

Country: USA Energy Star

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 		

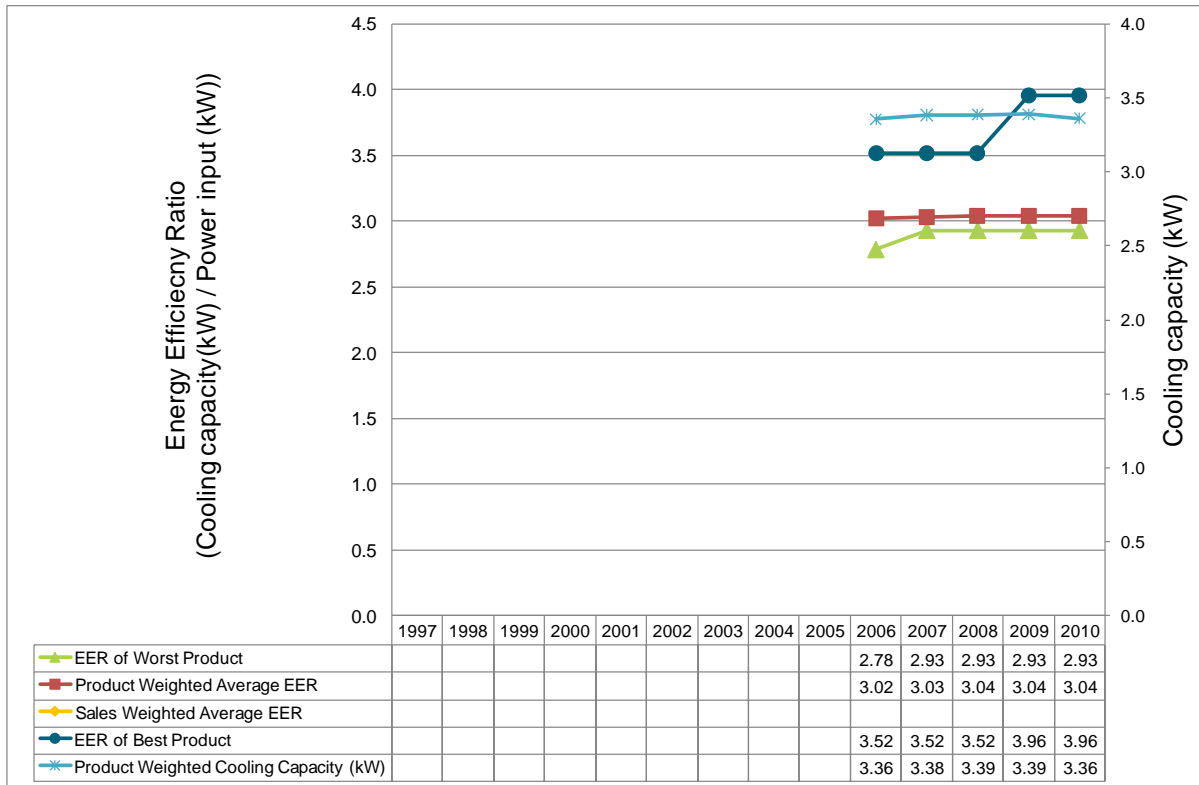
Important note for the USA: Ducted air conditioners (central) are excluded from this analysis as they are not generally used outside of the USA and Canada. Hence a significant proportion of US residential products (potentially of the order of 50%) are not represented. Single-ducted (portable) units are also excluded.

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

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

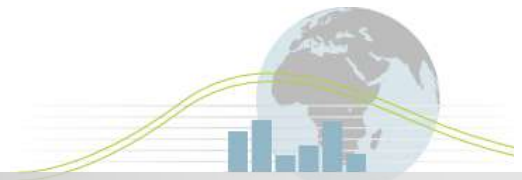


Energy Efficiency Ratio of New Unitary Air Conditioners USA Energy Star



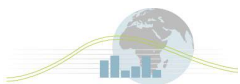
Key notes on Graph (see notes section 1)

- This graph includes unitary (packaged) air conditioners with cooling capacity under 14kW (47,800 Btu). The EER units are kW per kW (rather than Btu/kW)
- The right hand vertical axis is average cooling capacity, in kW.
- This graph includes only products that appear in the ENERGY STAR database and so is not representative of the whole US market. In particular, lower performing products are not included, nor Packaged Terminal Air Conditioners (PTACs).
- Data for each year was extracted from the March 2010 full ENERGY STAR data. A proportion of the data from each year could not be included in the analysis due to missing data fields and other quality issues. Insufficient data were usable for 2001 to 2005 to be considered representative of the data set as a whole, and so they are not presented here. See Notes on Data section 1.2 for details.



Energy Efficiency Ratio of New Split Air Conditioners USA Energy Star

Insufficient data was available to the mapping and benchmarking annex at the time of publication to produce this graphic.



