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:

<table>
<thead>
<tr>
<th>M&amp;B Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerator only and refrigerators with freezer compartments</td>
<td>The primary compartment is for fresh storage in the temperature range $5^\circ C \geq T &gt; 0^\circ C$ and</td>
</tr>
<tr>
<td></td>
<td>* The unit has no freezer compartment, or</td>
</tr>
<tr>
<td></td>
<td>* The unit has a freezer compartment of any temperature rating but</td>
</tr>
<tr>
<td></td>
<td>a volume of less than 14 litres, or</td>
</tr>
<tr>
<td></td>
<td>* The unit has a frozen food compartment of any volume that is</td>
</tr>
<tr>
<td></td>
<td>rated as $0^\circ C \geq T &gt; -15^\circ C$</td>
</tr>
<tr>
<td>Refrigerator/Freezer</td>
<td>The primary compartment for fresh storage in the temperature range $5^\circ C \geq T &gt; 0^\circ C$ and</td>
</tr>
<tr>
<td></td>
<td>the primary frozen food compartment is greater than 14 litres and has a rated temperature $T \leq -15^\circ C$</td>
</tr>
<tr>
<td>Freezer only</td>
<td>A unit where all compartments have a temperature rating $T \leq -15^\circ C$</td>
</tr>
</tbody>
</table>

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

http://mappingandbenchmarking.iea-4e.org/matrix?type=product&id=13
The information and analysis contained within this summary document is developed to inform policy makers. Whilst the information analysed was supplied by representatives of National Governments, a number of assumptions, simplifications and transformations have been made in order to present information that is easily understood by policy makers, and to enable comparisons with other countries. Therefore, information should only be used as guidance in general policy - it may not be sufficiently detailed nor robust for use in setting specific performance requirements. Details of information sources and assumption, simplification and transformations are contained within the document.

### 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.

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**Issue date:** December 2012
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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.
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**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.
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Issue date: December 2012

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.
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**Issue date:** December 2012

### 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.
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### 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:

<table>
<thead>
<tr>
<th>Policy name</th>
<th>Period in force</th>
<th>Description</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC Energy Label¹</td>
<td>1995 – 2010</td>
<td>Defines A to G efficiency classes</td>
<td>All domestic refrigeration appliances to be labelled – improvement in the average efficiency over time</td>
</tr>
<tr>
<td>EC MEPS (EuP)²</td>
<td>1999 – (July) 2010</td>
<td>Limit sales to A, B, C class, plus D &amp; E for chest freezers</td>
<td>All domestic refrigeration - improvement in the average efficiency over time</td>
</tr>
<tr>
<td>Industry Commitment³</td>
<td>2002 - 2010</td>
<td>CECED commitment: only B or better (except chest freezers) on market by end 2004</td>
<td>Improvement in the average efficiency over time</td>
</tr>
<tr>
<td>EC Energy Label⁴</td>
<td>2004-2010</td>
<td>Defines A+ and A++ classes</td>
<td>All domestic refrigeration - improvement in the average efficiency over time</td>
</tr>
<tr>
<td>EC MEPS (EuP)⁵</td>
<td>July 2010</td>
<td>Limits sales to products reaching at least A class.</td>
<td>All domestic refrigeration - improvement in the average efficiency over time</td>
</tr>
<tr>
<td></td>
<td>July 2012</td>
<td>Limits sales to products attaining at least A+ class. (note that the maximum EEI requirement for A+ is lowered in 2014)</td>
<td></td>
</tr>
</tbody>
</table>

Denmark
Domestic Refrigerated Appliances

The information and analysis contained within this summary document is developed to inform policy makers. Whilst the information analysed was supplied by representatives of National Governments, a number of assumptions, simplifications and transformations have been made in order to present information that is easily understood by policy makers, and to enable comparisons with other countries. Therefore, information should only be used as guidance in general policy - it may not be sufficiently detailed nor robust for use in setting specific performance requirements. Details of information sources and assumption, simplification and transformations are contained within the document.

