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# COOL HOMES

STAYING COOL WITHOUT  
AIR CONDITIONING

# Cooling the Home in a Hot Climate

by Jodie Walker

**Heat waves, for many years no more than an inconvenience for most people, seem undeniably to be increasing in frequency and impact.**

In particular, the risk of adverse effects or mortality from heat exposure in sensitive demographics such as the elderly, the young and the economically disadvantaged mean that heat is steadily becoming a more a significant problem from a range of perspectives.

In the modern world, air conditioning is relied upon to cool our homes and offices. It keeps us comfortable on those very hot days and we have become accustomed to employing it even on milder days. Air conditioning is a luxury that is used thoughtlessly by many. It may do the job of keeping us cool in the immediate and medium terms but its effectiveness as a long-term solution clearly has limits.

This issue of The Secret Agent Report will look into the problems around air conditioning from an environmental, societal and behavioural perspective. We will also bring to light a variety of other cooling methods that should be considered as an alternative to air conditioning usage.

## **THE CHALLENGES OF AIR CONDITIONING**

Clearly, air conditioning is a solution to keeping people cool at home and at work that has become essentially ubiquitous in the western developed world. Its use is increasing globally in spite of significant arguments in favour of reducing our reliance on air conditioning. More sustainable methods to cool our homes and offices need to be adopted to make current and future "...urban areas more climate resilient", (Lundgren, 2013). For this to happen, some prominent barriers at both societal and individual levels will need to be addressed. These will be discussed below.

## **ENVIRONMENTAL CHALLENGES**

The biggest issue with air conditioning is the burden it places on the environment. It has been estimated that air





Air conditioning units outside an apartment building.  
(Photo by Stawomir Kowalewski / Pixabay)

conditioning usage worldwide requires 1 trillion kilowatt hours of electricity annually which is more than twice the total amount of energy used by all of Africa, (Dahl, 2013). It is expected that the energy needed for air conditioning will continue to increase each year as we experience more hot weather.

The high energy consumption of air conditioning has negative consequences on climate change and on the environment in general. The urban heat island effect is "...a result of heat absorption in cities and refers to the difference in temperatures measured inside and outside the city." (Kovats, 2008). Not only do buildings absorb and store heat from the sun, they can also reflect it. Pollution from cars and also industrial production add heat to cities. This is intensified by the fact that there are fewer trees and green spaces to cool the air, (Ford, 2011).

Air conditioning contributes directly to the urban heat island effect as heat from outlets is emitted directly into the atmosphere. A study in Taipei City found that air conditioning heat discharge increased the outside air temperature up to 2 degrees Celsius from 7pm to 2am, (Hsieh, 2007). During extensive hot weather, homes are less likely to cool down overnight. The urban heat island effect exacerbates the problem and regularly results in increased air conditioning

usage at night, which in turn causes additional electricity consumption.

#### **SOCIETAL CHALLENGES**

Sustainable development has become more popular and prominent in certain countries and cities but it's still not common practice in many population centres throughout both the established and the emerging worlds. Modern buildings that tend to have large glass surface areas and flat concrete roofs have for many years been designed for air conditioners. Without them, they simply become a heat trap, (Lundgren, 2013).

**The ease of being able to install an air conditioner has allowed developers to get away with poorly designed buildings that may appear pleasing aesthetically but perform poorly from an efficiency perspective.**

This is especially the case in the apartment market where inadequately designed buildings are obviously intended to stand for decades – ensuring the consequences of their inefficiencies will have to be contended with for extended periods of time.



Air conditioning can strain the electricity supply system during times of heavy use. This increases the risk of electricity outages. This is a huge problem if the only method of cooling in our homes is dependent on the availability of electricity. If we are dependent on electricity for cooling, this means we are also dependent on all the components of the supply chain including oil and coal. As heat becomes more of an issue, this dependency increases people's vulnerability to heat exposure, especially during times of natural disaster, (Lundgren-Kownacki et al, 2018).

