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Gabrielle Kuiper || IEEFA Guest Analyst

Smart air conditioners could reduce energy bills for consumers

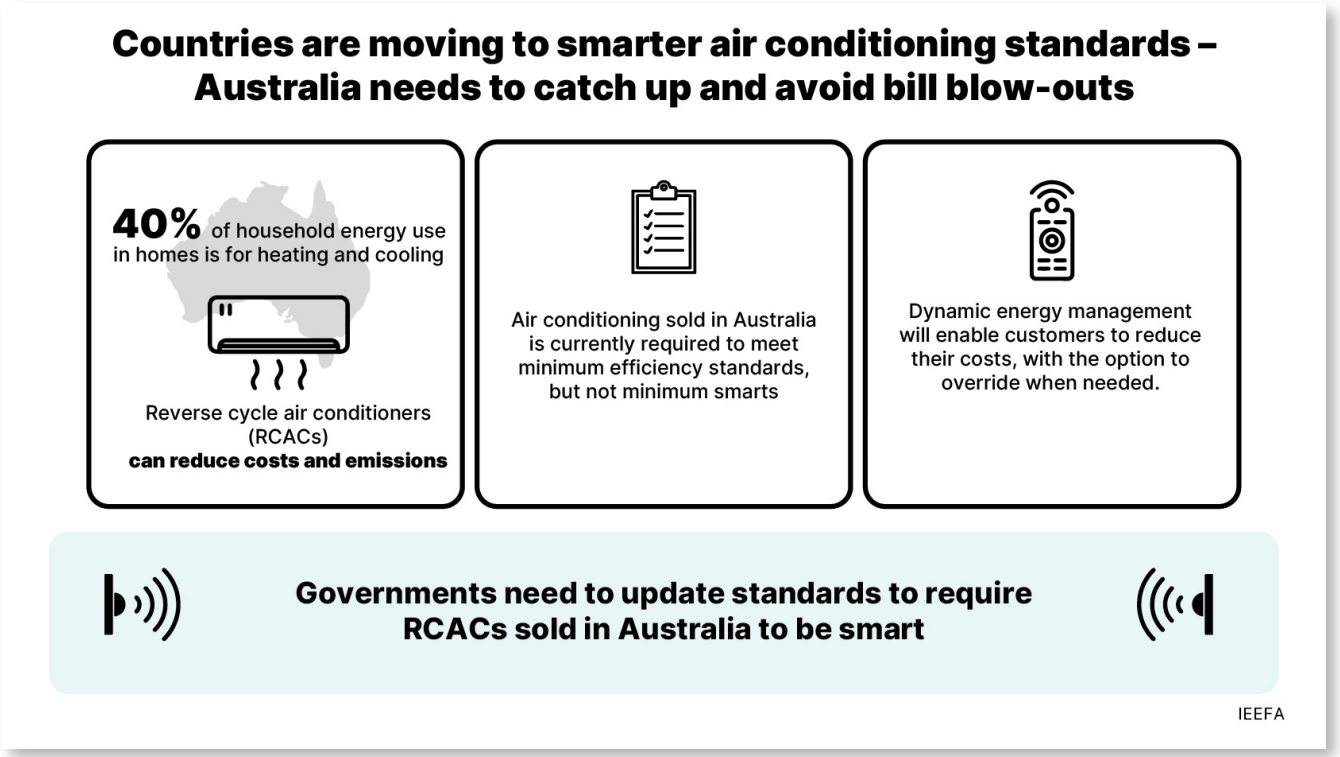
- *Space heating and cooling is a major contributor to household energy bills, so smarter, more efficient electric reverse cycle air conditioners (RCACs) could reduce costs as well as emissions.*
- *Air conditioning sold in Australia is currently required to meet minimum efficiency standards, but not minimum smarts.*
- *The availability of cheap Wi-Fi controllers makes it cost-effective to require all RCACs to be smart – able to have their energy use dynamically managed, with customers able to override this as needed.*
- *Governments should consider subsidising a variety of low-cost add-on sensors and devices to make existing RCACs smart.*

Heating and cooling is the largest component of household energy use

Heating and cooling accounts for about 40% of the energy use in an average Australian home. Improving the thermal performance of Australian homes is vital to reduce costs and improve residents' health and is discussed at the end of this briefing note. The focus of this note is the savings that could be made by requiring reverse cycle air conditioners (RCACs) to be smart – where their energy use can be dynamically managed, with customers able to override this as needed.

