Country:	EU10
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:

<table>
<tr><td>Definition & scope</td><td colspan="3">‘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.’

Including only:
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)</td></tr>
<tr><td>Type</td><td>Unitary
(‘packaged’, in single mounting, including double duct units)</td><td>Split units,
(single room unit and single condenser linked by pipe-work)</td><td>Multi-split
(two or more room units and single condenser linked by pipe-work)</td></tr>
<tr><td>Other variables invited (but not analysed)</td><td colspan="3">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</td></tr>
</table>

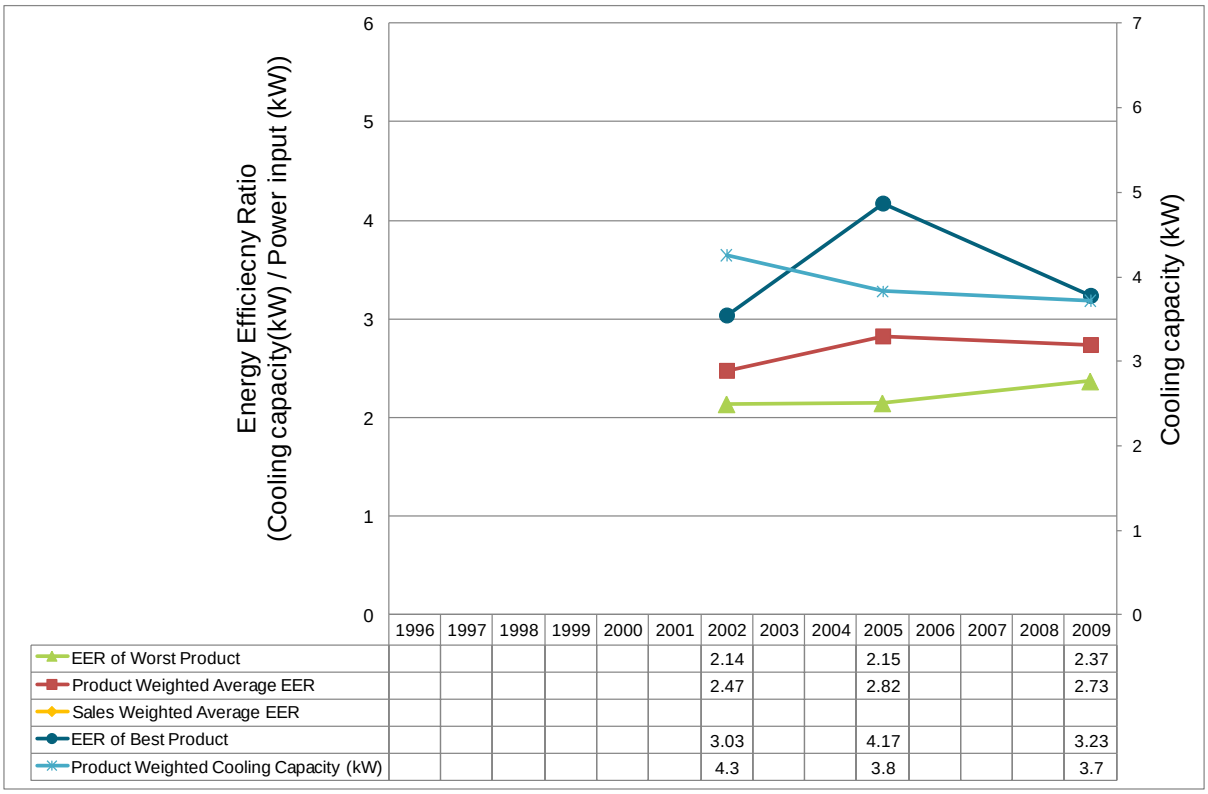
Important note: Ducted air conditioners (central) are excluded from this analysis as they are not generally used outside of the USA and Canada.