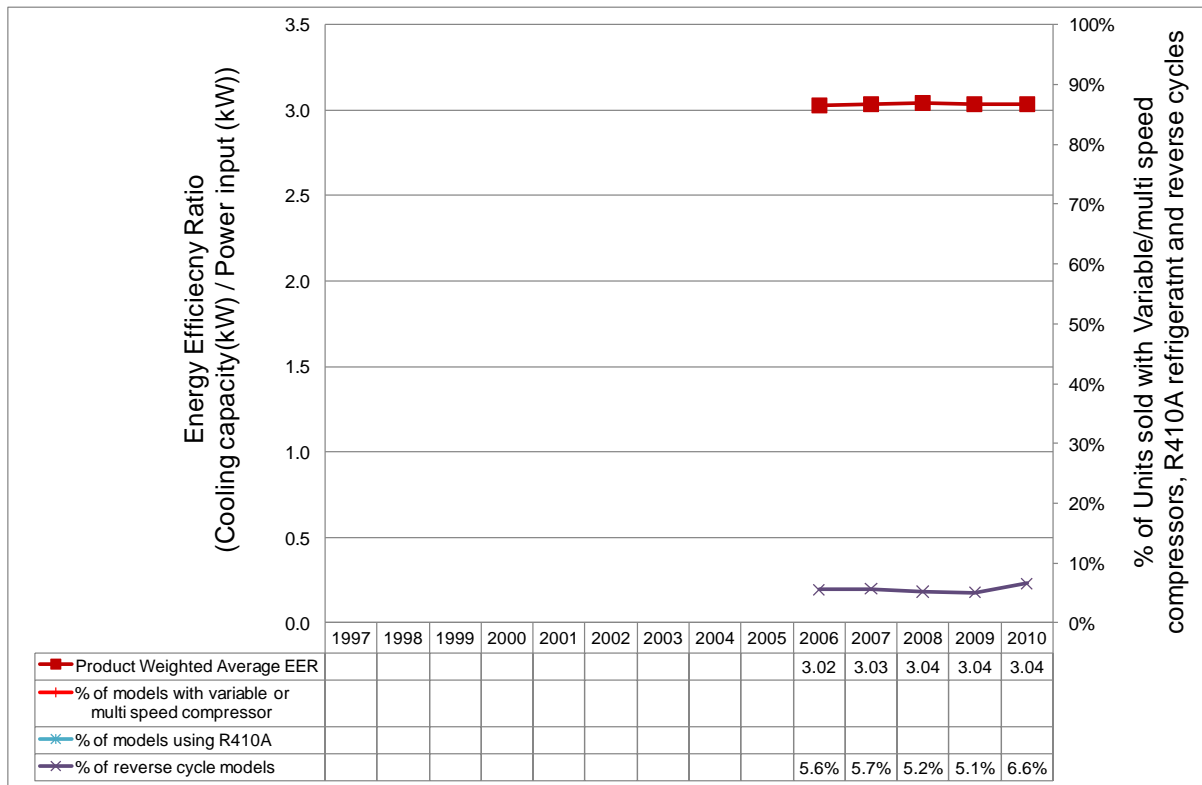


Energy Efficiency Ratio of New Multi-split Air Conditioners USA Energy Star

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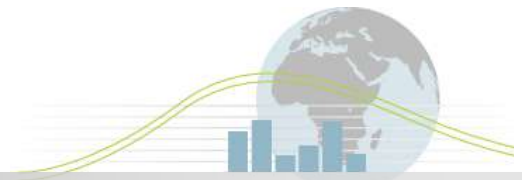


Other Characteristics of New Residential Air Conditioners USA Energy Star



Key notes on Graph (See notes section 2)

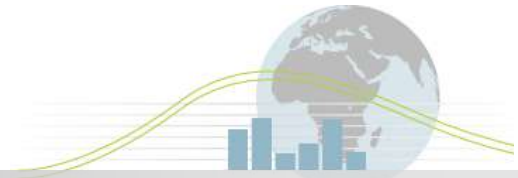
- This graph includes only products that appear in the ENERGY STAR database and so is not representative of the whole US market (lower performing products are not included).
- The ENERGY STAR programme does not record which refrigerant, nor whether the unit has a variable or multi-speed compressor.
- Data for each year was extracted from the March 2010 full ENERGY STAR data. A proportion of the data from each year could not be included in the analysis due to missing data fields and other quality issues. Insufficient data were usable for 2001 to 2005 to be considered representative of the data set as a whole, and so they are not presented here. See Notes on Data section 1.2 for details.



Seasonal Energy Efficiency Ratio of New Residential Air Conditioners – USA Energy Star

Insufficient data was available to the mapping and benchmarking annex at the time of publication to produce this graphic.

