

Country: United Kingdom

Technology: Retail display cabinets

Sub Category: Chilled and Frozen

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:

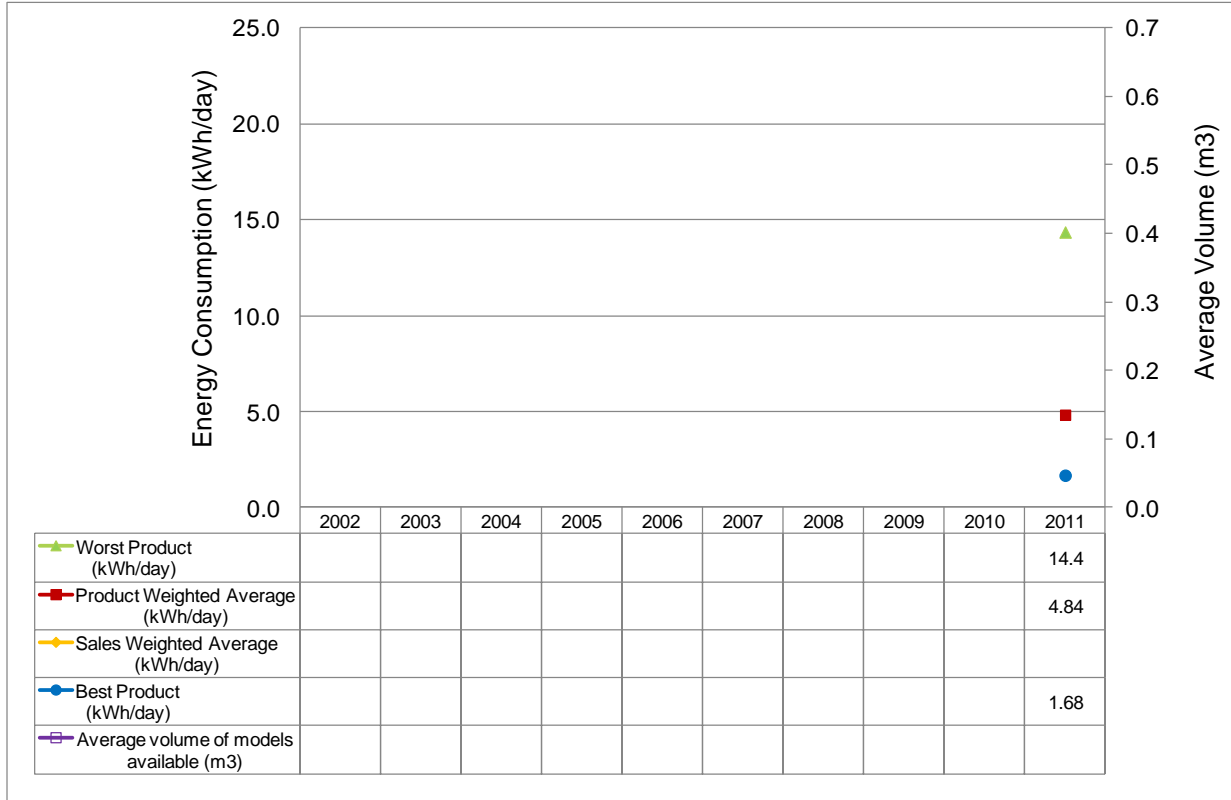
Definition & scope	Scope is limited to: <i>“Refrigerated integral retail display cabinets of types a) vertical chilled with glass door(s) as used for beverages and b) horizontal/semi-horizontal freezers as used for ice cream merchandising. Cabinets must enable customers to view the contents stored in the cabinet even when it is closed either through an opening in the cabinet, or through a transparent door or lid, and also enable customers to self-serve contents. ‘Integral’ means ‘plug in’ or self-contained, such that the cabinet incorporates a compressor and condensing unit within its housing.”</i>	
Intended purpose / content	Beverage display or similar uses, i.e. vertical chilled cabinets with glass door(s)	Ice cream display or similar, i.e. horizontal/semi vertical freezer cabinets
Temperature class (storage temperature)	Vertical cabinets with glass door for chilled storage at: a) -1 to +10°C ('H1' class, EU) b) 3.3°C ±1.1°C (USA/Canada) c) 'As manufacturer stipulates' (Australia) d) Others TBD	Horizontal and semi-horizontal ice cream cabinets for frozen storage at: a) -15 and below ('L1' class, EU) b) -21°C (USA, prior to 1Jan2010; Canada prior to 12Apr2012) c) -26.1°C (USA since 1Jan2010 and Canada since 12Apr2012) d) 'As manufacturer stipulates' (Australia) e) Others TBD
Cabinet orientation and doors / covers (not night covers)	Vertical chilled cabinet with: a) Single door full height b) Double doors full height c) Single under-counter d) Double under-counter	Horizontal frozen cabinet of: a) Small size (TDA and volume definition TBD) b) Standard size (TDA and volume definition TBD)

Other characteristics to be noted: Refrigerant type; Presence of lighting; Presence of circulation fan; Defrost type; Outer dimensions; Ambient test conditions class.

A full product definition is provided at the annex website¹.