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

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

Energy Efficiency Ratio of New Unitary Air Conditioners EU10

If

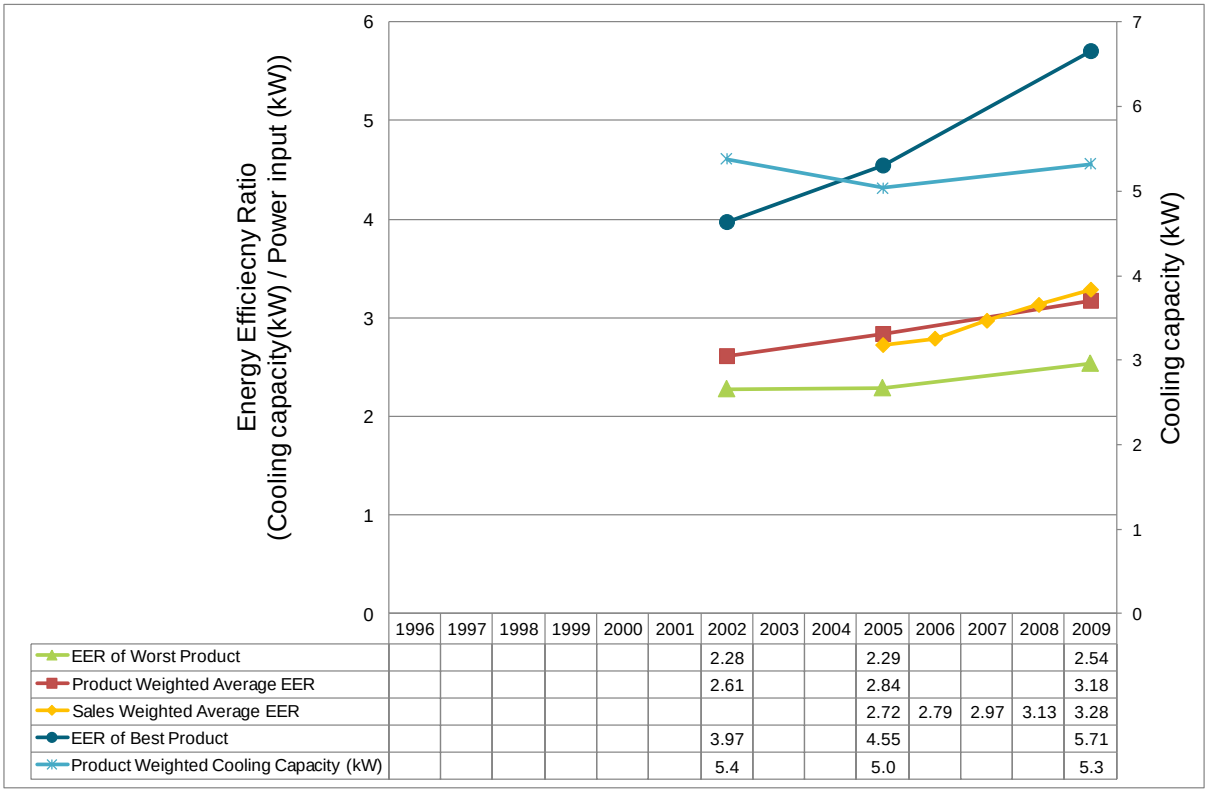


Key notes on Graph (see notes section 1)

- This graph includes unitary (packaged) air conditioners with cooling capacity under 12. The EER units are kW per kW.
- Data for this graph comes only from the Eurovent data set, in which unitary products account for between 9% (2002) and <1% (2009) of products included.
- Product weighted data, and best and worst products are derived from the Eurovent Certification[1] databases of that year (see Notes on Data section for full details). Poor performing products are less likely to be certified, and so poorer performing products than those shown above are likely to be available on the EU market.
- No sales weighted data is available because performance data was not separated out by product type. However, unitary products account for between 1.6% (2002) and 0.3% (2005) of sales according to the GfK dataset.

