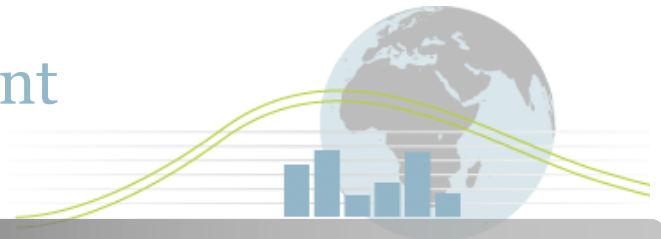


4E

Mapping Document



Country:	Australia
Technology:	Air Conditioners
Sub Category:	Residential, Packaged/Unitary, Split and Multi-split

Introduction

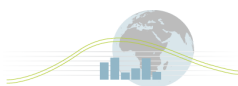
The first stage in the Mapping and Benchmarking process is the definition of the products, i.e. clearly setting the boundaries that define the products for use in data collection and analysis. Doing this ensures that comparison between the participating countries is done against a specific and consistent set of products. The summary definition for this product is:

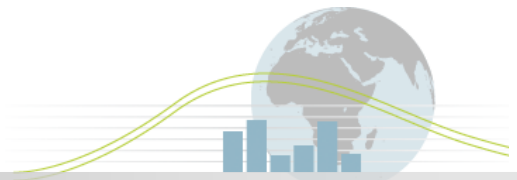
Definition & scope	<p><i>'Air conditioners used in dwellings and designed to maintain the temperature of indoor air at a given temperature level for a given heat load to be extracted.'</i></p> <p>Including only:</p> <ul style="list-style-type: none"> • Products of up to 14 kW cooling capacity (indicative, to exclude products used only in commercial premises) • Electrically driven vapour compression (Absorption units excluded) • Cooling only units, and cooling function of reverse cycle units. (Data for heating cycle / heat pumps to be invited but not analysed). • Air cooled condensers, and water/condensate spray assisted (water cooled units excluded) • Only air to air units (water chillers excluded) 		
Type	Unitary ('packaged', in single mounting, including double duct units)	Split units, (single room unit and single condenser linked by pipe-work)	Multi-split (two or more room units and single condenser linked by pipe-work)
Other variables invited (but not analysed)	<ul style="list-style-type: none"> • Mounting (Window / thru-wall; Other fixed mounting; Mobile) • Variable speed drive / multi-speed compressor (yes / no) • Refrigerant (designated according to ASHRAE refrigerant numbering system) • Standby consumption 		

Important note: Ducted air conditioners (central) are excluded from this analysis as they are not generally used outside of the USA and Canada.