¹ see <http://mappingandbenchmarking.iea-4e.org/matrix?type=product&id=10>

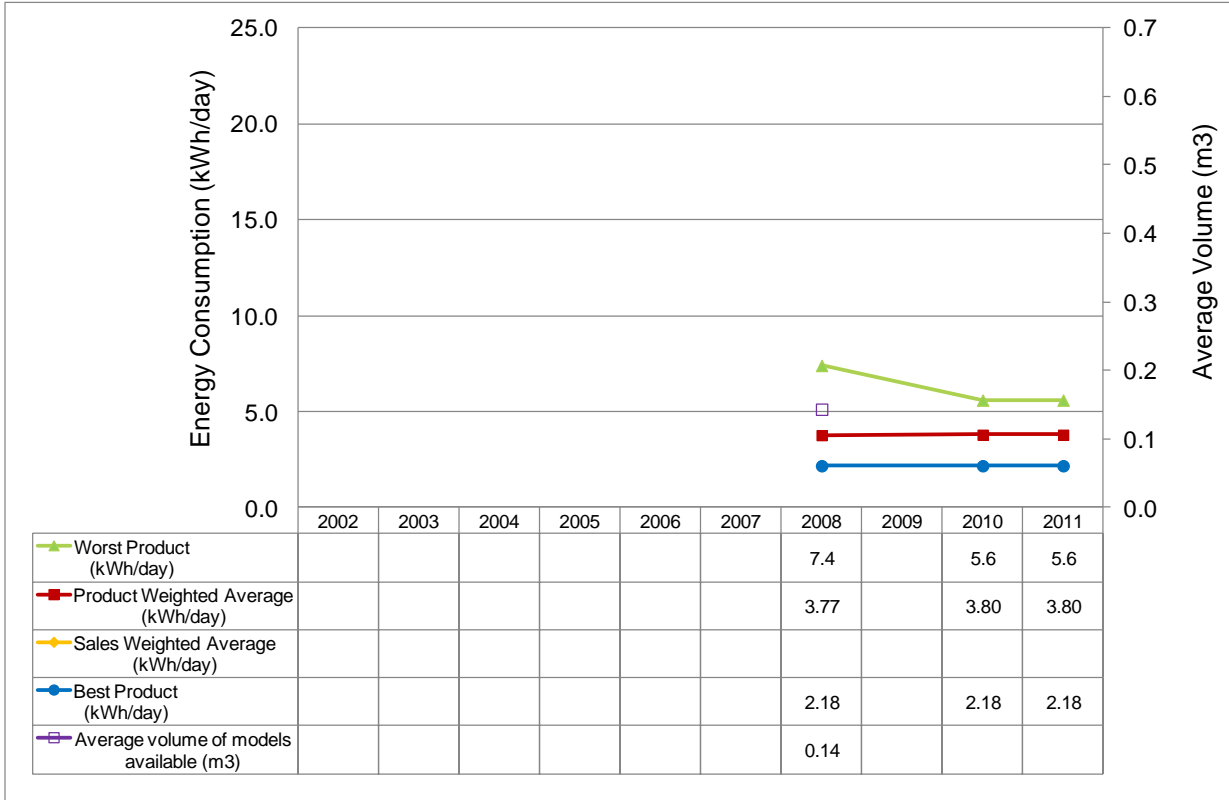
Energy consumption of new chilled retail display cabinets United Kingdom – ECA data set



Key notes on Graph (see notes section 1)

- Products covered are self-contained (integral) vertical chilled cabinets with glass door(s). Volume is the refrigerated internal storage volume (no data available).
- Data were supplied by the Enhanced Capital Allowance (ECA) Scheme managers on behalf of the Carbon Trust. No sales data were available.
- This is a partial market data set and includes products meeting the ECA Energy Technology List criteria and available for sale in each year.
- See table on page 15 for the numbers of products included in each year, plus associated explanation of confidence levels in the data. Numbers of products are low and so data should be interpreted with extreme caution. Only years with 13 and more products are plotted.

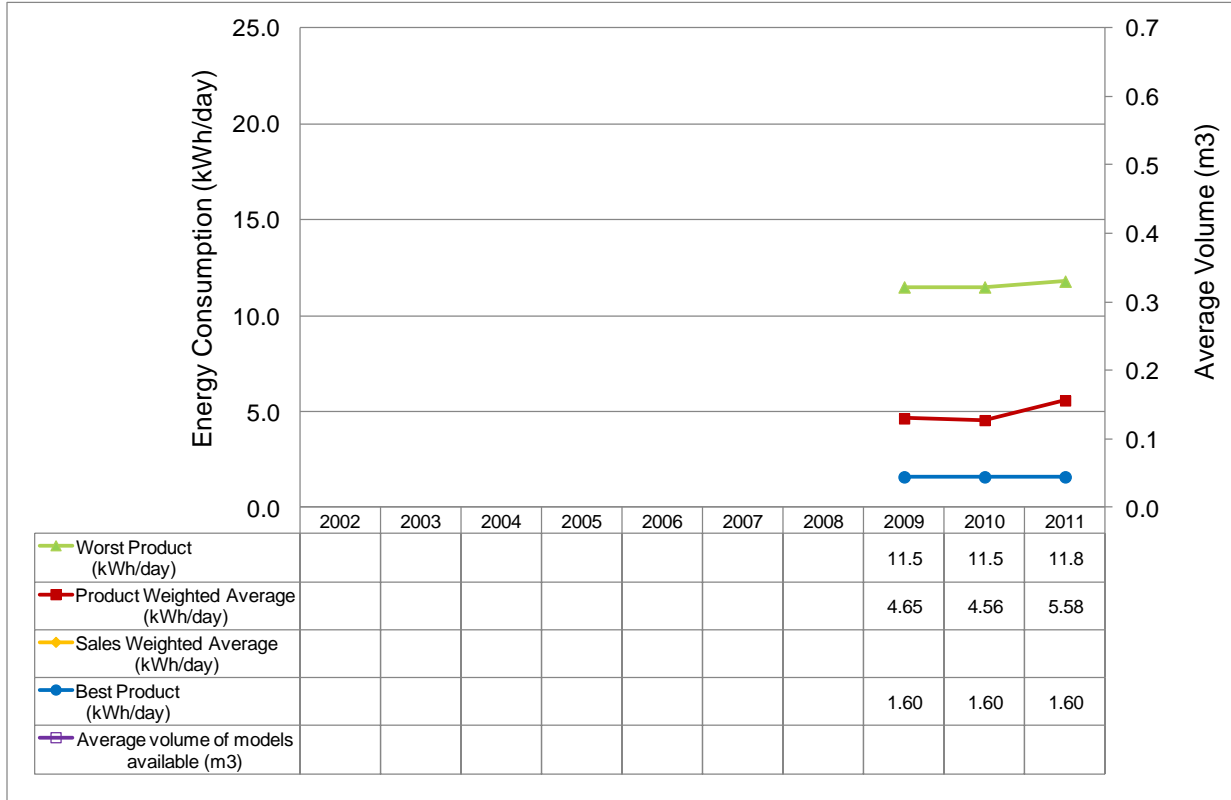
Energy consumption of new chilled retail display cabinets United Kingdom – UK Test House data set