[1] www.eurovent-certification.com

Energy Efficiency Ratio of New Split Air Conditioners EU10

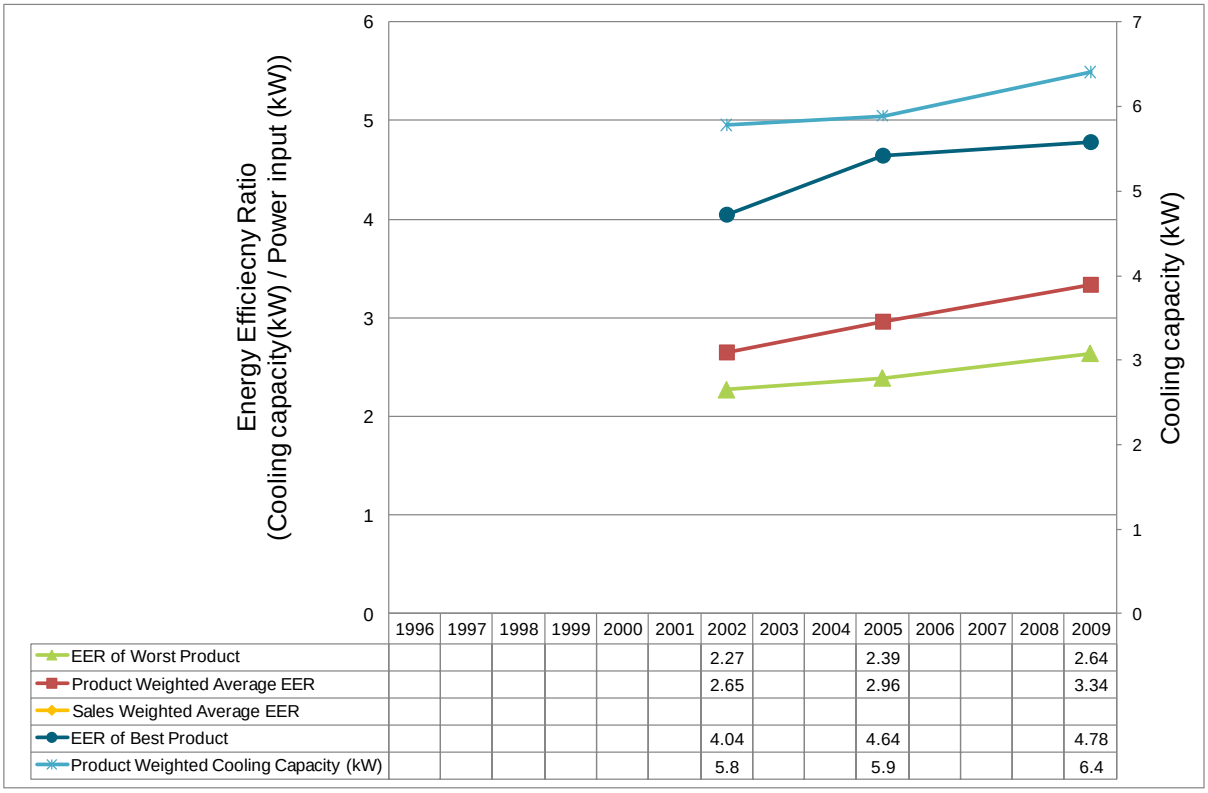


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EER of Worst Product							2.28			2.29				2.54
Product Weighted Average EER							2.61			2.84				3.18
Sales Weighted Average EER										2.72	2.79	2.97	3.13	3.28
EER of Best Product							3.97			4.55				5.71
Product Weighted Cooling Capacity (kW)							5.4			5.0				5.3

Key notes on Graph (see notes section 1)

- This graph includes split air conditioners with cooling capacity under 12 kW. The EER units are kW per kW.
- Product weighted data for this graph comes from the Eurovent data set, in which split products account for between 89% (2002) and 96% (2009) of products included. Poor performing products are less likely to be certified, and so poorer performing products than those shown above are likely to be available on the EU market.
- Sales weighted data from the GfK data set has been included for the years 2005 to 2009 since for these years split products accounted for over 95% of total sales, and so the data was considered reasonably comparable to data purely for split products (the GfK performance data could not be separated into product types). This data should still be treated with caution.
- The sales weighted data is approximated back to EER values from label classes, and so should be treated with some caution (See *Key calculations undertaken* in Notes on Data Section 1 for details).

