

Country: Denmark

Technology: Domestic refrigerated appliances

Sub Category: Refrigerators, refrigerator-freezers and freezers

## 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. 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:

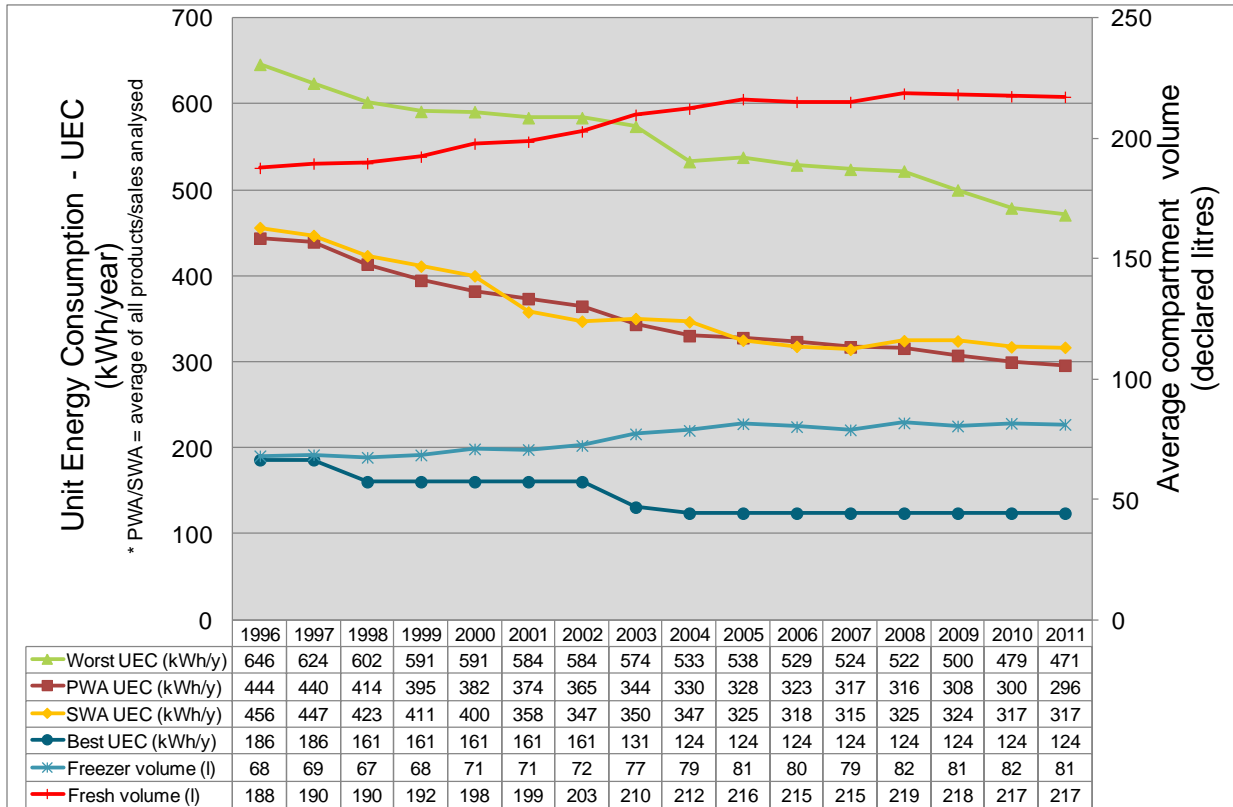
M&B Category	Description
<b>Refrigerator only and refrigerators with freezer compartments</b>	The primary compartment is for fresh storage in the temperature range $5^{\circ}\text{C} \geq T > 0^{\circ}\text{C}$ and <ul style="list-style-type: none"> <li>• The unit has no freezer compartment, or</li> <li>• The unit has a freezer compartment of any temperature rating but a volume of less than 14 litres, or</li> <li>• The unit has a frozen food compartment of any volume that is rated as <math>0^{\circ}\text{C} \geq T &gt; -15^{\circ}\text{C}</math></li> </ul>
<b>Refrigerator/Freezer</b>	The primary compartment for fresh storage in the temperature range $5^{\circ}\text{C} \geq T > 0^{\circ}\text{C}$ and the primary frozen food compartment is greater than 14 litres and has a rated temperature $T \leq -15^{\circ}\text{C}$
<b>Freezer only</b>	A unit where <i>all</i> compartments have a temperature rating $T \leq -15^{\circ}\text{C}$

