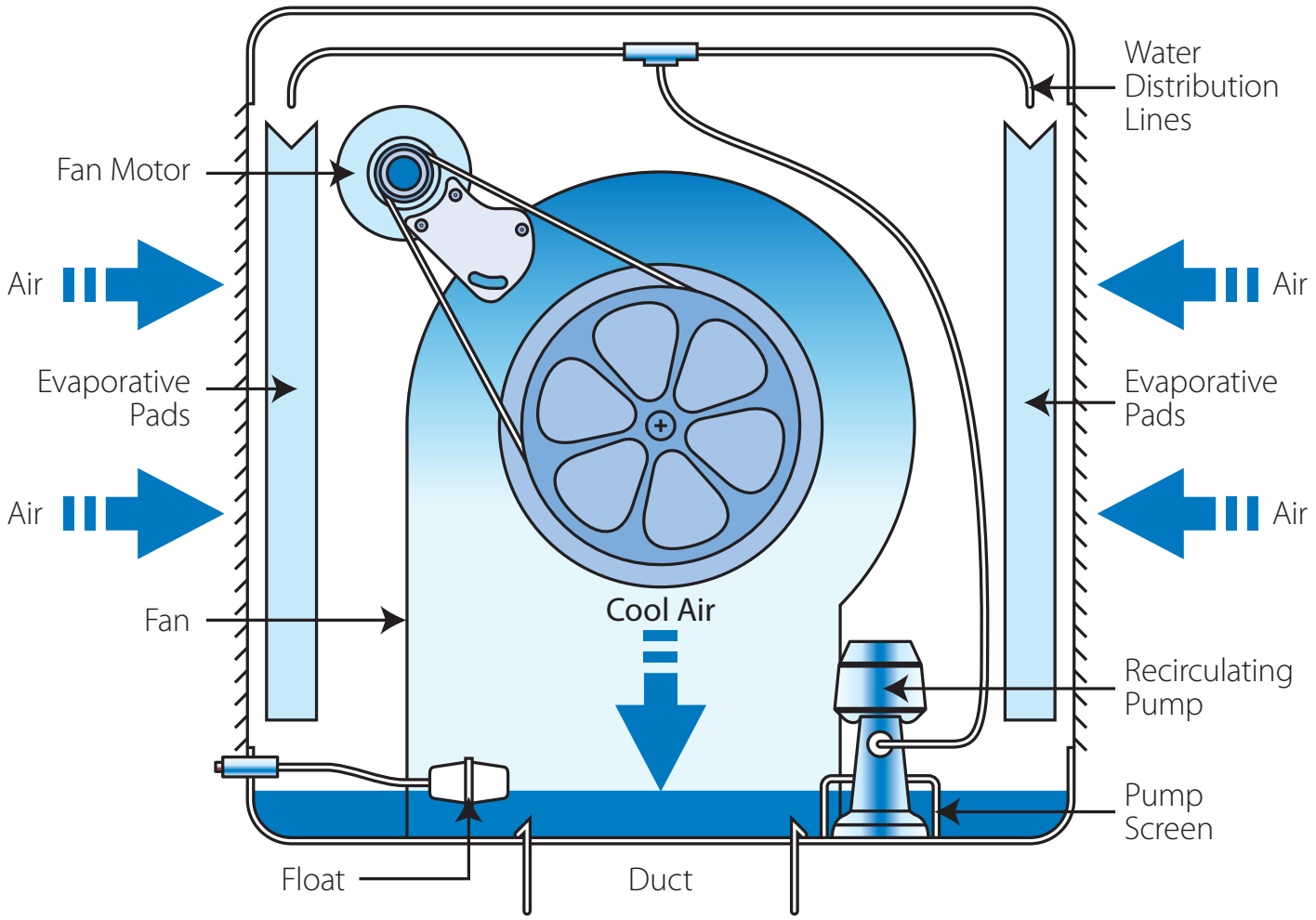
Evaporative air cooling systems draw air over wet pads and surfaces. This results in the evaporation of water into the air which reduces the air temperature and increases its moisture content. The cooled humidified air cools the inside area before exiting via the open windows, doors or mechanical ventilation openings. Cool air can only get into the home if the hot internal air has a way to get out. Airflow rates are generally high and these systems are most effective in hot, dry, low humidity climates and where increased indoor humidity levels do not adversely affect comfort.