### INDIVIDUAL CHALLENGES

The investment made into an air conditioner is followed by ongoing maintenance and running costs. The running costs are not only high, they are compounded by the fact that air conditioning units generally cool only one room at a time. Houses and even some apartments need more than one air conditioner installed in order to cool all the common areas, unless they have a central cooling system.

One of the biggest barriers to overcome at the individual level is not one of cost. Rather it is the fact that air conditioners make a building more appealing to their target market. Air-conditioning has progressed beyond being considered a luxury by many contemporary property buyers. Rather it is regarded as an essential.

**In the rental market too, air conditioning is an expectation more than an extra. For example, when a tenant inspects a potential rental property, one of the most common questions asked is 'does it come with air conditioning?'**

It may well be that a major shift in perception is required in order to accept forms of cooling that are alternatives to air-conditioning.

That we have become too dependent on air conditioning may simply be that we don't know any other way. Most of the knowledge and understanding around how to cool a home naturally has been lost or diminished as our dependency on air-conditioning has grown.

"The faith in modern scientific solutions to achieving comfort has side-stepped local knowledge in many parts of the world, and cooling comfort is increasingly delegated to technical experts, potentially with primarily commercial concerns. AC has therefore become the most common option for cooling comfort." (Wilhite, 2009).

Increasing people's awareness of the environmental issues surrounding air conditioning is a policy worthy of prioritising. There is an accompanying need to educate people on how to cool the home using methods that consume less energy and are therefore less of a burden on the environment.

A study in Darwin was conducted with the aim of helping low income households create energy savings whilst also improving their thermal comfort. Due to the hot climate, it has been estimated that about 45% of electricity usage in Darwin is for air conditioning. It was found that whilst the barriers to saving energy were different amongst participants, simply educating them on how they could save energy was enough to bring about behaviour change to reduce energy usage, (Trombley and Halawa, 2017).

### ALTERNATIVE METHODS TO COOL THE HOME

Increasing global temperatures means that it is highly likely that we will be faced with more heat waves and long-term heat exposure. This means that homes and workplaces will become more reliant on air conditioning for most of the year, (Kjellstrom, 2009).



An artist's impression of Melbourne's green future - which includes plenty of green roofs. (Photo by City of Melbourne)

Alternative cooling solutions to air conditioning need to become commonplace – a move that requires concerted effort from designers, developers and consumers alike. Replacing air conditioners with a combination of the methods discussed below could significantly reduce the energy usage of the world whilst improving thermal comfort levels.

### URBAN PLANNING AND BUILDING DESIGN

There are various ways urban planners and developers can help improve building insulation and reduce the urban heat island effect. Increasing the amount of green and open spaces as well as incorporating more reflective surfaces on buildings can help improve their thermal capacity. In addition, positioning of buildings can make a difference to street ventilation and air-flow, helping to prevent heat build up. More shade structures or large trees will impact energy efficiency inside surrounding buildings.

Building geometry and the materials used in construction can have dramatic effects on how cool a home stays without air conditioning. Roofs account for 20-25% of urban surfaces and provide important potential to impact temperatures both externally and internally through improvement in design and execution. (Lundgren, 2013)

For example, ‘green roofs’, where garden beds, lawns and trees have been planted, have a number of benefits for cities. They help to improve a building’s insulation, resulting in energy savings and they have been shown to reduce the urban heat island effect and they capture pollutants in the air, (Konasova, 2014).

Green roofs help to remove heat from the air through the evapotranspiration, a process capable of reducing the temperature of the roof’s surface.

**It has been found that on a hot day, the surface of a green roof can be cooler than air temperature, whereas a regular roof’s surface can be up hotter by up to 50 degrees Celsius, (Liu and Baskaran, 2003).**

In cities where land for green space is limited, green roofs have the added benefit of being an economical use of space. Such roofs would otherwise be empty expanse the addition of greenery not only introduces climatic benefits but also creates attractive environs for the enjoyment of residents.