Energy Efficiency Ratio of New Multi-split Air Conditioners EU10

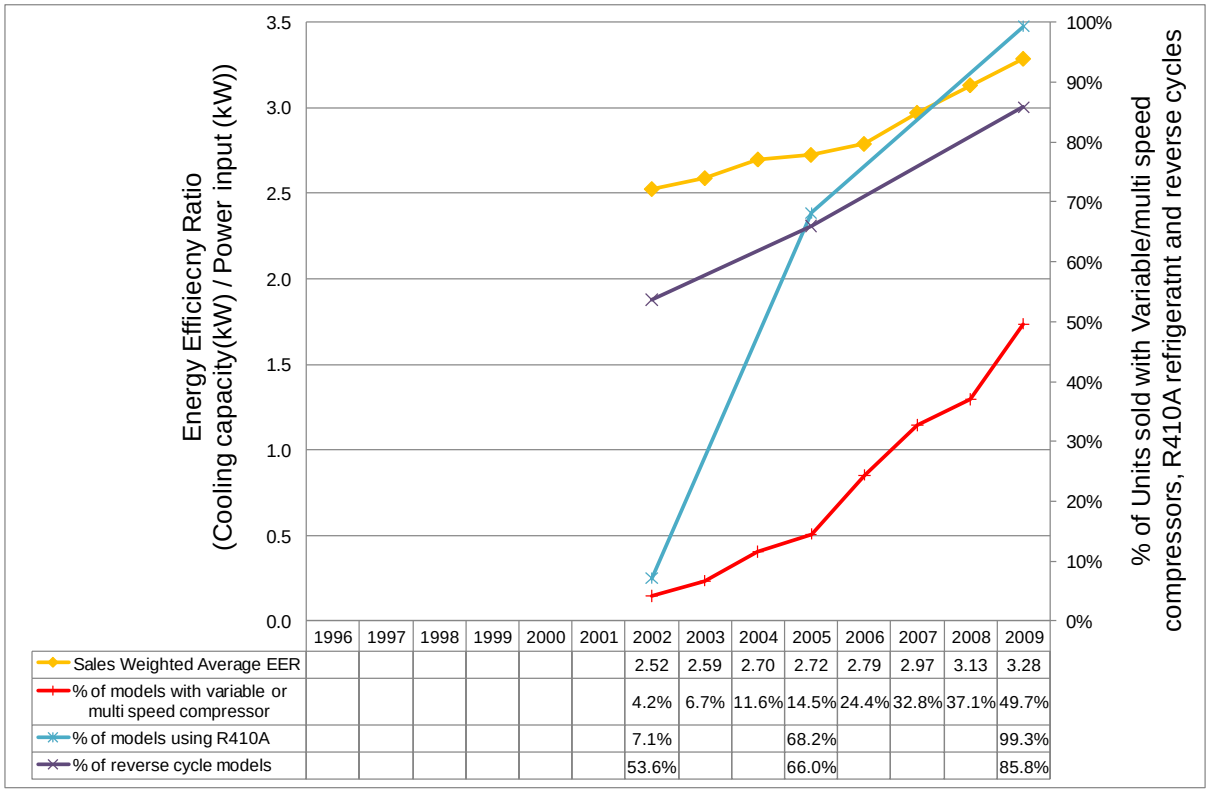


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EER of Worst Product							2.27			2.39				2.64
Product Weighted Average EER							2.65			2.96				3.34
Sales Weighted Average EER														
EER of Best Product							4.04			4.64				4.78
Product Weighted Cooling Capacity (kW)							5.8			5.9				6.4

Key notes on Graph (See notes section 1)

- This graph includes multi-split air conditioners with cooling capacity under 12 kW. The EER units are kW per kW.
- Data for this graph come only from the Eurovent data set, in which multi-split products account for between 11% (2002) and 30% (2009) of products included. Poor performing products are less likely to be certified, and so poorer performing products than those shown above are likely to be available on the EU market.
- No sales weighted data is available because performance data was not separated out by product type (but multi-split products account for between 3.5% (2005) and 7.4% (2002) of sales according to the GfK dataset).

Other Characteristics of New Residential Air Conditioners EU10



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Sales Weighted Average EER							2.52	2.59	2.70	2.72	2.79	2.97	3.13	3.28
% of models with variable or multi speed compressor							4.2%	6.7%	11.6%	14.5%	24.4%	32.8%	37.1%	49.7%
% of models using R410A							7.1%			68.2%				99.3%
% of reverse cycle models							53.6%			66.0%				85.8%

Key notes on Graph (See notes section 2)

- Data on refrigerant R410A and on % reverse cycle units are derived from the Eurovent data and so are product-weighted (not available in GfK data).
- Data on % units with inverter (variable speed) drive are derived from GfK sales weighted data (not available in Eurovent data).
- EER are for all products in the GfK dataset. In 2009 products were sold in the following proportions:

  Unitary (packaged): 0.6% Split: 95.5% Multi-split: 3.9%
- The proportion of split products rose from 75% in 2002 to 86% in 2003 and 94% in 2004.

Seasonal Energy Efficiency Ratio of New Residential Air Conditioners – EU10

No data on the seasonal energy efficiency ratio of new air conditioners was available to the Mapping and Benchmarking Annex at the time of publication.

Energy Efficiency Ratios in the Installed Residential Air Conditioner Stock – EU10

No data on the energy efficiency ratio of air conditioners in the installed stock was available to the Mapping and Benchmarking Annex at the time of publication.

Energy Consumption in the installed Residential Air Conditioner Stock – EU10

No data on the total energy consumption of air conditioners in the installed stock was available to the Mapping and Benchmarking Annex at the time of publication.

Major Policy Interventions (See notes Section 6)

Mandatory Energy Labelling was introduced in 2002 across the EU for air cooled split/multi-split, packaged (unitary) and single duct air conditioners, and for water cooled products. Labels apply to cooling mode, and also to heating mode where applicable.

There has been no voluntary energy label for air conditioners as such, but the Eurovent Certification scheme has had a category for air conditioners less than 12kW cooling capacity for which EER is declared since 1996 (for their category 'AC1').

No MEPS are yet in force in the EU for air conditioners, although MEPS are now under discussion for room air conditioners under the EU Ecodesign of Energy Related Products Directive. MEPS are not expected to be introduced before 2012.