Key notes on Graph (see notes section 1)

- Products covered are self-contained (integral) vertical chilled cabinets with glass door(s). Volume is the refrigerated internal storage volume.
- Data were provided from archived laboratory test results from a UK test house. No sales data were available.
- This is a partial market data set and includes only products contracted for testing during that year at a research facility/commercial UK test house.
- See table on page 15 for the numbers of products included in each year, plus associated explanation of confidence levels in the data. Numbers of products are low and so data should be interpreted with extreme caution. Only years with 13 and more products are plotted.

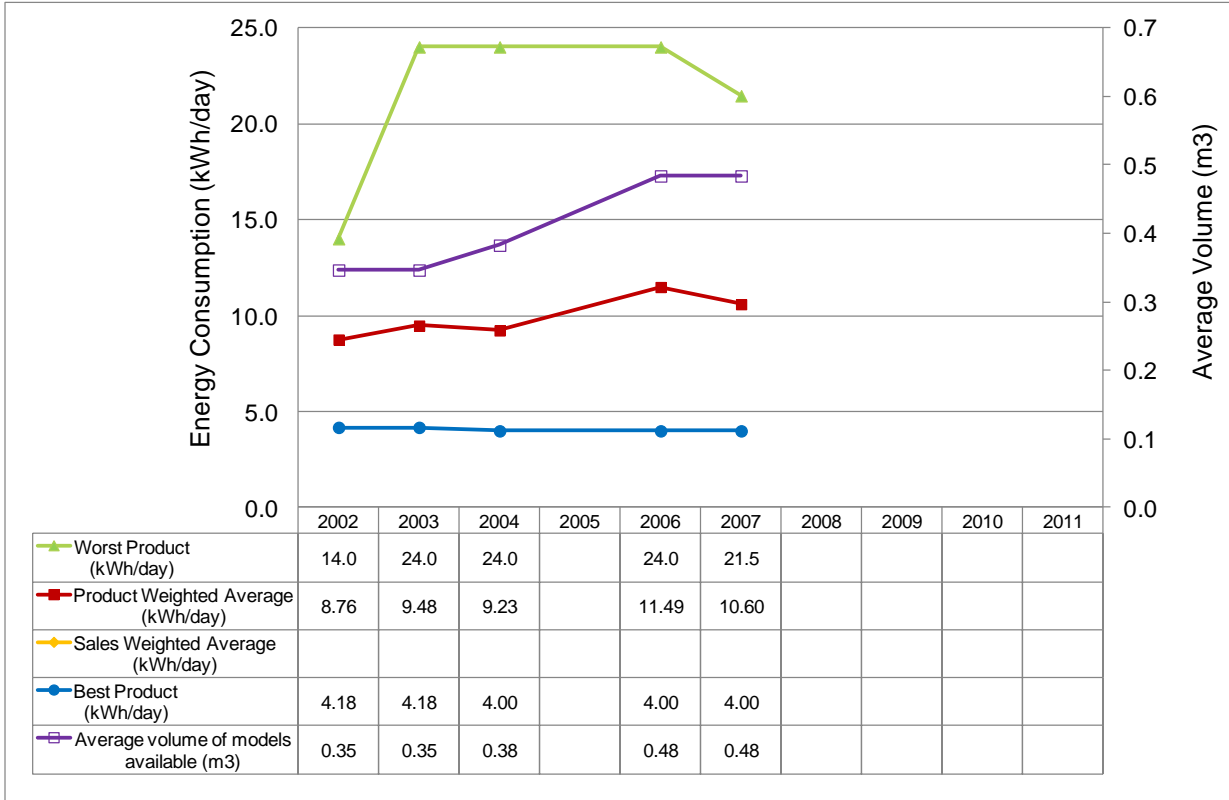
Energy consumption of new frozen retail display cabinets United Kingdom – ECA data set



Key notes on Graph (see notes section 1)

- Products covered are self-contained (integral) horizontal frozen ice cream merchandiser cabinets. Volume is the refrigerated internal storage volume.
- Data were supplied by the Enhanced Capital Allowance (ECA) Scheme managers on behalf of the Carbon Trust. No sales data were available.
- This is a partial market data set and includes products meeting the ECA Energy Technology List criteria and available for sale in each year.
- See table on page 15 for the numbers of products included in each year, plus associated explanation of confidence levels in the data. Numbers of products are low and so data should be interpreted with extreme caution. Only years with 13 and more products are plotted.