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

<http://mappingandbenchmarking.iea-4e.org/matrix?type=product&id=13>



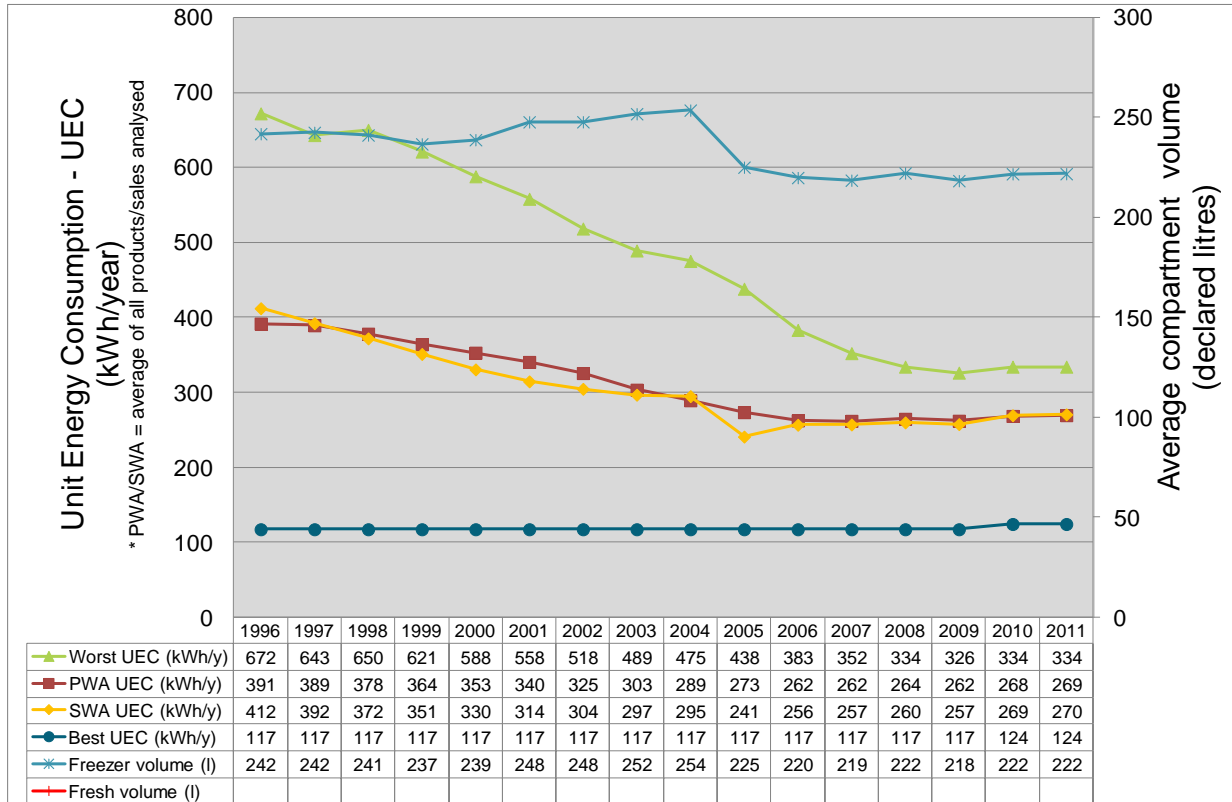
## Unit Energy Consumption of new refrigerator freezers in Denmark



### Key notes on Graph (see notes section 1)

- Sales weighted average uses a combination of product level performance information and sales data split by EU energy label.
- All volumes shown are sales weighted averages.
- The 'Worst UEC' is the UEC of the product at the 'worst 5%' point of a ranked list of products in the dataset.

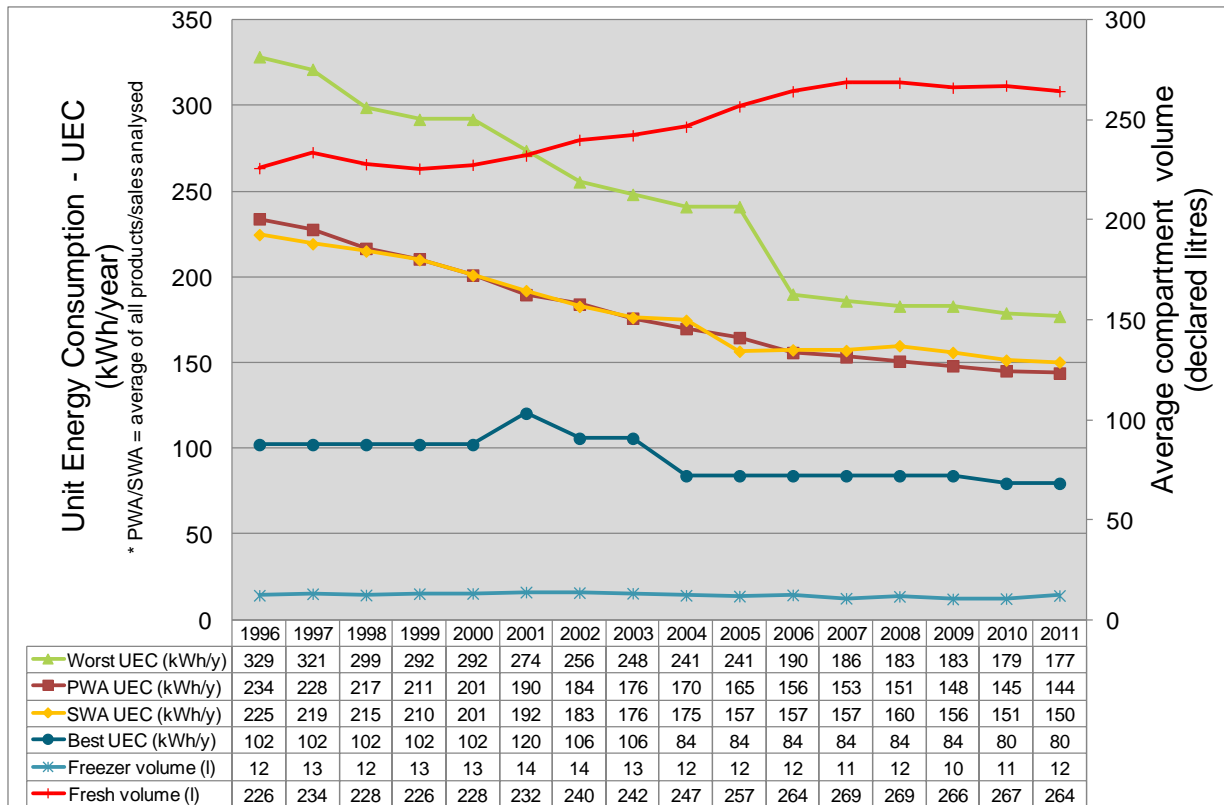
## Unit Energy Consumption of new freezers in Denmark



### Key notes on Graph (see notes section 1)

- Sales weighted average uses a combination of product level performance information and sales data split by EU energy label.
- All volumes shown are sales weighted averages.
- The 'Worst UEC' is the UEC of the product at the 'worst 5%' point of a ranked list of products in the dataset.