Cool roofs are another solution for reducing indoor heat. These roofs are made of highly reflective materials and have lighter coloured surfaces. As a result they can reflect up to

60% of the sunlight that hits them compared to the usual 10-20% reflected by regular, darker coloured roofs, (IIASA, 2012).

The layout of rooms and position of windows in buildings can help keep a building cooler by their impact on ventilation and air-flow. In the Darwin study, participants were asked to rank the benefits of participating in order of importance. Those who received structural retrofits were more likely to report increased comfort of their home as the greatest benefit compared to those who only had appliance upgrades or home maintenance treatments, (Trombley and Halawa, 2017).

### ALTERNATIVE COOLING TECHNOLOGIES

Ongoing work is being undertaken in order to find more efficient technologies for cooling. Renewable energy such as solar energy is one way air conditioners could be powered to reduce electricity consumption. The link is logical since air conditioning demand increases as the amount of solar radiation and heat increases. Even during heat waves, there would be enough energy to keep up with the high output. Nevertheless at present a number of barriers to solar powered air conditioning persist – and the high investment cost of installing the technology is perhaps chief amongst them.

District cooling systems are another potential way of cooling residential and commercial buildings at scale with reductions in energy consumption. Such systems function by distributing energy to surrounding buildings from a central source. Chilled water is produced at a plant and then this energy is piped out to buildings meaning that they don’t require their own chillers or air conditioners. Studies have demonstrated they can help reduce energy use by 20 to 35%. For example, in the Maldives, 60-70% of energy consumption is for cooling. District cooling was able to reduce this by 20%, (CCAC, 2016).

Self-evidently there is already a cost barrier associated with purchasing more energy efficient appliances. Alternative cooling technologies need to be affordable in order to be adopted by as many people as possible.

### CLIMATE SENSITIVE BEHAVIOURS

Many solutions for keeping cool during hot weather come back to the individual. These include “...changes in behaviour, awareness, the deployment of micro-cooling, and personal adaptive strategies”, (Lundgren-Kownacki, 2018).

Simply paying attention to slight changes in the weather, and modifying our behaviour can make a significant difference to the temperature inside our homes. Two of the biggest sources of heat in the home are windows and appliances. Shutting curtains or blinds to keep the heat out during the day and

leaving windows open at night when the outside temperature has cooled down, can help keep homes cooler. Adding fans near open windows can help create cool air tunnels inside.

Appliances that generate a lot of heat include washing machines, dryers, dishwashers and ovens. Excess heat can be minimised by choosing to do laundry or run the dishwasher at night, and by using cooking methods that don't involve turning on the oven during hotter days.

### **Rather than turning on the air conditioner, we can focus on ways to make ourselves cooler.**

It's often easier to cool ourselves down than to cool an entire house down. This can be achieved by such simple measures as having a cold shower, sipping on icy drinks, taking off socks and any excess layers of clothing, and applying cold cloths to the wrist or neck, (Toscano, 2014).

Longer term strategies include installing awnings or shutters on the outside of windows or planting shade trees nearby north or west facing windows. The types of curtains in the home can also make a difference to how much heat is blocked. Black out curtains and those in neutral colours work best for insulating homes. Also ensuring any gaps and cracks in the house are sealed up properly can make a difference to how much heat can enter the structure.

### **CONCLUSION**

As heat becomes more of an issue in the world, demand for air conditioning will continue to climb unless there is more education provided on alternative, efficient approaches to cooling our properties. It's a complex issue and naturally there is no single best way to cool our homes more efficiently. The way forward will require a combination of methods and demand cooperation from all levels of society including governments, developers, urban planners and individuals. ♦



It's easier to cool ourselves down with a fridge than to cool the whole apartment. (Taken from Friends Season 2 Episode 9 "The One with Phoebe's Dad")

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**Words** by Jodie Walker  
**Design** by Sheng Yi Lee

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**info@secretagent.com.au**  
**(+61) 3 9349 4333**

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