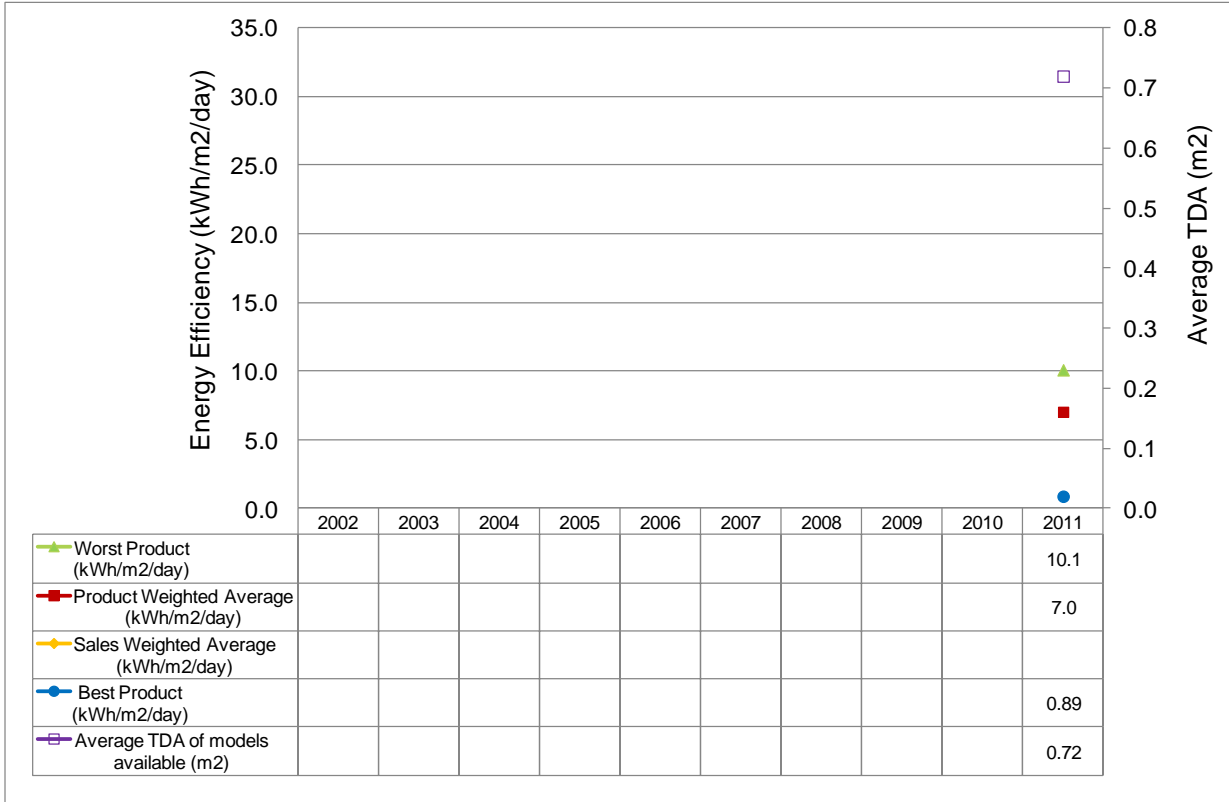
Energy consumption of new frozen retail display cabinets United Kingdom – UK Test House data set



Key notes on Graph (see notes section 1)

- Products covered are self-contained (integral) horizontal frozen ice cream merchandiser cabinets. Volume is the refrigerated internal storage volume.
- Data were provided from archived laboratory test results from a UK test house. No sales data were available.
- This is a partial market data set and includes only products contracted for testing during that year at a research facility/commercial UK test house.
- See table on page 15 for the numbers of products included in each year, plus associated explanation of confidence levels in the data. Numbers of products are low and so data should be interpreted with extreme caution. Only years with 13 and more products are plotted.