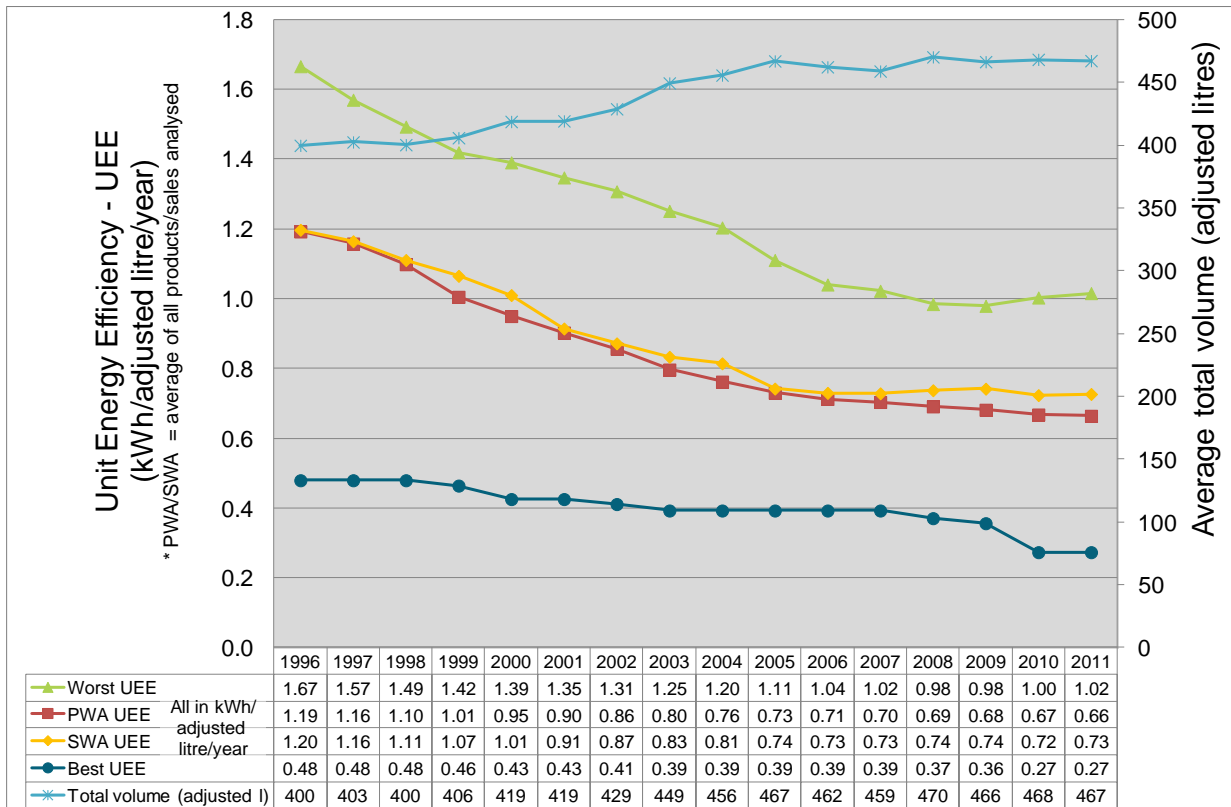
## Unit Energy Consumption of new refrigerators and refrigerators with freezer compartments in Denmark



### Key notes on Graph (see notes section 1)

- Sales weighted average uses a combination of product level performance information and sales data split by EU energy label.
- All volumes shown are sales weighted averages.
- The 'Worst UEC' is the UEC of the product at the 'worst 5%' point of a ranked list of products in the dataset.