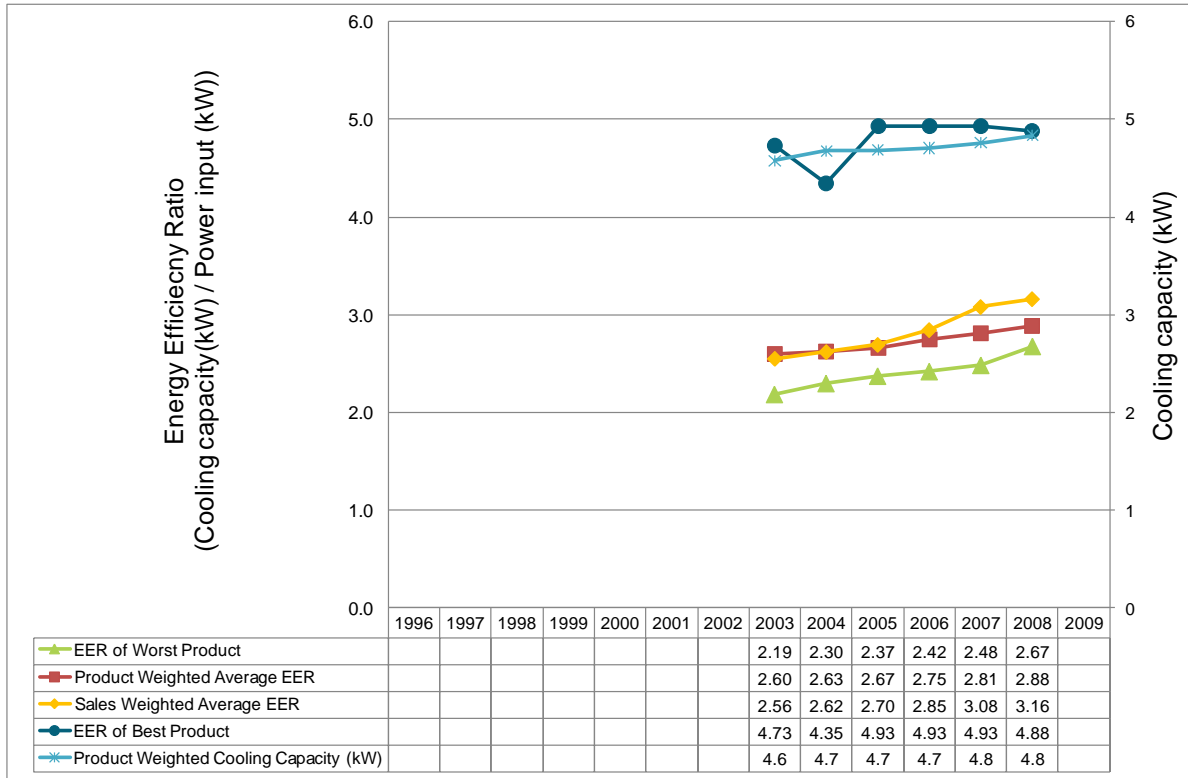
The detailed product definitions can be found at the Annex website:

<http://mappingandbenchmarking.iea-4e.org/matrix>



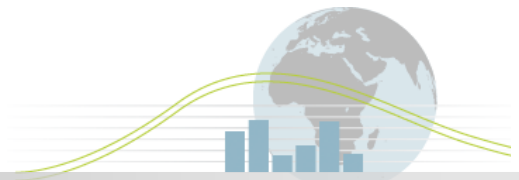


Energy Efficiency Ratio of New Residential Air Conditioners - Australia

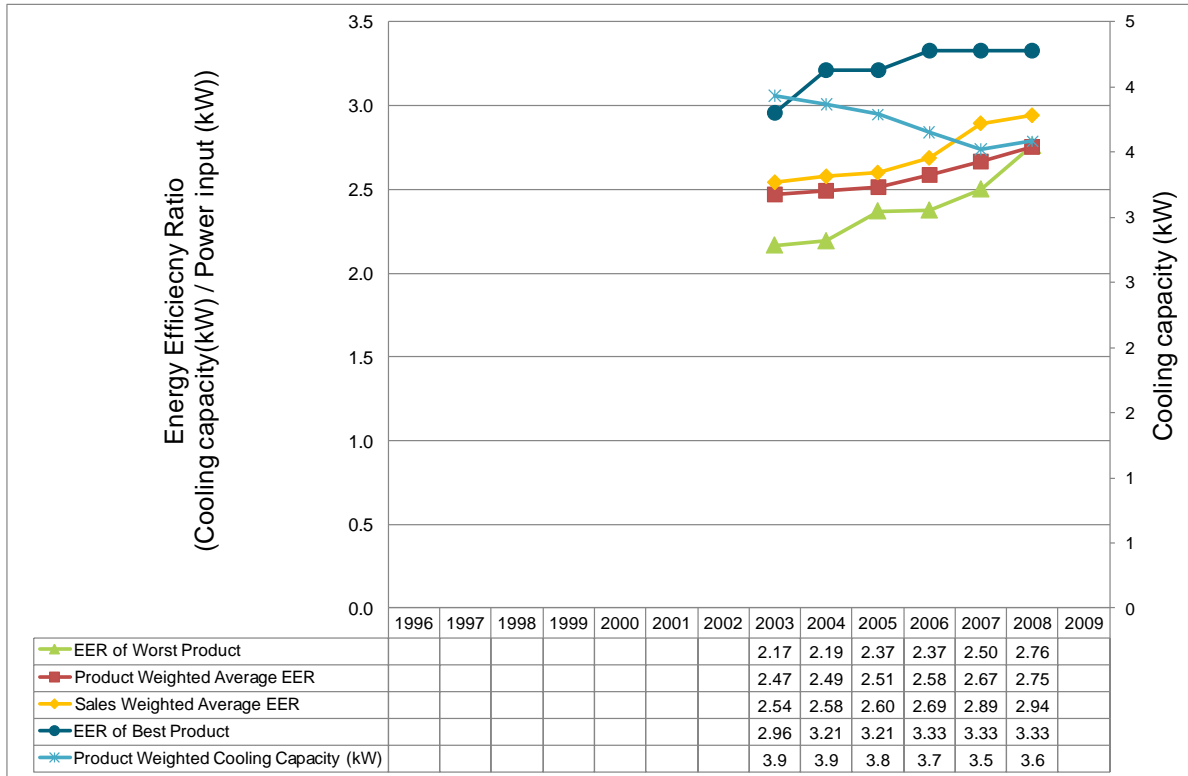


Key notes on Graph (see notes section 1)

- This graph includes unitary (packaged), split and multi-split products under 14kW cooling capacity. The EER units are kW per kW.
- Product-weighted data is fully representative of the Australian market, being from mandatory registration scheme. Sales weighted data is also full market, but only available for 2003-2008. Data was provided separately for each year.
- The data covers split and packaged products, as multi-splits are a small proportion of the residential market and are not yet regulated (and so not on the mandatory registration database).
- These types of air conditioner accounted for the vast majority of the total residential air conditioner market in 2008 in Australia (probably approaching 90%, remainder single duct / mobile packaged and multi-split). And in 2008 they were sold in the following proportions:
Unitary (packaged): 24% Split: 76% Multi-split: Unknown (but small)
- In order to indicate a Worst performing product that reflects the broad market (as opposed to representing perhaps a single unusual or wrongly reported product), the 'EER of worst product' is in fact the EER of the product at the 'worst 5%' point of a ranked list in the dataset. The Best performing product is that with the highest EER.