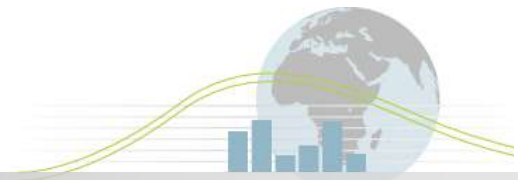




Energy Efficiency Ratio's in the Installed Residential Air Conditioner Stock - USA

Insufficient data was available to the mapping and benchmarking annex at the time of publication to produce this graphic.





Energy Consumption in the installed Residential Air Conditioner Stock - USA

Insufficient data was available to the mapping and benchmarking annex at the time of publication to produce this graphic.



Major Policy Interventions (See notes Section 6)

The US has had MEPS for air conditioners since 1990, with a revision in October 2000 under the DOE final rule '10 CFR 430'. The MEPS cover cooling only and reverse cycle units both with and without louvered sides, and also units designed for casement only and casement slider windows.

DOE anticipates revised MEPs for room air conditioners by June 2011 which will incorporate standby and off mode energy limits.

The ENERGY STAR voluntary labelling programme for energy efficient Room Air Conditioners (RACs) entered into force in 1996, covering cooling-only RACs without reverse cycle. This covered window RACs, through-the-wall RACs, and the casement and slider-casement RAC products. An update and scope expansion became effective in November 2005 to include louvered and non-louvered reverse-cycle RACs (or heat pump RACs). Packaged Terminal Air Conditioners (PTACs) are not eligible for ENERGY STAR rating.

Cultural Issues (See Notes Section 7)

No information available.

Notes on data

Section 1: Notes on Product Energy Efficiency Ratio

1.1 Test methodologies, Performance Standards and Labelling Requirements

The test methodology underlying both the MEPS and ENERGY STAR programme is the US Department of Energy's (DOE) test procedure as defined in 10 CFR 430, Subpart B, Appendix F, "Uniform Test Method for Measuring the Energy Consumption of Room Air Conditioners". This method is consistent with the methods and conditions in American National Standard (ANS) Z234.1–1972, "Room Air Conditioners," sections 4, 5, 6.1, and 6.5, and American Society of Heating, Refrigerating and Air Conditioning in Engineers (ASHRAE) Standard 16–69, "Method of Testing for Rating Room Air Conditioners." These standards use the ISO 5151 Climate Class T1¹.

Mandatory MEPS for room air conditioners have been in force in the USA since 1990 with revision in 2000, and planned further revision in 2011.

The voluntary ENERGY STAR programme has covered room air conditioners since 1996.

1.2 Product Energy Efficiency Ratio Graphic

Source:

The data for this graphic is the March 2010 ENERGY STAR database. This contained data on 2,369 products registered on the scheme from 2001 to 2010. For this analysis, products available in any given year were assumed to be those registered in that year plus all products registered in the previous 3 years (ie 2008 contains all products registered in 2008, 2007, 2006 and 2005). The ENERGY STAR "no longer active" tags have been ignored (ie all products in the list were assessed for every relevant year, as it was not recorded when products became inactive).

Key calculations undertaken:

Conversion from Btu/hr to kW: Multiply by 0.293/1000.

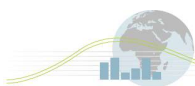
Conversion of US/Canadian EER in (Btu/hr/kW) to EU EER (kW/kW): Multiply by 0.293.

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.

¹ <http://www.clasponline.org/clasp.online.worldwide.php?teststandard=224>.



Original Data Limitations

The ENERGY STAR programme is designed to identify better performing products and so is only representative of the products in the market that meet ENERGY STAR criteria, which are typically the top 25% of the market, although this proportion grows over time from each new criteria release date as products on the market improve. Graphics and data are therefore not representative of the entire US market.

Proportion of data set included:

The data used are those published from the ENERGY STAR archive database for March 2010. This included data on 2,369 products. 1,206 of these had no date for 'when qualified' and so had to be removed as it was not possible to place them in a given year. From the remaining 1,163 products, it was then necessary to produce a list for each given year that contained only:

- Products that had qualified by the given year (ie their Qualified date was in or before the given year)
- Products that have not got a 'No longer manufactured' date before the given year
- Products that met the Energy Star criteria valid during the given year

The number and percentage of data points (products, from the original 2,369) remaining after this filtering process were:

2006	484	20%
2007	541	23%
2008	576	24%
2009	650	27%
2010	622	26%

Filtering the 1,163 products in this way had to take account of the complexity of the ENERGY STAR criteria being banded according to the capacity, criteria changing at two points in the period being analysed (2000 and 2005) and also scope changing in 2005 (to add reverse cycle products and provide separate thresholds for casement units).

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. No data were available on whether US products had this feature.
- 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). No data were available on refrigerant type for US products.
- 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). These data were provided for all US ENERGY STAR products.

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 data available for the USA.

Section 4: Notes on EER of Stock

No data available.

Section 5: Notes on Consumption of Stock

No data available.

Section 6: Notes on Policy Interventions

No further issues to add.

Section 7: Notes on Cultural Issues

No data available.