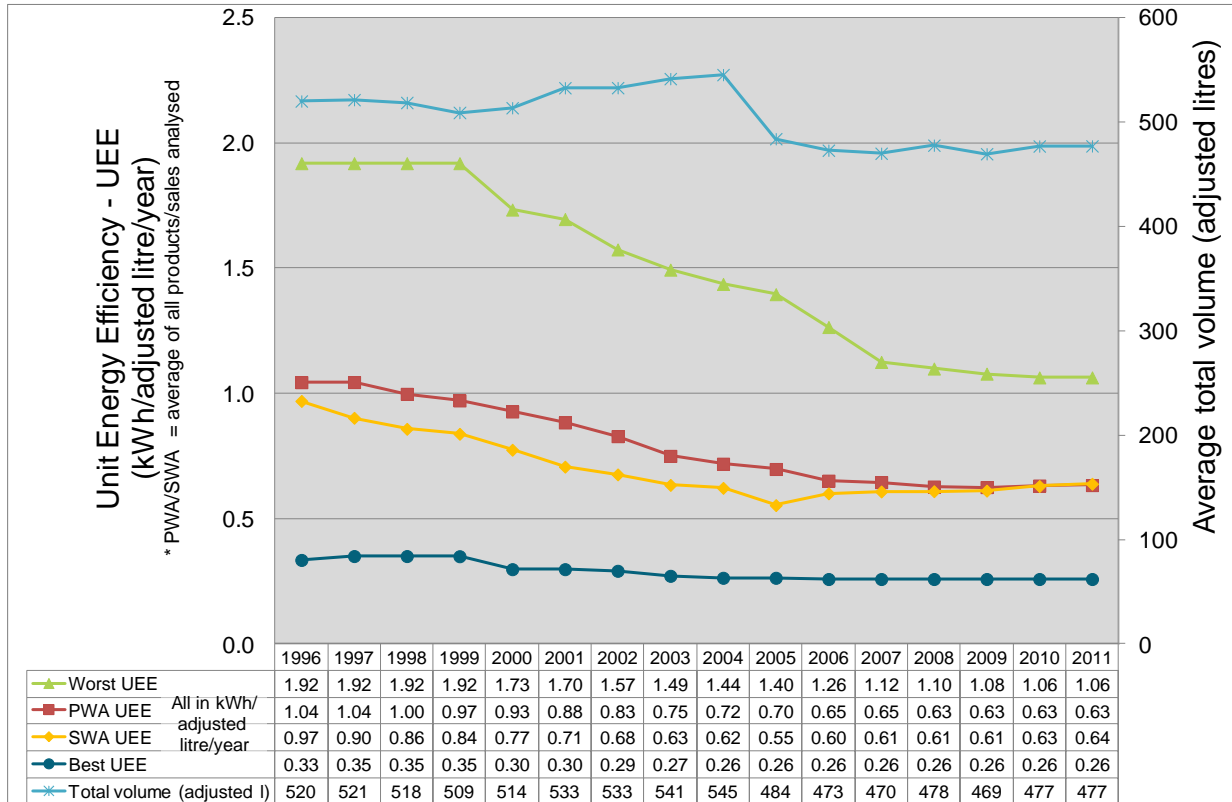
## Unit Energy Efficiency of new refrigerator freezers in Denmark



### Key notes on Graph (see notes section 1)

- Sales weighted average uses a combination of product level performance information and sales data split by EU energy label.
- The average total volumes shown (adjusted litres) are calculated using the temperatures and a slightly modified version of the volume adjustment method defined in EU/regulations. The average unit energy efficiency (UEE) is then calculated using these total adjusted volumes.
- All volumes shown are sales weighted averages.
- The 'Worst UEE' is the UEE of the product at the 'worst 5%' point of a ranked list of products in the dataset.

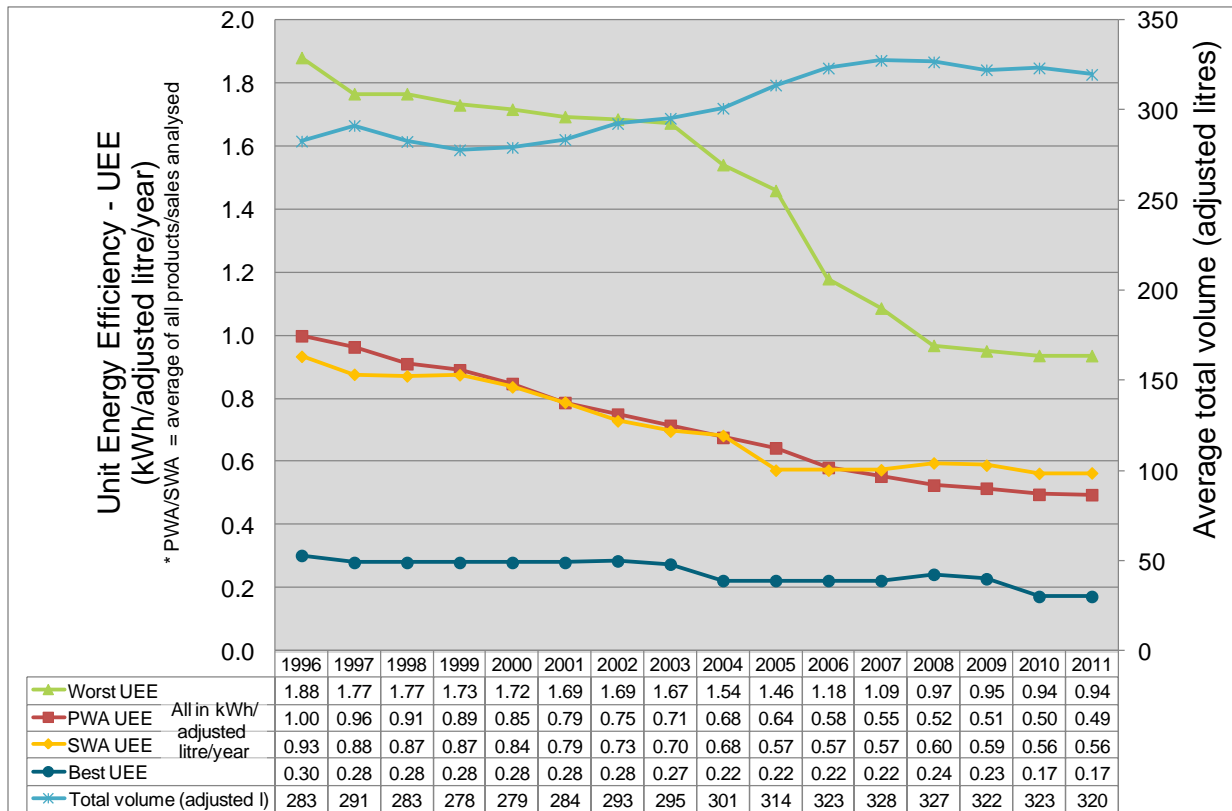
## Unit Energy Efficiency of new freezers in Denmark



### Key notes on Graph (see notes section 1)

- Sales weighted average uses a combination of product level performance information and sales data split by EU energy label.
- The average total volumes shown (adjusted litres) are calculated using the temperatures and a slightly modified version of the volume adjustment method defined in EU/regulations. The average unit energy efficiency (UEE) is then calculated using these total adjusted volumes.
- All volumes shown are sales weighted averages.
- The 'Worst UEE' is the UEE of the product at the 'worst 5%' point of a ranked list of products in the dataset.