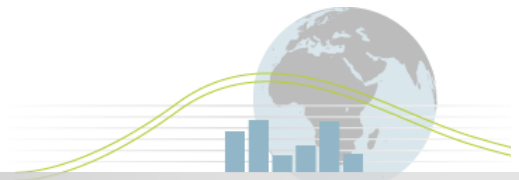


Energy Efficiency Ratio of New Unitary/Packaged Air Conditioners Australia

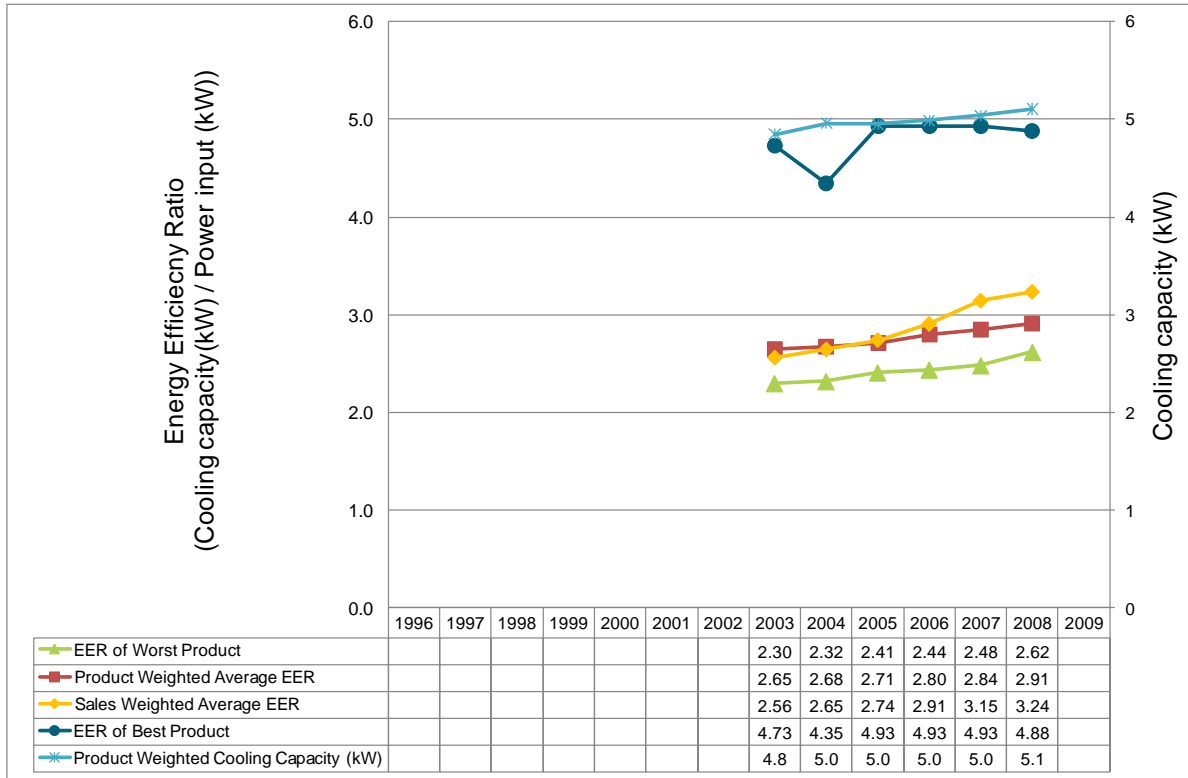


Key notes on Graph (see notes section 1)

- This graph includes unitary (packaged) air conditioners with cooling capacity under 14kW. The EER units are kW per kW.
- Product-weighted data is fully representative of the Australian market, being from mandatory registration scheme. Sales weighted data is also full market, but only available for 2003-2008. Data was provided separately for each year.
- In order to indicate a Worst performing product that reflects the broad market (as opposed to representing perhaps a single unusual or wrongly reported product), the 'EER of worst product' is in fact the EER of the product at the 'worst 5%' point of a ranked list in the dataset. The Best performing product is that with the highest EER.

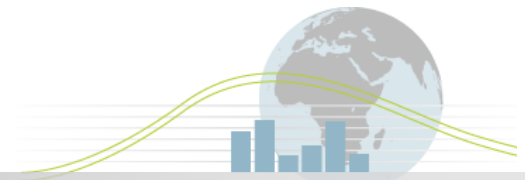


Energy Efficiency Ratio of New Split Air Conditioners Australia



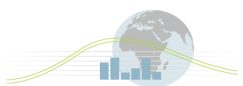
Key notes on Graph (see notes section 1)

- This graph includes split air conditioners with cooling capacity under 14kW. The EER units are kW per kW.
- Product-weighted data is fully representative of the Australian market, being from mandatory registration scheme. Sales weighted data is also full market, but only available for 2003-2008. Data was provided separately for each year.
- In order to indicate a Worst performing product that reflects the broad market (as opposed to representing perhaps a single unusual or wrongly reported product), the 'EER of worst product' is in fact the EER of the product at the 'worst 5%' point of a ranked list in the dataset. The Best performing product is that with the highest EER.

