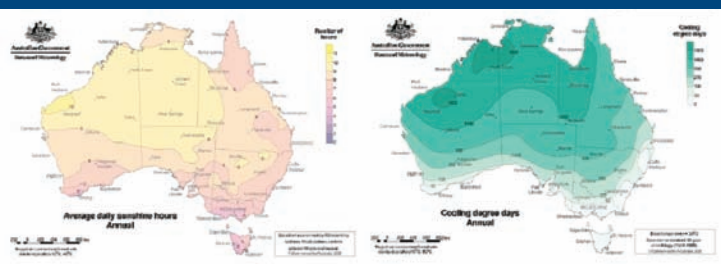


# SOLAR AIR CONDITIONING: OPPORTUNITIES AND OBSTACLES IN AUSTRALIA



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# 1. Executive Summary

## **What is Solar Air Conditioning?**

Solar air conditioning is the application of solar thermal energy (heat) to production of conditioned air through a thermally-driven refrigeration process.

## **Why is Solar Air Conditioning Useful *and* Necessary for Australia?**

Australia has a very sunny climate, with high demand for air conditioning. Air conditioning's impacts upon the electricity network and the environment threaten to affect our quality of life. On hot summer's days, the electricity grid increasingly faces the danger of overload due to air conditioner use, which would cause essential service disruption and severe economic impact. Associated with air conditioning's high use of energy is significant environmental pollution, namely in the form of greenhouse gas emissions – with the resultant climate change impacting not only upon our environment, but also our health and productivity.

Of the many ways of individually addressing air conditioning's impact upon the grid and environment, solar air conditioning (SAC or solar cooling) is one of the few solutions that provides cooling *and* addresses peak loading, and does so with reduced environmental impact.

## **Solar Air Conditioning Fellowship and Investigative Study**

At present, there exists little awareness or understanding of solar air conditioning within Australia. A fellowship was undertaken to address solar cooling related skills deficiencies, with the intention of raising awareness, developing understanding, and providing a framework for a future Australian solar air conditioning market. This report forms one such dissemination activity.

## **Benefits of Solar Air Conditioning**

The fellowship resulted in the understanding that solar air conditioning:

- can contribute to Australia's cooling requirements
- can also provide heating of living areas and domestic hot water
- can alleviate pressure upon the electricity network
- can provide environmental benefits
- can address the particularly high cooling demand of existing building stock
- can already be applied to commercial buildings and industrial applications, and will soon be readily applied to residential buildings
- has already successfully demonstrated itself in Europe, the USA, and Asia
- presents interesting opportunities of note to Australia
  - Application of rejected heat to swimming pools
  - Incorporation of biomass or cogeneration to deliver greenhouse gas-minimal operation
- holds particular promise in tropical environments, and therefore presents a domestic and export opportunity

## **Barriers to Implementation**

There are barriers to be overcome if solar cooling is to live up to its market potential and supply a significant part of Australia's cooling and heating needs. The barriers relate to ignorance, market factors, social factors, buildings' characteristics, and environmental impact. However, the largest barrier at present is economic. Although a simple comparison of SAC and conventional A/C system prices is complex to perform, the economics of solar cooling are generally unfavourable when compared to conventional cooling systems. This is due to:

- Cost of solar collector
- System complexity
- Low energy prices in Australia because of cheap fossil fuel and unaccounted environmental costs
- Cross-subsidy for air conditioning, by which all energy users pay for electrical network infrastructure required to satisfy installation of new air conditioners, with a 2kW<sub>e</sub> air conditioner, which may cost \$1000, requiring \$6000 of infrastructure
- Lack of economic reward for producing or reducing energy during times of peak load
- Lack of incentive for building owners to install energy efficient equipment in leased buildings

## **Overcoming Barriers**

Many of the aforementioned economic barriers are also faced in Europe, and are presently being addressed through research, development, and demonstration systems. However, addressing the market-related barriers requires some governmental intervention. The following measures improve the economic viability of solar air conditioners:

- To reduce collector costs, increased production volumes can be stimulated by further subsidies
- To simplify system design, standardised modules are being produced
- Cross-subsidies could be addressed by making air conditioner buyers pay the costs of infrastructure upgrades thus necessitated by their air conditioner use
- The peak load effect would be reduced by passing on peak costs to the user (interval metering), thereby also encouraging uptake of alternate cooling measures
- Building owners could be encouraged to install energy efficient systems by providing a market recognition mechanism such as an 'energy passport'
- Environmental costs that are presently excluded from energy prices could be addressed through a carbon tax or trading mechanism

Such measures would benefit solar cooling, as well as other Australian industries, particularly those related to sustainability in cities.