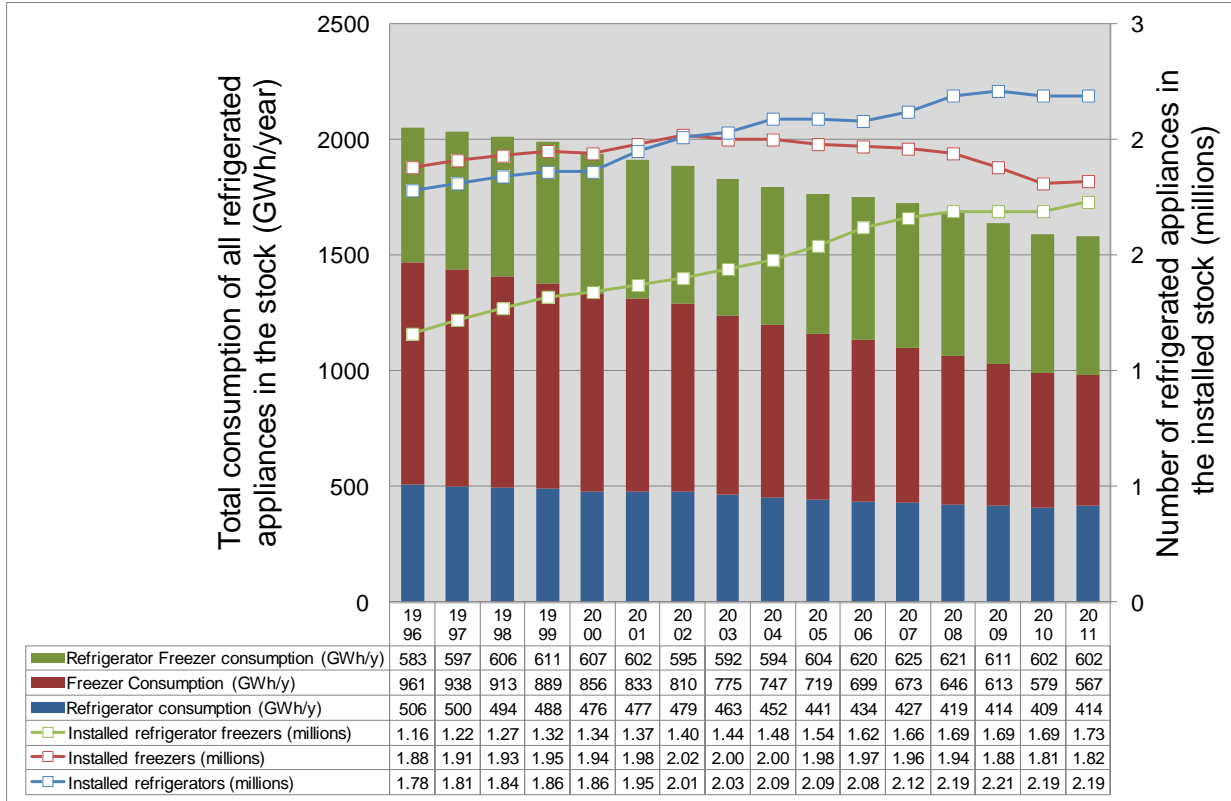
## Unit Energy Efficiency of new refrigerators and refrigerators with freezer compartments in Denmark



### Key notes on Graph (see notes section 1)

- Sales weighted average uses a combination of product level performance information and sales data split by EU energy label.
- The average total volumes shown (adjusted litres) are calculated using the temperatures and a slightly modified version of the volume adjustment method defined in EU/regulations. The average unit energy efficiency (UEE) is then calculated using these total adjusted volumes.
- All volumes shown are sales weighted averages.
- The 'Worst UEE' is the UEE of the product at the 'worst 5%' point of a ranked list of products in the dataset.

## Energy Consumption of the installed stock of refrigerated appliances in Denmark



### Key notes on Graph (see notes section 2)

- Data derived from the Danish stock model ELMODEL-domestic.



## Major Policy Interventions (see notes section 3)

Policy intervention in the refrigerated appliance market in Denmark is a combination of EU wide activities and those conducted on the national level.

### EU Wide Regulations:

Policy name	Period in force	Description	Impact <i>Relative impact of policy</i>
EC Energy Label <sup>1</sup>	1995 – 2010	Defines A to G efficiency classes	All domestic refrigeration appliances to be labelled – improvement in the average efficiency over time
EC MEPS (EuP) <sup>2</sup>	1999 – (July) 2010	Limit sales to A, B, C class, plus D & E for chest freezers	All domestic refrigeration - improvement in the average efficiency over time
Industry Commitment <sup>3</sup>	2002 - 2010	CECED commitment: only B or better (except chest freezers) on market by end 2004	Improvement in the average efficiency over time
EC Energy Label <sup>4</sup>	2004-2010	Defines A+ and A++ classes	All domestic refrigeration - improvement in the average efficiency over time
EC MEPS (EuP) <sup>5</sup>	July 2010  July 2012	Limits sales to products to those reaching at least A class.  Limits sales to products attaining at least A+ class. (note that the maximum EEI requirement for A+ is lowered in 2014)	All domestic refrigeration - improvement in the average efficiency over time

<sup>1</sup> [www.legislation.hmso.gov.uk/si/si1994/Uksi\\_19943076\\_en\\_1.htm](http://www.legislation.hmso.gov.uk/si/si1994/Uksi_19943076_en_1.htm).