Evaporative air coolers use electricity to generate and distribute the cooled air via their fans and pumps. Water is consumed by evaporation to produce the cooling effect and by the unit water quality management system, which is designed to minimise salt build-up within the water reservoir.

The potential to waste water

Studies have shown that many evaporative air coolers have been installed with the default factory settings unchanged. In many systems this involves the unit "dumping" or "bleeding" significant quantities of water to the drain for the full length of time that the system is turned on. This water consumption is often either excessive or not necessary and represents a significant waste of water and an increase in operating costs.

Typical direct evaporative air cooler components.



The results of a study initiated by the Department of Sustainability and Environment, and managed by AIRAH, indicated that potentially up to 2.5GL/year of water could be saved in Victoria by optimising the water consumption of evaporative air coolers in the residential sector. Some ways to make your evaporative air cooling system more water and energy efficient are listed in this guide.

Purchasing a new system

There are some key things to consider when purchasing a new evaporative air cooler or system:

Choosing the right system – For optimum performance and reduced water and energy consumption, systems should be sized and designed in accordance with the AIRAH DA29 application manual (in conjunction with the manufacturer's sizing guide and recommendations) and installed by a reputable contractor. Always use licensed practitioners and obtain compliance certificates to ensure a high standard of work.

Water management system – Different units manage their water quality differently. Automatic systems that use conductivity sensors to control bleed or dump volumes are recommended as they provide the best water efficiency. Systems with continuous bleed or frequent (timed) dumping have been shown to waste large amounts of water if not set up or commissioned correctly.

Automatic controls – Coolers should not run if cooling is not needed. Automatic controls provide the most reliable method of ensuring that the system meets the cooling load most effectively. Coolers should ideally include a programmable time control, an automatic indoor temperature or comfort control, and a manual override or on/off switch.

Ventilation only modes – Some operating modes allow the unit to ventilate the home without evaporating water (i.e. air on/water off). This mode is particularly useful when outside air temperatures are not too hot (e.g. at night time) and during periods of high outdoor humidity when evaporative cooling is less effective. Using the system to only ventilate can sometimes provide better comfort than evaporative cooling during periods of extreme outdoor humidity.

Fan speed – Some units use variable speed motors to control the amount of cooling provided. Air coolers with variable speed fans tend to be more energy and water efficient.

Evaporation efficiency – Evaporative air coolers are often tested and rated for how well they can evaporate water and cool the air, using Australian standard AS 2913. Units with higher evaporation efficiency generally require less power and water to provide an equivalent amount of cooling.

Understanding the system

An important aspect that is often overlooked by home owners is the need to understand how the system works – not only how to use the controls provided, but also how best to use the system under various circumstances. For example, when outdoor temperatures are low but cooling is still required, systems can be operated in ventilation only mode (water off/air on). When outdoor humidity levels are high the system should also operate in ventilation only mode as the cooling ability of the system diminishes with rising outdoor humidity. And remember to leave the doors and windows of the areas to be cooled open; the hot air needs to get out to allow the cooled air to get in.

Installers and manufacturers produce operating information specific for their systems and home owners should ensure that they are aware of and apply these recommendations to get the most out of their cooling system.

Maintenance

It is best to carry out maintenance of an evaporative air cooler at the beginning and end of the cooling season. Manufacturers specify the maintenance requirements for their equipment. Maintenance should be carried out by reputable maintenance service providers. Maintenance tasks should be detailed in the operating and maintenance manual supplied with the system.

It is important to consider the safety of personnel carrying out maintenance on evaporative air coolers as they are often mounted high on a building and have live electrical connections.

Improving an existing system

You can improve an existing evaporative air cooling system to increase its water and energy efficiency (see retrocommissioning for more information).

Water management system – Systems can be recommissioned (set to the correct levels) or be upgraded to an automatic system (using conductivity sensors). Conductivity sensors are used to monitor the water quality within the unit and automatically control the amount of water that needs to be sent to drain.