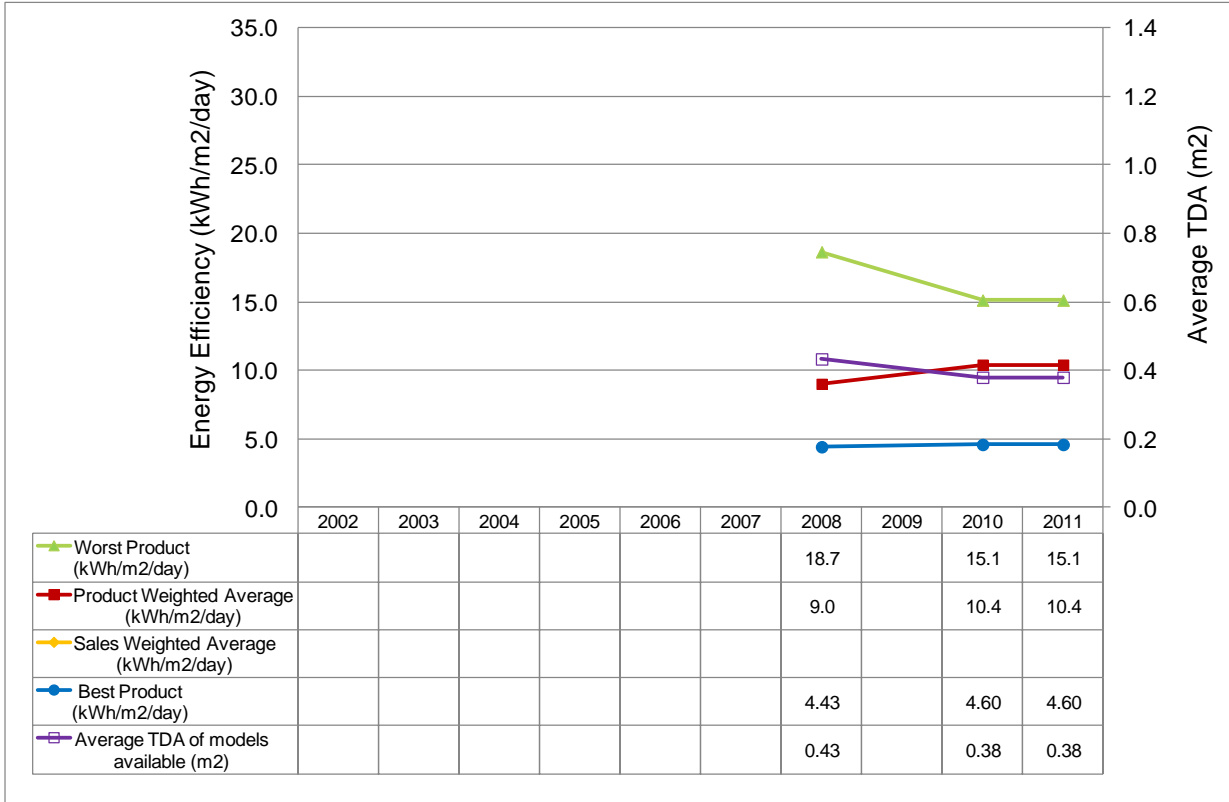
Energy efficiency of new chilled retail display cabinets United Kingdom – ECA data set



Key notes on Graph (see notes section 1)

- Products covered are self-contained (integral) vertical chilled cabinets with glass door(s). TDA is the Total Display Area, the open or glazed viewable area for food products on display, in square metres.
- Data were supplied by the Enhanced Capital Allowance (ECA) Scheme managers on behalf of the Carbon Trust. No sales data were available.
- This is a partial market data set and includes products meeting the ECA Energy Technology List criteria and available for sale in each year.
- See table on page 15 for the numbers of products included in each year, plus associated explanation of confidence levels in the data. Numbers of products are low and so data should be interpreted with extreme caution. Only years with 13 and more products are plotted.

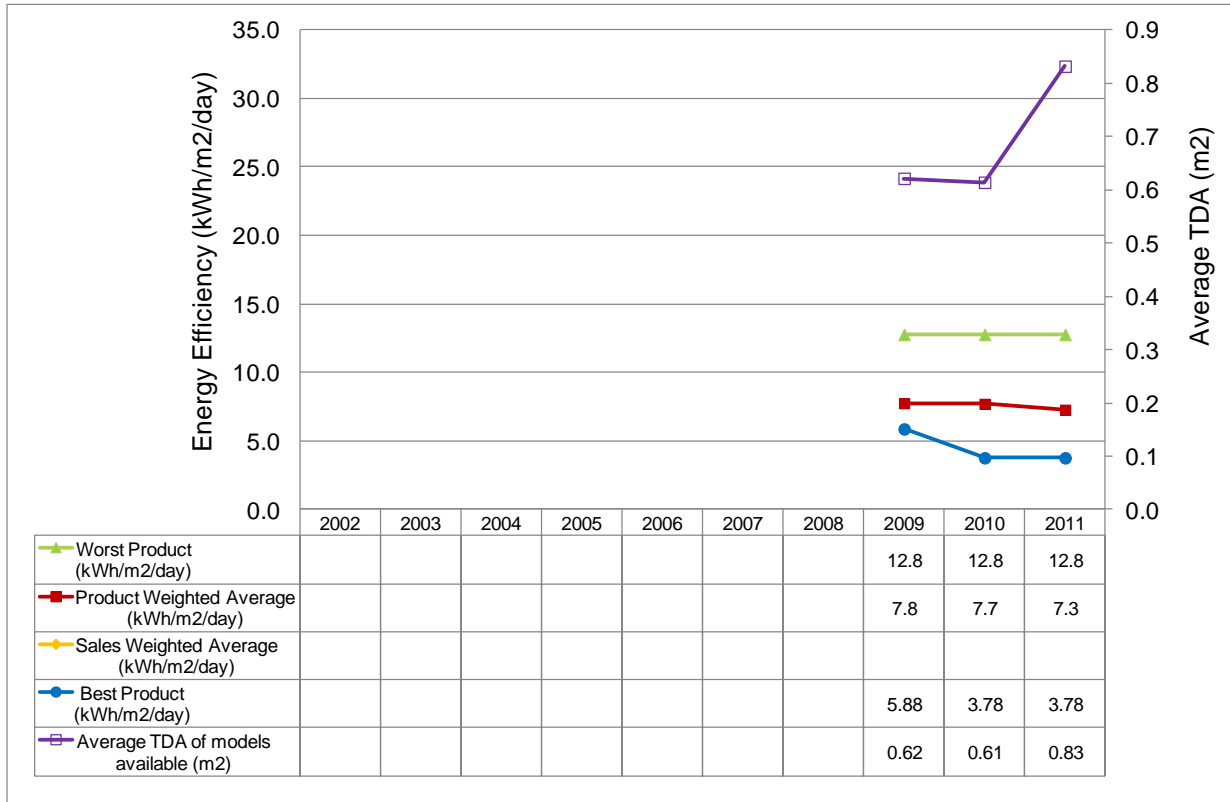
Energy efficiency of new chilled retail display cabinets United Kingdom – UK Test House data set