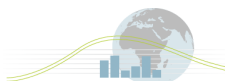
<sup>2</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1996:236:0036:0043:EN:PDF>

<sup>3</sup> "Voluntary commitment of reducing energy consumption of household refrigerators, freezers and their combinations (2002-2010)" 31<sup>st</sup> October 2002.

<http://www.ceced.eu/ICECED/easnet.dll/ExecReq/Redirection?eas:oldfilename=/community/files/296/phpXLy1ow/UICCOLD2002.pdf>

<sup>4</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:170:0010:0014:EN:PDF>

<sup>5</sup> Directive 96/57/EC repealed and replaced by Regulation 2009/643/EC <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:191:0053:0068:EN:PDF>



Policy name	Period in force	Description	Impact <i>Relative impact of policy</i>
EC Energy Label <sup>6</sup>	2011-	Introduces new labelling format and the introduction of A+++. Also slightly revises EEI definition of A+.	All domestic refrigeration - improvement in the average efficiency over time

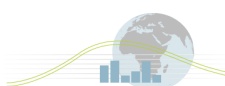
**Danish National Policy Intervention:**

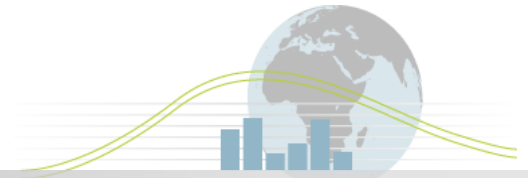
From the late 1990s, the Danish Energy Saving Trust (DEST) has been promoting efficient white goods, including supporting some subsidy programmes by Danish utilities. Over the period, it is believed A-labelled appliances have entered the market earlier than would have been the case without this market stimulation.

Especially the A++ campaign in autumn 2005, where a subsidy of 1000 DKR per sold A++ chest freezer, made a significant impact on the sales distribution, documented by data from the importer of white goods association in Denmark, FEHA.

Also, there have been a series of more informative campaigns, e.g. “Cheapest in the long run”, aiming at general information and promotion of DEST’s own label.

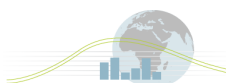
<sup>6</sup>Directive 94/2/EC repealed and replaced by Regulation 1060/2010 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:314:0017:0046:EN:PDF>





## Cultural Issues (see notes section 4)

No Information provided.



## Section 1. Unit Energy Consumption and Unit Energy Efficiency Graphics

### 1.1 Test methodologies, Performance Standards and Labelling Requirements

Energy consumption is claimed according to the requirements of the EC energy label and the appropriate energy efficiency class allocated according to the calculations given in the energy label directives.

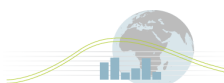
The test standard for EC energy labelling is EN 153 which calls upon the EN ISO 15502.

Test Standard name	Date in force	Description	Comments
EN 153:2005  Methods of measuring the energy consumption of electric mains operated household refrigerators, frozen food storage cabinets, food freezers and their combinations, together with associated characteristics.	2005	Energy, temperature and volume of all types of domestic cold appliances are measured in accordance with test standard (BS) EN 153 and used for energy label declarations.  EN 153 refers to EN ISO 15502:2005	Supersedes EN 153:1995 (withdrawn 30 June 2008). Although there is some debate as to which test standard is currently valid under UK law.
EN ISO 15502: 2005  Household refrigerating appliances, refrigerator freezers – characteristics and test methods.	2005	Defines characteristics and test methods	Prior to this standard there were four test standards for each of the main refrigerating appliance types

Specific information:

#### External/ambient test temperature

25 ± 0.5°C (Deviations from 25°C within ± 0.5°C are corrected in accordance with EN 153:2006 Clause 15.2.1.)



## Internal temperatures for the appliances

<ul style="list-style-type: none"> <li>Fridge compartment</li> </ul>	Mean temp of +5°C (no tolerance because in general, the energy consumption at this temp is obtained by interpolation.)
<ul style="list-style-type: none"> <li>Freezers (0-2 Star)</li> </ul>	Various classifications incorporating temperature ranges from +3 to -18°C
<ul style="list-style-type: none"> <li>Freezer compartment (3 or 4 star compartment)</li> </ul>	-18°C or colder

### 1.2 Product Classifications

(Source: COMMISSION REGULATION (EC) No 643/2009<sup>7</sup>)

Group	Description
1	Refrigerator with one or more fresh-food storage compartments
	Refrigerator-cellar, cellar and wine storage appliance
3	Refrigerator-chiller and refrigerator with a 0-star compartment
4	Refrigerator with a 1-star compartment
5	Refrigerator with a 2-star compartment
6	Refrigerator with a 3-star compartment
7	Refrigerator-freezer
8	Upright freezer
9	Chest freezer
10	Multi-use and other appliances

### 1.3 Data sources and limitations

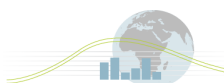
Sources:

Sales data comes from FEHA - The Danish Association for Suppliers of Electrical Domestic Appliances.

Product data comes from ELDA. ELDA is a governmental database that collects full datasets of product information for the complete Danish market of white goods based on manufactures product information.