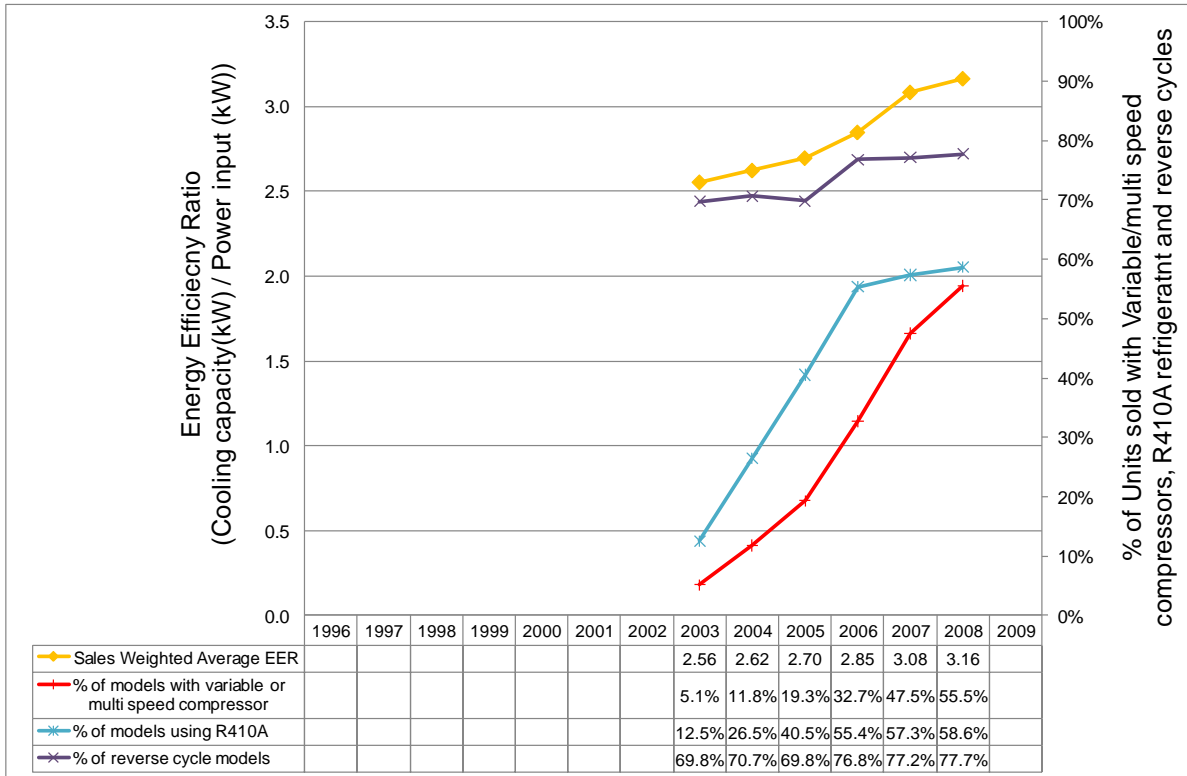


Energy Efficiency Ratio of New Multi-split Air Conditioners Australia

No data was available on to the Annex on multi-split products at the time of publication (but it is estimated that they probably represent much less than 10% of the residential market).



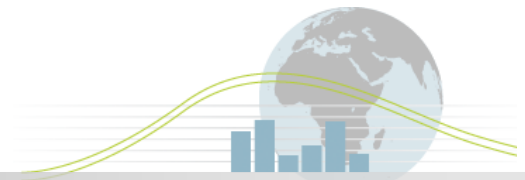
Other Characteristics of New Residential Air Conditioners Australia



Key notes on Graph (See notes section 2)

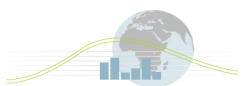
- Data is fully representative of the Australian market, being from mandatory registration scheme, provided separately for each year.
- Sales weighted average standby consumption in 2008 was 4W, with 2.4 W product weighted. Worst performer was [40]W¹.