Automatic controls – Controls can be upgraded by replacing simple on/off controls with thermostatic and programmable controls.

Reducing the cooling load – Adding internal and external shades and wall or ceiling insulation to the area being cooled will reduce the amount of time that the air cooler needs to operate, to achieve the desired temperature, saving both energy and water.

Ductwork – Ducts can be sealed to prevent leakage, their insulation level can be increased, and shut-off dampers can be installed to seal the system when it is not in use.

Ember protection screens – In locations that may be subject to a potential bush fire hazard it is recommended that ember protection screens are installed on the unit, to protect from burning embers entering the cooler, and possibly causing a fire.

Maintenance – As with any mechanical device, periodic maintenance is required to guarantee good performance.

Retrocommissioning

Retrocommissioning is a term used to describe the commissioning of an existing system that has never been commissioned correctly. AIRAH DA29 outlines a standardised process for retrocommissioning evaporative air cooling systems. The process involves surveying and evaluating the system, identifying, evaluating and selecting potential improvements, modifying the system with agreed upgrades, commissioning the upgraded system and reviewing the system, typically after six months operation, to ensure all is well. Retrocommissioning can be carried out by licensed plumbers, maintenance service providers or water treatment service providers. Any Plumbing or electrical work must be carried out by appropriately qualified practitioners.

Energy efficiency and water efficiency

In many cases energy and water consumption are interlinked. Strategies used to improve the water efficiency of evaporative air cooling systems, including control, operation and maintenance strategies can also act to improve their energy efficiency. This can further reduce the already low costs associated with the operation of evaporative air cooling systems.

Frequently asked questions

Can I use rainwater in my evaporative air cooler?

Rainwater can be used to substitute or supplement the water supply to an evaporative air cooler as long as it is clean (drinking water quality) and secure (not open to contamination).

Can I use recycled water in my evaporative air cooler?

The quality of recycled water can vary significantly and using this water source as a supply for your evaporative air cooler is not recommended without seeking expert advice.

Can I reuse the drain water from my evaporative air cooler?

The water that is drained from the evaporative air cooler may have elevated salt levels. This water may be suitable for reuse as irrigation water (of salt tolerant plants) or for non-critical water uses such as toilet flushing or even washing clothes. This water should never be reintroduced into the drinking water supply or used as drinking water.

Can I store the drain water and reuse it later?

Because evaporative air coolers tend to wash the air of dirt and dust, the drain water can contain nutrients and microbes as well as elevated salt levels. Similar to grey water, the storage of this water can encounter microbial growth problems and instantaneous use (without storage) is recommended in residential applications, unless the water is treated.

Can I permanently turn off the bleed water in my evaporative air cooler?

Bleed can only be turned off if the unit dump cycle is frequent enough to provide the required TDS control and the water supply quality is good (i.e. drinking water quality).

How do I measure the salinity level of drain water?

Salinity is most easily measured using an electrical conductivity (EC) meter, the higher the salt concentration the more electrically conductive the water will be. Special hand held salinity meters are available for this purpose.

What is the lifespan of the average evaporative air cooler?

Although dependent on a range of factors, a typical high quality evaporative air cooler that is correctly installed, operated, and maintained could be expected to last in excess of 20 years.

What alternatives are there to using an evaporative air cooler?

A refrigerative air conditioning system could be used as a replacement for an evaporative air cooler. Refrigerative systems have the advantage of consuming no water during their operation, however, they typically use a lot more electricity than an evaporative system resulting in higher operating costs and the refrigerants they use can have a high global warming potential, which can be damaging to the environment if they are allowed to leak from the system.

More information

More information on evaporative air coolers can be obtained from:

AIRAH (www.airah.org.au)

DA29 Evaporative Air Cooling Systems (2011)
– contains detailed information on all of these issues.

Smart Water Fund (www.smartwater.com.au)

Non-residential Evaoporative Air Cooling Systems
– Water efficiency and conservation (2011)

Department of Health (Victoria) (www.health.vic.gov.au)

Evaporative coolers – An operation and maintenance guide for owners (2001)