The number of models and sales analysed by product category are presented in the tables below.

<sup>7</sup> Directive 96/57/EC repealed and replaced by Regulation 2009/643/EC <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:191:0053:0068:EN:PDF>



## Refrigerator freezers:

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Products in dataset	513	543	588	652	767	862	943	1083	1116	1209	1233	1337	1418	1455	1769	1525
Products analysed	510	540	585	649	765	860	939	1079	1112	1205	1231	1335	1416	1453	1767	1523
% products included	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Sales in dataset	128,185	135,332	138,076	149,845	140,475	154,641	157,068	155,120	169,724	169,038	173,002	168,165	152,611	140,077	142,865	143,313
Sales analysed	127,372	134,553	137,354	149,156	140,057	154,496	156,950	154,867	169,096	168,665	172,462	167,951	152,027	139,038	142,050	141,681
% Sales included	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%

## Freezers:

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Products in dataset	373	362	404	407	436	459	501	618	676	653	633	697	736	740	923	750
Products analysed	367	356	399	404	433	456	498	615	673	650	630	694	733	737	920	747
% products included	98%	98%	99%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Sales in dataset	81,241	92,355	94,455	95,590	89,600	94,500	94,050	86,723	102,559	101,899	91,525	87,993	81,017	75,024	66,911	66,911
Sales analysed	80,099	91,254	93,675	95,126	89,241	94,189	93,788	86,565	102,321	101,776	91,018	87,632	80,091	71,763	66,330	66,266
% Sales included	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	99%	100%	99%	96%	99%	99%

## Refrigerators and refrigerators with freezer compartments:

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Products in dataset	309	316	352	344	391	431	469	506	520	516	556	615	641	651	806	699
Products analysed	303	310	348	340	387	427	465	502	516	512	552	611	637	647	802	695
% products included	98%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	100%	99%
Sales in dataset	79,981	93,059	89,303	94,755	82,925	88,059	96,232	92,718	101,747	96,812	112,886	102,638	95,405	84,000	79,523	79,075
Sales analysed	78,979	92,093	88,685	94,092	82,358	87,600	95,877	92,387	100,857	96,458	111,150	101,762	92,673	80,264	77,429	76,507
% Sales included	99%	99%	99%	99%	99%	99%	100%	100%	99%	100%	98%	99%	97%	96%	97%	97%

## 1.4 Data manipulations and specific limitations

### 1.4.1 Overview of the mapping and benchmarking process

There are essentially 4 stages to the mapping and benchmarking process for domestic refrigerated appliances as detailed below:

Stage:	Description
1. Data Cleaning and Pre-processing	<ul style="list-style-type: none"> <li>• Removal of duplicate entries</li> <li>• Pre-processing to align all terminology and reported test values to be consistent between countries</li> <li>• Assigning of local, mapping and benchmarking and EU categories</li> <li>• Etc</li> </ul>
2. Production of mapping outputs	<ul style="list-style-type: none"> <li>• Production of mapping outputs based on local test methodologies</li> </ul>
3. Normalisation of test data	<ul style="list-style-type: none"> <li>• Calculation of adjusted volumes</li> <li>• Assignment Unit Energy Consumption to individual compartments</li> <li>• Normalisation for test temperature differentials</li> </ul>
4. Production of Benchmarking outputs	<ul style="list-style-type: none"> <li>• Post processing of benchmarking results</li> <li>• Production of benchmarking report</li> </ul>

The details of this process are described in three supporting documents that accompany this mapping report:

1. The **product definition** describes the exact characteristics of the product being analysed; the energy metrics that will be calculated; the technological, usage and other characteristics that will be considered; and any other policy or cultural information that will be collected
2. The **summary of approach** provides an overview of the mapping and benchmarking process for analyzing domestic refrigerated appliances for all countries and regions.
3. The **actions and assumptions** report details the specific steps that were necessary to allow the data submitted from a specific country or region to be included in the mapping and benchmarking process as described in the product definition and summary of approach.

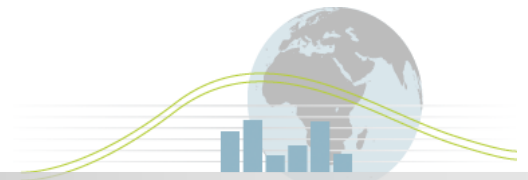
All these documents can be found at the annex website:

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

by clicking on the "X" in the matrix table that aligns with *Denmark* and *Domestic refrigerated appliances 2012*.

#### 1.4.2 *Specific cautions for this data*

Please refer to the actions and assumptions document described in Section 1.4.1.

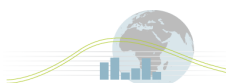


## Section 2. Energy Consumption of the installed stock of refrigerated appliances graphic

### 2.1 Data sources and limitations

Source: Danish stock model ELMODEL-domestic<sup>8</sup>.

<sup>8</sup> <http://www.ens.dk/en-US/Info/FactsAndFigures/scenarios/model/elmodel-bolig/Sider/Forside.aspx>





## Section 3. Major Policy Interventions

### 3.1 Pan-European Policy

#### 3.1.1 Mandatory Legislation:

##### **COMMISSION REGULATION (EC) No 1060/2010**<sup>9</sup>

**Program Type:** Mandatory Label

**Year Published:** 28/09/2010

**Year Effective:** 30/11/2011<sup>10</sup>

**Economy:** EU Member Countries

**Implementing Agency:** National bodies of EU member Countries

##### **Description:**

Revises energy labelling scale for domestic refrigeration appliances through the introduction of a new high efficiency class (A+++ where unit EEI<22) from 30 November 2011. The regulations also revises the maximum EEI value for A+ declarations from EEI<44 to EEI<42 from 1 July 2014.