Key notes on Graph (see notes section 1)

- Products covered are self-contained (integral) vertical chilled cabinets with glass door(s). TDA is the Total Display Area, the open or glazed viewable area for food products on display, in square metres.
- Data were provided from archived laboratory test results from a UK test house. No sales data were available.
- This is a partial market data set and includes only products contracted for testing during that year at a research facility/commercial UK test house.
- See table on page 15 for the numbers of products included in each year, plus associated explanation of confidence levels in the data. Numbers of products are low and so data should be interpreted with extreme caution. Only years with 13 and more products are plotted.

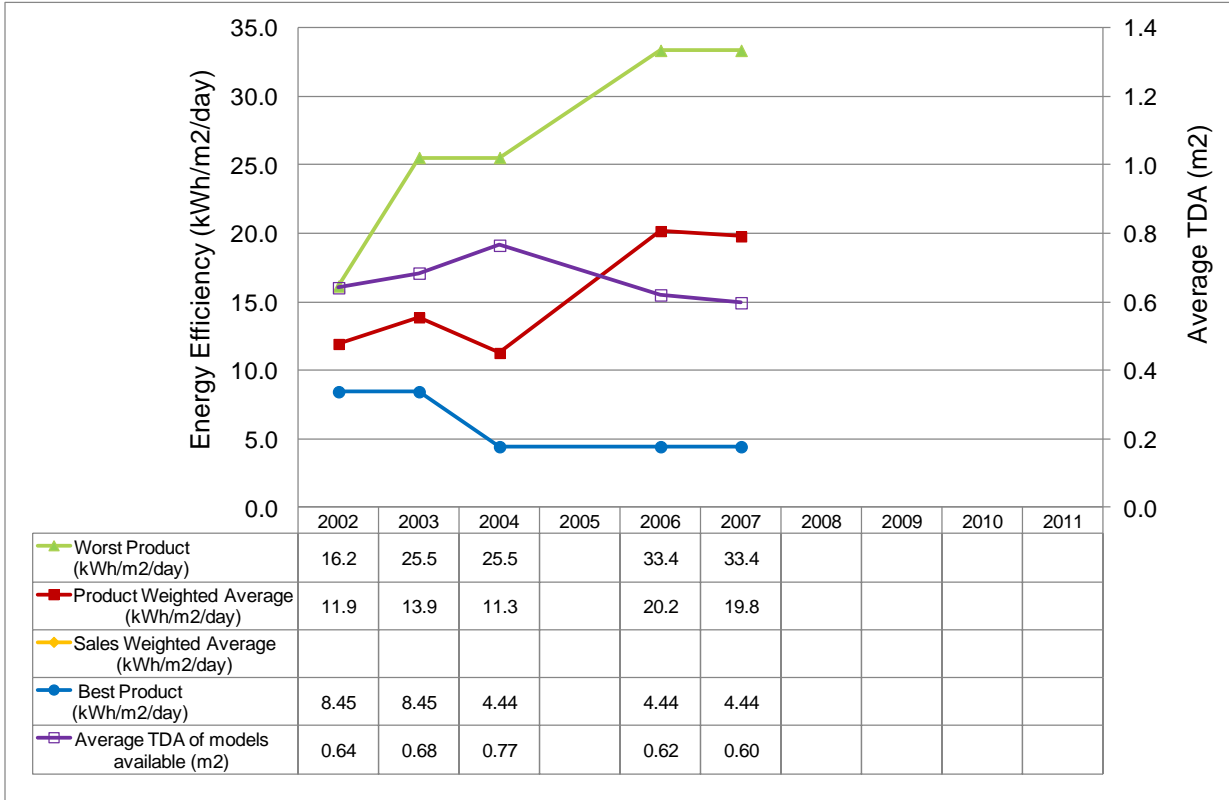
Energy efficiency of new frozen retail display cabinets United Kingdom – ECA data set



Key notes on Graph (see notes section 1)

- Products covered are self-contained (integral) horizontal frozen ice cream merchandiser cabinets. TDA is the Total Display Area, the open or glazed viewable area for food products on display, in square metres.
- Data were supplied by the Enhanced Capital Allowance (ECA) Scheme managers on behalf of the Carbon Trust. No sales data were available.
- This is a partial market data set and includes products meeting the ECA Energy Technology List criteria and available for sale in each year.
- See table on page 15 for the numbers of products included in each year, plus associated explanation of confidence levels in the data. Numbers of products are low and so data should be interpreted with extreme caution. Only years with 13 and more products are plotted.

Energy efficiency of new frozen retail display cabinets United Kingdom – UK Test House data set



Key notes on Graph (see notes section 1)

- Products covered are self-contained (integral) horizontal frozen ice cream merchandiser cabinets. TDA is the Total Display Area, the open or glazed viewable area for food products on display, in square metres.
- Data were provided from archived laboratory test results from a UK test house. No sales data were available.
- This is a partial market data set and includes only products contracted for testing during that year at a research facility/commercial UK test house.
- See table on page 15 for the numbers of products included in each year, plus associated explanation of confidence levels in the data. Numbers of products are low and so data should be interpreted with extreme caution. Only years with 13 and more products are plotted.