Future-proofing heating and cooling to ensure RCACs are able to be used as flexible demand is particularly important given the number of homes that will electrify their heating to reduce their utility bills and emissions over the next couple of decades. The financial case for electrification is becoming compelling, as research from IEEFA has shown.

There are several forms of heating and cooling available to Australian households, but this report focuses on RCACs as they are the most energy-efficient heater and cooler of all types, irrespective of fuel source, and the most commonly installed cooling technology in Australian homes.



The potential demand flexibility capacity of electrified heating and cooling via RCAC is significantly smaller than hot water or electric vehicles (EVs) in most modelling, such as the work by NERA Economic Consulting and Energy Synapse on Valuing Load Flexibility in the NEM. Nonetheless, it is important to consider the potential for demand flexibility in RCAC given that demand flexibility offers a significant opportunity to minimise whole-of-system costs under high levels of variable renewable generation. Moreover, increased climate change will result in greater heating and cooling extremes, resulting in larger numbers of RCAC installations and therefore greater need to manage demand from these devices.

Smart air conditioning standards in Australia

So what is the current state of 'smart' air conditioning in Australia?

Air conditioners in Australia have to meet Minimum Energy Performance Standards (MEPS) set by the Australian Government. Some air conditioners can have their energy use managed remotely or are 'demand response enabled'. This means that the customer or a third party, usually known as an aggregator, can turn the air conditioner up or down, in return for financial or other rewards. It is in this sense that 'smart' is being used to refer to active management of an RCAC in this briefing note.

The PeakSmart scheme, introduced in Queensland in 2012, offers customers a cash rebate of up to AUD400 for air conditioners with a DRED or 'demand response enabling device', which allows electricity distributors Energex and Ergon to send signals to turn off or down these appliances. In keeping with what would be expected in a changing climate, it was reported that Energex remotely cut power to 170,000 air conditioners six times in a month during the 2023-24 summer.

Energy Queensland now has access to 170,000 DRED-enabled air conditioners, the largest fleet of managed appliances in the country. The DREDs are manufactured to comply with the AS4755 standard, which is crude and outdated – for example, it does not feature two-way communication, let alone any energy monitoring, verification or interoperability.

Unfortunately, under a new Technical Regulator Guideline last year, the South Australian Government imposed AS4755 on all single- and three-phase air conditioners with a cooling capacity of up to 19 kilowatts (kW) installed in South Australia from 1 July 2023.

A more modern approach to smart air conditioning is Wi-Fi control, which allows remote management of the air conditioner via a home wireless network and usually a smartphone app. A Wi-Fi microcontroller costs less than USD2 (excluding management software/apps). Of course, aggregators then have to develop platforms to manage aggregations of distributed energy resource (DER) devices, but these software development costs are small compared to the costs of electricity generation or network infrastructure, as the Origin CEO has highlighted.

Of the split-system air conditioners reviewed on consumer website CHOICE, the vast majority (290 out of 323 products at time of writing) have Wi-Fi control as standard or optional. There are almost 6,000 air conditioners listed in the GEMS Regulator database, but this does not record the availability of Wi-Fi or other forms of comms. Of the 5,758 air conditioners available, 59% are voluntarily listed as having 'demand response capability' – which is defined as compliance against AS4755 (the 2012 or 2014 versions) or an 'unknown' standard.

Recently a coalition of large tech companies (including Apple, Google, Amazon and Samsung) have developed Matter, a new global open source interoperability smart home standard that applies to heating, ventilation and air conditioning (HVAC) controllers, as well as EV charging and a raft of household appliances. Matter includes an energy management function, which enables appliances to track and report on their energy usage or generation in real time.

It's worth noting that alongside smart RCAC units, smart thermostats are available to manage heating or air conditioning using Wi-Fi. For example, the cheapest Sensibo product is AUD149 and offers full control of an air conditioning unit from anywhere via a smart phone app, seven-day schedules and timers, and "intelligent algorithms to optimise the operation of your air conditioner" – including reacting to the local weather conditions and geo-fencing to know if you're about to arrive or leave home. In addition, Sensibo can act as a cloud-based home energy management system (HEMS) for multiple air conditioning units through its energy saver plan, costing AUD2.49/month. The company claims to have more than 250,000 households subscribed globally, totalling 868 megawatts (MW) under Sensibo's management.

International moves to 'smart appliances'

Alongside the development of standards like Matter, there are a number of current and planned moves towards 'smart appliances' across North America and Europe. While many of these are currently voluntary, the direction of travel is clear: towards becoming smart.

In the US, the ENERGY STAR program for efficient appliances includes voluntary criteria for 'connected' products, including air conditioners. One of these criteria is that open standards shall be used for all communication layers. California has just introduced its first flexible demand appliance standard for pool pumps, with further standards coming for hot water systems, behind-the-meter batteries and EV chargers.