This deregulated regulation repeals and replaces by Directive 96/57/EC.

##### **COMMISSION REGULATION (EC) No 643/2009 (implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for household refrigerating appliances)**<sup>11</sup>

**Program Type:** Mandatory Minimum Performance Standards

**Year Published:** 22/07/2009

**Year Effective:** 1 July 2010 and 1 July 2014

**Economy Affected:** EU Member Countries

**Implementing Agency:** National bodies of EU member Countries

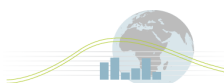
##### **Description:**

Technically this regulation repeals Directive 96/57/EC and places a requirement on national governments to enact appropriate legislation to restrict the sales of domestic refrigerated

<sup>9</sup>Directive 94/2/EC repealed and replaced by Regulation 1060/2010 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:314:0017:0046:EN:PDF>

<sup>10</sup> Implementation of some requirements delayed to 30/3/2012

<sup>11</sup> Directive 96/57/EC repealed and replaced by Regulation 2009/643/EC <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:191:0053:0068:EN:PDF>



products to those where the performance exceeds a specified energy efficiency index (EEI) as follows:

Application date	EEI	Equivalent EU Label
01 July 2010	EEI < 55	A
01 July 2012	EEI < 44	A+
01 July 2014	EEI < 42	A+ <sup>12</sup>

**In general**, other requirements laid out in the preceding directives detailed below remain the same.

**Commission Directive 2003/66/EC<sup>13</sup>**

**Program Type:** Mandatory Label

**Year Published:** 03/07/2003

**Year Effective:** 2004

**Economy:** EU Member Countries

**Implementing Agency:** National bodies of EU member Countries

**Description:**

Revises and extends the existing A-G energy labelling scale for domestic refrigeration appliances through the introduction of 2 new high efficiency classes (A+ and A++) from 1 July 2004.

This directive is the amendment of the framework directive 94/2/EC implementing Council Directive 92/75/EEC for mandatory labelling scheme, which was agreed in 1992 and cancelled the framework directive 79/530/EEC.

**Directive 96/57/EC<sup>14</sup>**

**Program Type:** Minimum Energy Performance Standard - Mandatory

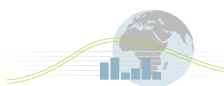
**Product:** Refrigerator-freezers

**Economy:** EU Member Countries

<sup>12</sup> Note the maximum required EEI for A+ units were reduced from 44 to 42 from 1 July 2014

<sup>13</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:170:0010:0014:EN:PDF>

<sup>14</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1996:236:0036:0043:EN:PDF>



**Year Published:** 03/09/1996

**Year Effective:** 03/09/1999

**Implementing Agency:** National bodies of EU member Countries

**Description:**

Introduces Minimum Energy Performance Standards for all domestic refrigeration types. In effect removes all products below European Label C from the market (labels D and E allowed for chest freezers).

**Commission Directive 94/2/EC<sup>15</sup>**

**Program Type:** Mandatory Label

**Year Published:** 22/09/1992

**Year Effective:** 21/01/1994

**Economy:** EU Member Countries

**Implementing Agency:** National bodies of EU member Countries

**Description:**

Introduces the EU's A-G energy label for refrigerated domestic appliances.

**3.1.2 Voluntary Initiatives**

**Voluntary Commitment on Reducing Energy Consumption of Household Refrigerators, Freezers and their Combinations<sup>16</sup>**

**Program Type:** Minimum Energy Performance Standard - Voluntary

**Product:** Refrigerator-freezers

**Economy:** EU Member Countries

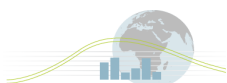
**Description:** The European Commission has pursued voluntary agreement with the European Federation of Domestic Appliance Manufacturers (CECED) to improve the energy efficiency of household refrigerating appliances.

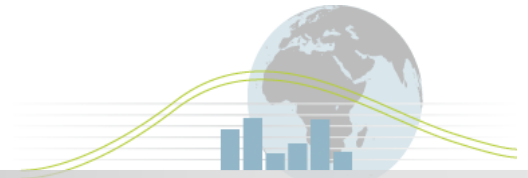
**Year Published:** 31/10/2002

<sup>15</sup> [www.legislation.hmso.gov.uk/si/si1994/Uksi\\_19943076\\_en\\_1.htm](http://www.legislation.hmso.gov.uk/si/si1994/Uksi_19943076_en_1.htm).

<sup>16</sup> "Voluntary commitment of reducing energy consumption of household refrigerators, freezers and their combinations (2002-2010)" 31<sup>st</sup> October 2002.

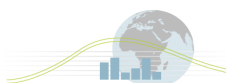
<http://www.ceced.eu/ICECED/easnet.dtl/ExecReq/Redirection?eas:oldfilename=/community/files/296/phpXLy1ow/UICCOLD2002.pdf>

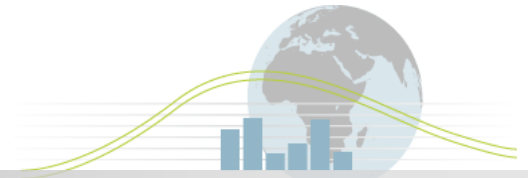




**Year Effective:** Applicable from 2002-2010

**Implementing Agency:** European Federation of Domestic Appliance Manufacturers - <http://www.ceced.org/>





## Section 4. Cultural Issues

No additional notes.