Total energy consumption in the existing retail display cabinets stock - United Kingdom

Key notes on Graph (See Notes Section 3)

- No time series data on the total energy consumption of these types of retail display cabinets in the existing stock were made available to the Annex at the time of publication.
- However, UK Government publications² estimated that all integral retail display cabinets (which include products outside the scope of this analysis) consumed 4,650 GWh in the UK in 2009 with a stock of 582,000 units.

² BNCR RDC02: Refrigerated Display Cases Government Standards Evidence Base 2009: Reference Scenario, version 1.1, June 2010. Available from <http://efficient-products.defra.gov.uk/product-strategies/viewall/briefing-note>

Major Policy Interventions (See notes Section 4)

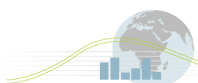
There are no policies Europe-wide affecting refrigerated display cabinets, although these products have been the subject of an eco-design preparatory study for the European commission³. No draft implementing measures arising from that study had been made available at August 2011.

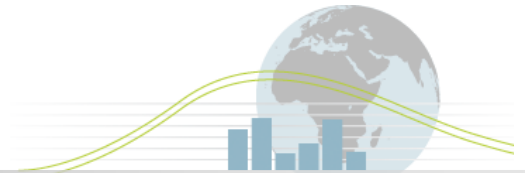
One UK government policy is directly aimed at increasing market penetration of highly efficient retail display cabinets, amongst other commercial and industrial products: the Carbon Trust's Enhanced Capital Allowances Scheme⁴ provides access to tax breaks for businesses buying products listed on the Energy Technology List. The criteria for display cabinets cover both integral (self-contained) and remote products with thresholds set in the format of energy efficiency indices of energy consumption per 24 hours per unit display area (TEC/TDA, kWh/day/m²). Separate thresholds are set for remote and integral units, and thresholds vary according to storage temperature and not according to product sub-type. Cabinets must be tested to BS EN ISO 23953-2:2005. The criteria aim to distinguish products at the top 25% of the market for energy efficiency.



³ European Commission DG TREN Preparatory Studies for Eco-design Requirements of EuPs [TREN/D1/40-2005/LOT12/S07.56644] Lot 12, Commercial refrigerators and freezers, Final Report December 2007. See http://www.ecofreezercom.org/documents_1.php (this Internet site is focused on the subsequent Lot 1 study, but the Lot 12 final report is made available there).

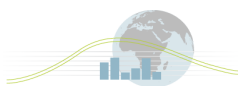
⁴ See <http://etl.decc.gov.uk/etl>





Cultural Issues (See Notes Section 5)

- No information available.



Notes on data

Section 1: Notes on Product Consumption

1.1 Test methodologies, Performance Standards and Labelling Requirements

Two test methodologies are relevant to the UK dataset:

- ISO 23953-1:2005 Refrigerated display cabinets -- Part 1: Vocabulary used in conjunction with ISO EN 23953 Refrigerated display cabinets -- Part 2: Classification, requirements and test conditions. This international standard is the basis of test methodologies in Europe, Australia and China.
- BS EN441 (superseded by ISO EN23953 in 2005).

Whilst very similar in most respects, ISO 23953 and EN441 differ on their requirements for door openings during test. In addition, both of these test methodologies allow the same wide range of different storage temperatures and ambient conditions during test for which a range of adjustments to results are required to make them mutually comparable (see below).

There are no mandatory standards or labelling requirements for retail display cabinets in the UK. A voluntary scheme to recognise the most efficient products, under the Enhanced Capital Allowances Scheme, is described in the major policy Interventions section above.

1.2 Product Consumption Graphic

The chosen metric for consumption for both frozen and chilled cabinets is kWh per day.

Data sources and data cleaning

There were 2 sources for the data used in this analysis:

- a) A dataset of products registered on the Carbon Trust's Energy Technology List⁵. This data set was provided by the scheme managers and included data on 102 cabinets covering 2007 to 2011. The data set used included more supplementary detail for products than is published on the Carbon Trust web site which enabled the full analysis to be carried out. Data included other than energy consumption were basic cabinet type, total display area (TDA), storage temperature, whether doors are glazed or solid. This dataset is only representative of the best products on the market as the scheme aims to differentiate the top 25% of the market by energy efficiency.
- b) A dataset accumulated by a UK test house through many years of product testing of a wide range of cabinets types. This included performance data on 75 cabinets covering 1997 to 2010. Data were provided with brand and model details deleted but otherwise mostly with a comprehensive set of product characteristics and test method details. The dataset includes a reasonable range of different product

⁵ The public database can be interrogated at <http://etl.decc.gov.uk/etl/find/>

efficiencies but does not include any products unable to reach the necessary temperature requirements of testing which are nevertheless available on the market. Due to the low numbers of products in many years and product subtypes, this dataset also cannot be considered fully representative of the market.

The databases were filtered to only include products meeting the scope of analysis. In some cases where descriptive data were incomplete, assumptions were made as to whether a product was in or out of scope. The following product types were deleted from the data sets:

- Products with opaque doors and drawer units
- Refrigerated (chilled) products without doors
- Combination refrigerator/freezer units
- All freezer units higher than 1m (cannot be horizontal units)⁶
- All upright/vertical freezer units.

In order to have data sets that better represent products available on the market (as opposed to the more limited set of products for which ECA applications were registered in that year, or the year in which products were tested), it was assumed that products would continue to be available for four years after first registration. I.e. products would be carried forward to four successive years after first registration. This resulted in the product numbers shown in the table below.