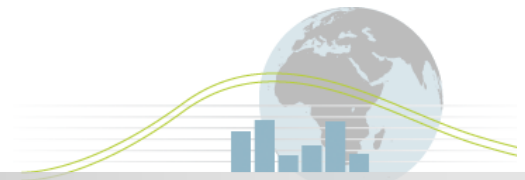
¹ Not the extreme worst, but ignoring the worst [5]% outliers.



Seasonal Energy Efficiency Ratio of New Residential Air Conditioners - Australia

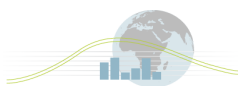
No data was available on to the Annex on the Seasonal Energy Efficiency Ratio of products at the time of publication.

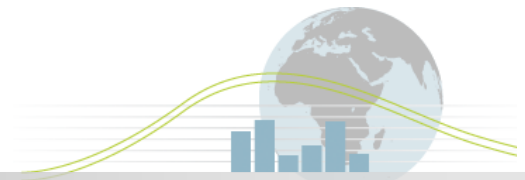




Energy Efficiency Ratio's in the Installed Residential Air Conditioner Stock - Australia

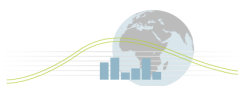
No data was available on to the Annex on the installed residential air conditioners at the time of publication.





Energy Consumption in the installed Residential Air Conditioner Stock - Australia

No data was available on to the Annex on the total consumption of installed residential air conditioners at the time of publication.



Major Policy Interventions (See notes Section 6)

Single phase non-ducted air-conditioners for household use are regulated for energy labelling and MEPS in Australia. Multi-splits are excluded from Australian energy labels and MEPS.

Single phase air conditioner energy label star rating started nationally in 1992, showing EER and kWh per 500 hours of use for heating and cooling. The scheme thresholds were updated in 2000 and 2010, employing a revised calculation algorithm, though still making use of the same test method. MEPS for single phase air conditioners were introduced in 2004 and updated in 2006 and 2010.

Three phase (larger) air conditioners have had MEPS since October 2001 and were upgraded in 2010, see <http://www.energyrating.gov.au/pac1.html>.

April 2010 new policies introduced included:

- The star rating is based on an annual consumption calculation which includes standby and other non-operational consumption (eg crank case heaters).
- More stringent MEPS for selected products for cooling mode, and introduction of MEPS for heating mode.
- For peak demand management, Australia has developed and published a standard for a common demand response interface for air conditioners to receive and respond to signals from the energy utility to 'cycle' during peak periods. This is being called a Demand Response (DR) interface. The DR interface receives signals via a Demand Response Enabling Device (DRED). It is currently optional to have the interface on air conditioners (though some incentives may be provided by energy suppliers). A Regulatory Impact Study is being prepared for mandating the presence of DR interfaces on air conditioners sold in Australia. In trials, the cycling of air conditioners to reduce peak demand was not noticed by consumers.

Additional new requirements from April 2011 will include:

- MEPS levels for all products will be based on annual EER and annual COP, including standby and other non-operating energy consumption.
- Mandatory power factor requirements.

Cultural Issues (See Notes Section 7)

With energy labelling, over time the market trends towards a majority of products having star ratings that are bunched around the range of 3.5 to 5 stars. Market research demonstrates that consumers use the star rating labels in purchase decisions and that it also provides suppliers with a means to differentiate their product with a view to increasing market share.

Government regulatory impact statements (RIS) have demonstrated that there is significant market failure in the air conditioner market that can only be addressed through the

implementation of MEPS. Also that the introduction of an appropriate MEPS does not have an adverse affect on market competition, availability of product features and performance or the availability of low cost models in each of the main product categories. RIS have found there is only a weak correlation between product efficiency and price.