The UK has developed voluntary standard PAS 1878:2021 for energy smart appliances (ESAs). ESAs are defined as "electrical consumer devices that are communications-enabled and capable of responding automatically to incentive signals (such as price) or other more direct control signals (such as specific instruction to operate at a given power at a certain time of day), by shifting or modulating their electricity consumption, storage, and/or production". The standard includes requirements for the use of two-way communication that allows appliances to

receive and act upon price and other direct control signals and the OpenADR communication protocol/standard. In 2026 the ESA standard is intended to become a requirement for heat pumps, battery energy storage systems (BESS) and EV chargers, and from 2028 it is likely to be required more broadly, presumably including for RCACs.

The European Commission has proposed a voluntary Code of Conduct to ESA manufacturers, including HVAC manufacturers. It includes an agreement by signatories to make all reasonable efforts to "Ensure the implementation of interoperability profiles based on standardised open Application Programming Interface / open communication protocol". The Code of Conduct was launched on 23 April 2024, with ten manufacturers (Arçelik, Clivet, Daikin, Electrolux, Miele, Mitsubishi Electric, Panasonic, Vaillant Group, Vestel and Viessmann) committed to making interoperable small appliances available within one year after the launch.

As a result of these international trends, we can expect to see an increasing number of smart appliances, including RCACs, available for import into Australia. Of course, participation in flexible demand programs will always be voluntary; consumers can be well-rewarded if they opt in, but are not required to participate. There may always be consumers with sensitive health needs, for example, who never participate. They may still benefit from the existence of the program, as networks are less likely to have to undertake load shedding in extreme circumstances, such as during a heatwave.

Consumer willingness to flex their demand

The first objection that is usually offered to the concept of flexing household demand, especially for heating and cooling, is that consumers don't want to participate – they want to heat and cool their homes to ensure their comfort. However, the evidence locally and internationally suggests many households are willing to change their electricity use in response to price signals or other rewards. In addition, non-financial motivations – supporting the grid in the public interest – can also be significant.

> **Many households are willing to change their electricity use in response to price signals or other rewards**

Impacts on comfort can be managed. Well-shaded, insulated homes, especially those with some thermal mass (such as concrete slab floors or insulated high-mass walls) or those with east- or south-facing living rooms protected from afternoon heat can maintain comfort for longer without cooling input. An Ausgrid pilot showed that leaving RCAC fans running while switching off compressors meant most people didn't even notice that their compressors, which use most of the energy, had been managed. The CoolSaver Interim Report stated "88% of respondents did not notice a difference in their air conditioning cooling experience on the very hot days we activated their power saving mode." This reflects the importance of air movement to provide comfort.

In Australia, two of the three large gentailers, Origin and AGL, offer demand response opportunities for households with smart meters.

Origin's Spike product is underpinned by OhmConnect technology and provides a gamified platform through which households earn 'Spike rewards' for reducing their energy use at peak times. Over 150,000 Origin customers have participated in the Spike program since it launched. Origin staff have stated that this 'behavioural' demand flexibility accounts for less than 10% of Origin's 1.4GW virtual power plant, and that Origin's goals with the Spike program are as much about customer engagement, efficiency and brand as the megawatts of peak demand

reduction. They also noted that few customers have taken up the opportunity to purchase a Sensibo smart thermostat via the Spike program, highlighting the importance of smarts being built into newly purchased appliances. Origin also has considerable household flexible demand capacity under management through solar and battery inverters, electric vehicles, and smart meters (hot water and pool pumps).

AGL meanwhile offers transparent monetary rewards under its Peak Energy Rewards program: AUD5 in bill reduction for energy demand reduction for a one-hour event; or up to AUD10 in bill credits for a two-to-three-hour event. AGL achieves just above 50% participation of enrolled 'Peak Energy Rewards members' for each event, and 80% succeed in reducing demand sufficiently to be rewarded for their energy savings. In 2022-23, across 22 state-wide peak events and seven network events, more than 100,000 Peak Energy Rewards members saved 259 megawatt hours (MWh) and earned over AUD1,300,000 in customer rewards, equivalent to AUD5/kWh – more than 10 times the per-hour cost of electricity. Like Origin, AGL staff noted the company is interested in the customer retention benefits of the program, but also recognise the portfolio value with some flexible demand capacity tied into AGL's trading desk.

In addition, 30,000 Amber Electric customers are on plans that incentivise them to flex their demand in line with wholesale market prices while providing a 'safety net' regarding their maximum electricity costs to limit perceptions of risk.