Some years in these datasets had very few products including. Attempts were made to quantify the confidence levels associated with averages from those small datasets. This was done through statistical analysis of the variance present in a much larger dataset of comparable products - the Australian dataset of over 570 products was used for this. The results were that datasets with 14 products included would result in an average performance for the market that we could be 95% sure was within +/- 45% of the actual 'market' average. This was chosen as the threshold but with significant warnings associated with most of the remaining data.

Years for which 13 or less products are available in any category were not plotted on the graphs in this document. It must also be borne in mind that the averages from the ECA dataset will not be whole market averages but of the top 30% or so of the market; and also the UK test house dataset does not include poorest performing products (which would have failed the temperature requirements of test). ***These datasets should be interpreted with extreme caution.***

No sales data were available for any products and so data are only product-weighted.

⁶ This filter criterion is imperfect as it allows through vertical frozen cabinets less than 1m high. For example some under counter frozen units could end up in the analysed data set with horizontal ice cream merchandisers. The number of misplaced cabinets is not expected to significantly distort the results.

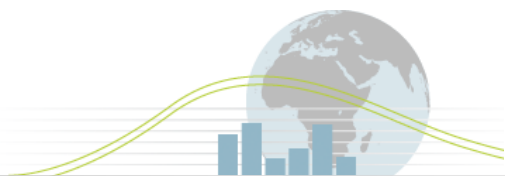


Table of final number of products analysed in each year (including products carried forward from previous 4 years; excluding products deemed out of scope and with partial or dubious data). Datasets in brackets were eliminated from the graphs in this document.

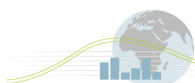
	Frozen horizontal (ice cream) cabinets		Chilled vertical glass door cabinets	
	ECA data set	UK Test house data set	ECA data set	UK Test house data set
1997	-	(3)	-	-
1998	-	(9)	-	-
1999	-	(9)	-	-
2000	-	(13)	-	-
2001	-	17	-	-
2002	-	20	-	(1)
2003	-	21	-	(6)
2004	-	21	-	(6)
2005	-	14	-	(8)
2006	-	15	-	(13)
2007	(3)	14	(1)	(8)
2008	(3)	(12)	(5)	14
2009	45	(12)	(9)	(12)
2010	53	(3)	(12)	14
2011	72	(3)	26	14
All years	176	186	53	96

Normalisation of data for mapping

This document includes below only a brief summary of the adjustments made to these data to render them mutually comparable for mapping. For details on the background to these adjustments, and on the wider adjustment is made for benchmarking purposes, see the separate document *'Product Normalisation Methodology: Integral Refrigerated Retail Display Cabinets'*.

The following aspects required adjustment (normalisation) for mapping analysis:

- 1) Door openings: the door opening regime of ISO23953 was adopted as the basis for comparison. Hence, products tested to (or assumed to have been tested to) EN 441 had their energy consumption/efficiency figures reduced by 3.9% to compensate for the slightly longer period of test with the door open (derived from empirical data).
- 2) Lighting regime: the lighting regime of ASHRAE 72 (24-hour lighting) was adopted as the basis for comparison. Hence, products tested to EN 441 and ISO 23953 (12 hour



lighting) had their energy consumption/efficiency figures increased. The size of increase would ideally be estimated from the lighting wattage and type when known, otherwise presence or not of lighting and its wattage and the necessary factors are estimated from empirical evidence.

- 3) Storage temperature during test: EU/UK standards allow a range of different storage temperatures for different food stuffs, several of which were used variously in the test results. Chilled cabinet data were normalised to an assumed storage temperature of 5.5°C which is the typical average temperature achieved with the EU temperature classes H1 and H2; frozen cabinets were normalised to a storage temperature of -26°C which is the average temperature under EU temperature class L1.
- 4) Ambient temperature and humidity during test: EU/UK standards allow a range of ambient test conditions, called temperature classes. Temperature class 3 was adopted as the basis for comparison, and all cabinets tested in classes 2, 3 and 4 had their data adjusted. Any cabinets tested at classes significantly different to the target temperatures for the products in scope (classes 0, 1, 5, 6, 7, 8) were rejected (i.e. they were assumed not to be of the required type and no evidence was available to make the adjustment).

No other factors were subject to normalisation.

Section 2: Notes on Product Efficiency

2.1 Test methodologies, Performance Standards and Labelling Requirements

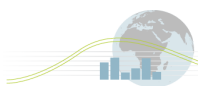
Test methodologies, standards and labelling apply to efficiency exactly as for product consumption above.

2.2 Product Efficiency Graphic

The ECA data set contained only total display area (TDA) data for cabinets. The UK test house data set contained a mix of TDA and internal volume data, some cabinets had both fields completed, some one or the other: For chilled cabinets all had TDA data but no more than 40% had volume data in any year; for frozen cabinets an average of 80% had TDA data in any year (including 100% in 9 of the 15 years) and an average of less than 70% had volume data. Overall it was decided to focus on TEC/TDA for the efficiency of both UK data sets.

Note that volumetric efficiency (kWh/cubic metre) data were available for 128 UK products (including products carried over from previous years).

The data sets used for efficiency analysis were exactly the same as for product consumption above.



Section 3: Notes on Consumption of Stock

No further information available.

Section 4: Notes on Policy Interventions

No further information available.

Section 5: Notes on Cultural Issues

No further information available.