Notes on data

Section 1: Notes on Product Energy Efficiency Ratio

1.1 Test methodologies, Performance Standards and Labelling Requirements

All energy labelling and MEPS standards for air-conditioners are published jointly by Standards Australia and Standards New Zealand. The key relevant standard is AS/NZS3823: *Performance of household electrical appliances – air conditioners and heat pumps*. Part 1 of the standard defines the test procedures for the determination of energy consumption and capacity; Part 2 sets out the requirements for energy labelling and MEPS. These standards have been cloned from ISO5151 and ISO13253 respectively and are technically equivalent. Cooling capacity and energy consumption is determined to condition T1.

These standards specify the calculation process for EER for cooling, the ratio of output (heating or cooling) to electrical power input, in kW per kW.

The Air Conditioners Star rating calculation (from AS/NZS 3823.2) is derived from the tested EER results according to the following table.

Star Rating	Star Rating Index (SRI)
1.0	$SRI < 1.5$
1.5	$1.5 \leq SRI < 2.0$
2.0	$2.0 \leq SRI < 2.5$
2.5	$2.5 \leq SRI < 3.0$
3.0	$3.0 \leq SRI < 3.5$
3.5	$3.5 \leq SRI < 4.0$
4.0	$4.0 \leq SRI < 4.5$
4.5	$4.5 \leq SRI < 5.0$
5.0	$5.0 \leq SRI < 5.5$
5.5	$5.5 \leq SRI < 6.0$
6.0	$6.5 \leq SRI < 7.0$
7.0	$7.0 \leq SRI < 8.0$
8.0	$8.0 \leq SRI < 9.0$
9.0	$9.0 \leq SRI < 10.0$
10.0	$10.0 \leq SRI$

1.2 Product Energy Efficiency Ratio Graphic

Source:

The data for this graphic is sourced from the mandatory Federal product register, including data from the mandatory energy label scheme for split and packaged products. The register does not include multi-split products. This is supplemented by GfK sales data for all products from 2003 to 2008.

Key calculations undertaken:

No additional normalisations were required as the test conditions are Climate Class T1.

Usage assumptions:

No usage assumptions have been made for air conditioners as there is no simple way to calculate an annual consumption from individual or average product performance data. For total consumption, Government modelling data is quoted where available (no data available for Australia).

Proportion of data set included:

Any products that were ducted or designed to operate on 3 phase supplies were excluded, and all products with over 14kW cooling capacity. This excluded around 4% of the data set.

Section 2: Notes on Other Energy Related Metrics

2.1 Test methodologies, Performance Standards and Labelling Requirements

No additional information relevant. Refer to section 1.2

2.2 Other Energy Related Metrics

The other metrics used to characterise the market are:

- The percentage of market that use variable speed drives or multi-speed compressors. These features improve efficiency in real use by more closely matching capacity to cooling demand, although efficiency under standard test conditions may not show savings.
- The percentage of market that use refrigerant R410A. This is a high pressure refrigerant fluid that has become commonly used throughout the world. It has been chosen for these graphs as indicative of the move to HFC refrigerants (away from CFCs / HCFCs).
- The percentage of the market that are reverse cycle products. These can be used for heating as well as cooling (often referred to as heat pumps).
- In addition, the Australian dataset included standby consumption (which is included in the mandatory energy label calculation since April 2010). Data on this has been analysed and is mentioned in the accompanying text.

Section 3: Notes on product Seasonal Energy Efficiency Ratio

The Seasonal Energy Efficiency Ratio (SEER) is calculated from efficiency performance at several capacity levels (often 25%, 50%, 75% and 100% of full load) according to a typical annual duty cycle. SEER is more indicative of efficiency achieved in practice than simple full load EER. No SEER data is available for Australian products.

Section 4: Notes on EER of Stock

None

Section 5: Notes on Consumption of Stock

None

Section 6: Notes on Policy Interventions

No further issues to add.

Section 7: Notes on Cultural Issues

Refer to section 1.2.