There is also a voluntary EU Ecolabel scheme for heat pumps[2]. This requires a minimum EER of 3.2 in cooling mode and COP 2.9 in heating mode for an electric air to air heat pump, plus a range of additional manufacturing, in use and end of life requirements including refrigerant Global Warming Potential (GWP).

Cultural Issues (See Notes Section 7)

Penetration of air conditioning varies significantly across the EU, in line with the climate. Italy and Spain alone account for over half of the products sold in the EU27 (33% and 21% respectively), followed by Greece (13%) and France (7%).

In 2009 products were sold in the following proportions:
Unitary (packaged): 0.6% Split: 95.5% Multi-split: 3.9%

[2] EU (2007, November 20). Directive 2007/742/EC - Eco-label to electrically driven, gas driven or gas absorption heat pumps. Official Journal , L 301/14.

Notes on data

Section 1: Notes on Product Energy Efficiency Ratio

1.1 Test methodologies, Performance Standards and Labelling Requirements

The test methodology in common usage, also required for Eurovent Certification, is EN14511-2004 *'Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling'*. This is a full load test methodology, with test conditions matching those of ISO 5151 Climate Class T1.

1.2 Product Energy Efficiency Ratio Graphic

Source:

The data includes unitary (packaged), split and multi-split products under 12kW cooling capacity. No mobile products are included (around 10% of EU product sales[3]). Data is from two sources to produce these graphics:

1. Sales weighted data is sourced from: GfK air conditioner sales data, with manufacturers' claimed performance figures from: Italy, Spain, Portugal, Greece, Great Britain, France, Germany, Netherlands, Belgium and Sweden. The data covers all 'GfK panel' (direct to consumer) sales of fixed (mobile excluded) air conditioners less than 12kW capacity. This includes split, multi-split and 'single' (packaged) products in the 10 countries, plus sales through the 'professional channel' (i.e. to wholesalers and contractors) of these products in Italy since 2008, and in Greece since 2007. GfK estimate that the GfK retail sales panel of retailers account for between 54% (2007) and 59% (2009) of all sales of these products in these countries. A separate source (EuP Lot 10 study report) suggests that Italy and Greece account for around 35% of the total EU market for air conditioners, but we do not know what proportion is via retail versus professional channels. If this split is 50/50 for both, then it is estimated that this data set could account for around 70% to 80% of the total market. For each of the years 2002 to 2009 the data provided the proportion of sales in labels A, B, C and 'other'; proportion of sales by cooling capacity and energy label; sales by cooling capacity alone; sales by presence of inverter technology; and sales by type of air conditioner (split, single and multisplit).

2. Product-weighted data is sourced from: The Eurovent Certification Company product database for comfort air conditioners for the years 2002, 2005 and 2009. Their 'AC1' database was used, which covers split, multi-split (only with 2 indoor units) and packaged products up to 12kW. Products marked in the database as 'Deleted' were not analysed. Eurovent Certification does not publish a formal estimate of the proportion of the market accounted for by products on their database, but members

[3] EuP Lot 10 study report, Draft report of Task 2, July 2008, Economic and Market Analysis, page 11 Figure 2-4.

include all of the leading suppliers in Europe and so is highly likely to account for over 50% of sales.

Key calculations undertaken:

No special calculations were required for the Eurovent data.

It was necessary to convert energy label classes (A, B, C and 'Other) back to EER values for the GfK data. This was done by selecting a specific EER value within each class that is representative of that class. It is recognised that the average may not be the mid point of the class, and the Eurovent data was used to derive a reasonable estimate of the most appropriate figure. The EER values were ordered for each year and an average calculated within each label class. The results are shown in the table below. These were the representative EERs used to calculate the overall sales weighted EER, with values for other years interpolated from these.

	A	B	C	Other (D and below)
2002	3.41	3.08	2.88	2.51
2005	3.33	3.05	2.86	2.53
2009	3.53	3.06	2.85	2.59

No 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.

Proportion of data set included:

All of the GfK data were used in the analysis.

Some products were deleted from the analysis from the Eurovent data, those that were for 3 phase electrical supply, water cooled, or those marked as having been deleted from the scheme. This eliminated approximately 29%, 18% and 44% of the data points in the 2002, 2005 and 2009 data sets respectively.

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).

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 were available for the EU.

Section 4: Notes on EER of Stock

No further information available.

Section 5: Notes on Consumption of Stock

No further information available.

Section 6: Notes on Policy Interventions

No further issues to add.

Section 7: Notes on Cultural Issues

No further information available.