While the sum total of the participation of these three retailer programs is only a small fraction of the almost 10 million residential customers in the National Electricity Market (NEM), two facts are salient here.

The first is that only households with smart meters can currently participate in these offers – less than 20% of NEM households (excluding households in Victoria) in 2020. Moreover, we are yet to have different prices available for flexing demand for different loads, though this has been proposed in the AEMC's draft rule on integrating price-responsive resources into the NEM. The AEMC's draft rule, proposed to commence on 2 February 2026, means retailers can separate out the loads in a house, offering customers different tariffs (cost per kW) for different devices, using the smarts in those devices, without installing multiple new meters. Alternatively, aggregated households could be included in the wholesale demand response mechanism, which is due to be reviewed in 2025.

The second salient fact is that not all customers need to flex their demand to make a difference to peak demand, but all customers stand to benefit from the resultant reductions in power system costs.

Improving the thermal performance of Australian homes

Alongside encouraging the adoption of smart air conditioning, improving the thermal performance of Australia's existing housing stock is vital. Our homes have very poor thermal performance by international standards. As of 2019, the average energy efficiency rating of existing Australian homes was only 1.7 stars, compared with an average of 7 stars for new homes.

The first priority should be upgrading the thermal performance of low-income housing (public, community and First Nations-controlled housing, as well as low-income owner-occupiers and low-income private rental properties) along the lines proposed by the Australian Council of Social Service. These are the people currently least able to afford to pay their energy bills. Where consumers own their own homes, AUD1 billion in low-interest loans is available to upgrade the thermal efficiency.

As Climateworks research has shown, when paired with full electrification, 'climate-ready' upgrades could deliver a large increase in bill savings, from AUD1,000/year in the Northern Territory, through to more than AUD4,500/year in the Australian Capital Territory. Climateworks defines 'climate-ready' upgrades as ceiling, floor and wall insulation, high levels of draught sealing, double-glazed windows, heavy drapes and roller shutters, combined with an efficient electric RCAC and a heat recovery ventilation system.

While in many cases, deeper thermal efficiency upgrades don't add up financially purely in terms of energy cost savings, the economic case is strengthened when health and wellbeing benefits are included, especially for vulnerable households. Therefore Australian governments should look at what types of thermal efficiency upgrades make economic sense once overall benefits to health and the energy system are taken into account.

Recommendations

First and foremost, Australian governments need to work to improve the thermal efficiency of homes in Australia. However, electrification of heating, especially in cooler parts of Australia, presents a significant parallel opportunity to improve the efficiency of heating and cooling and to create flexible demand via RCACs. This can reduce energy system costs and reduce bills for consumers.

Not only do efficiency standards need to be raised and appliances required to be smart, but these standards also need to be put in place as soon as possible – because the time of day of electricity use becomes increasingly important with growing variable renewable energy supply.

Therefore, IEEFA recommends:

1. The South Australian Government should consider replacing the requirement that appliances adhere to the AS4755 standard with a more sophisticated requirement that air conditioners sold in Australia are 'smart' – as outlined below.
2. The Commonwealth Government, in conjunction with state and territory governments, should investigate which of the following 'smart' requirements for RCAC systems should be put in place nationally via the Greenhouse and Energy Minimum Standards (GEMS) Act:
    - Communication capability/an open communication protocol e.g. Wi-Fi connectivity; and
    - Connection to a home energy management system (HEMS) as an alternative form of smart management.
3. Australian governments should consider subsidising a variety of add-on sensors and devices to make existing RCAC units smart.

Millions of homes across the NEM currently rely on gas heating, which is expensive and unsustainable. The financial case for switching gas and resistive electric heating to RCACs is strong, which could accelerate sales of RCACs. Therefore it is critical to have the right standards in place now. Australian governments should support efficient, smart electrification through high efficiency standards for heating and cooling, and ensuring heating and cooling demand can be flexed when needed, on a voluntary basis by homes and businesses.

When roughly a quarter of a million households are already flexing their electricity demand through voluntary retailer programs for as little as AUD5/hour, we know the public appetite to reduce bills through flexible demand exists. It is up to Australian governments to make this easier for consumers by normalising the sale of smart, efficient heating and cooling technology.

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About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

About the Author

Dr Gabrielle Kuiper is a DER Specialist and a Director at The Superpower Institute. She is an energy, sustainability and climate change professional with over twenty years' experience in the corporate world, government and non-government organisations and academia. She was previously the DER Strategy Specialist with the Energy Security Board.