<table>
<thead>
<tr>
<th>Policy name</th>
<th>Period in force</th>
<th>Description</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC Energy Label*</td>
<td>2011-</td>
<td>Introduces new labelling format and the introduction of A++. Also slightly revises EEI definition of A+.</td>
<td>All domestic refrigeration - improvement in the average efficiency over time</td>
</tr>
</tbody>
</table>

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.

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.

<table>
<thead>
<tr>
<th>Test Standard name</th>
<th>Date in force</th>
<th>Description</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 153:2005</td>
<td>2005</td>
<td>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</td>
<td>Supersedes EN 153:1995 (withdrawn 30 June 2008). Although there is some debate as to which test standard is currently valid under UK law.</td>
</tr>
<tr>
<td>EN ISO 15502: 2005</td>
<td>2005</td>
<td>Defines characteristics and test methods</td>
<td>Prior to this standard there were four test standards for each of the main refrigerating appliance types</td>
</tr>
</tbody>
</table>

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

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fridge compartment</td>
<td>Mean temp of +5°C (no tolerance because in general, the energy consumption at this temp is obtained by interpolation.)</td>
</tr>
<tr>
<td>Freezers (0-2 Star)</td>
<td>Various classifications incorporating temperature ranges from +3 to -18°C</td>
</tr>
<tr>
<td>Freezer compartment (3 or 4 star compartment)</td>
<td>-18°C or colder</td>
</tr>
</tbody>
</table>

1.2 Product Classifications

(Source: COMMISSION REGULATION (EC) No 643/2009⁷)

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

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.

Refrigerator freezers:

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<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Sales in dataset</td>
<td>513</td>
<td>543</td>
<td>548</td>
<td>562</td>
<td>786</td>
<td>862</td>
<td>943</td>
<td>1,283</td>
<td>1,116</td>
<td>1,200</td>
<td>1,233</td>
<td>1,337</td>
<td>1,418</td>
<td>1,455</td>
<td>1,769</td>
<td>1,525</td>
</tr>
<tr>
<td>Products analysed</td>
<td>510</td>
<td>540</td>
<td>545</td>
<td>549</td>
<td>765</td>
<td>860</td>
<td>939</td>
<td>1,079</td>
<td>1,112</td>
<td>1,205</td>
<td>1,231</td>
<td>1,335</td>
<td>1,416</td>
<td>1,453</td>
<td>1,767</td>
<td>1,523</td>
</tr>
<tr>
<td>% products included</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
<td>100%</td>
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<td>100%</td>
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</tr>
<tr>
<td>Sales in dataset</td>
<td>128,188</td>
<td>135,332</td>
<td>138,075</td>
<td>149,845</td>
<td>140,475</td>
<td>154,641</td>
<td>157,966</td>
<td>155,120</td>
<td>169,724</td>
<td>169,038</td>
<td>173,000</td>
<td>188,166</td>
<td>152,611</td>
<td>140,071</td>
<td>142,805</td>
<td>143,313</td>
</tr>
<tr>
<td>Sales analysed</td>
<td>127,372</td>
<td>134,153</td>
<td>137,354</td>
<td>149,176</td>
<td>140,057</td>
<td>154,496</td>
<td>156,395</td>
<td>154,867</td>
<td>169,096</td>
<td>168,666</td>
<td>172,462</td>
<td>167,951</td>
<td>152,027</td>
<td>139,038</td>
<td>142,030</td>
<td>141,681</td>
</tr>
<tr>
<td>% Sales included</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
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Freezers:

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</tr>
</thead>
<tbody>
<tr>
<td>Sales in dataset</td>
<td>373</td>
<td>392</td>
<td>404</td>
<td>407</td>
<td>436</td>
<td>459</td>
<td>561</td>
<td>618</td>
<td>676</td>
<td>653</td>
<td>633</td>
<td>667</td>
<td>736</td>
<td>740</td>
<td>923</td>
<td>750</td>
</tr>
<tr>
<td>Products analysed</td>
<td>367</td>
<td>385</td>
<td>399</td>
<td>404</td>
<td>433</td>
<td>468</td>
<td>515</td>
<td>567</td>
<td>593</td>
<td>630</td>
<td>694</td>
<td>733</td>
<td>737</td>
<td>909</td>
<td>741</td>
<td>741</td>
</tr>
<tr>
<td>% products included</td>
<td>99%</td>
<td>99%</td>
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<td>99%</td>
</tr>
<tr>
<td>Sales in dataset</td>
<td>81,241</td>
<td>92,355</td>
<td>94,465</td>
<td>95,540</td>
<td>95,600</td>
<td>95,904</td>
<td>95,035</td>
<td>97,263</td>
<td>102,059</td>
<td>101,899</td>
<td>101,141</td>
<td>100,199</td>
<td>87,999</td>
<td>81,017</td>
<td>75,024</td>
<td>66,911</td>
</tr>
<tr>
<td>Sales analysed</td>
<td>80,069</td>
<td>91,254</td>
<td>93,675</td>
<td>95,126</td>
<td>89,241</td>
<td>94,189</td>
<td>93,788</td>
<td>86,569</td>
<td>102,321</td>
<td>101,776</td>
<td>91,018</td>
<td>87,632</td>
<td>80,051</td>
<td>71,763</td>
<td>66,330</td>
<td>66,266</td>
</tr>
<tr>
<td>% Sales included</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
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</tr>
</tbody>
</table>

Refrigerators and refrigerators with freezer compartments:

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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Products in dataset</td>
<td>309</td>
<td>316</td>
<td>312</td>
<td>344</td>
<td>341</td>
<td>431</td>
<td>469</td>
<td>506</td>
<td>520</td>
<td>516</td>
<td>515</td>
<td>552</td>
<td>611</td>
<td>637</td>
<td>647</td>
<td>802</td>
</tr>
<tr>
<td>Products analysed</td>
<td>303</td>
<td>310</td>
<td>346</td>
<td>340</td>
<td>383</td>
<td>427</td>
<td>465</td>
<td>502</td>
<td>516</td>
<td>512</td>
<td>512</td>
<td>511</td>
<td>513</td>
<td>517</td>
<td>517</td>
<td>692</td>
</tr>
<tr>
<td>% products included</td>
<td>98%</td>
<td>98%</td>
<td>99%</td>
<td>99%</td>
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<td>99%</td>
</tr>
<tr>
<td>Sales in dataset</td>
<td>79,961</td>
<td>93,055</td>
<td>89,303</td>
<td>94,755</td>
<td>82,325</td>
<td>88,059</td>
<td>95,233</td>
<td>92,716</td>
<td>91,747</td>
<td>96,812</td>
<td>91,886</td>
<td>102,638</td>
<td>55,405</td>
<td>84,000</td>
<td>79,523</td>
<td>79,075</td>
</tr>
<tr>
<td>Sales analysed</td>
<td>78,319</td>
<td>90,035</td>
<td>89,196</td>
<td>92,292</td>
<td>85,158</td>
<td>97,000</td>
<td>91,979</td>
<td>92,287</td>
<td>100,857</td>
<td>98,466</td>
<td>111,105</td>
<td>101,762</td>
<td>95,573</td>
<td>80,364</td>
<td>79,829</td>
<td>77,509</td>
</tr>
<tr>
<td>% Sales included</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
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<td>99%</td>
<td>99%</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1. Data Cleaning and Pre-processing | • Removal of duplicate entries  
• Pre-processing to align all terminology and reported test values to be consistent between countries  
• Assigning of local, mapping and benchmarking and EU categories  
• Etc |
| 2. Production of mapping outputs | • Production of mapping outputs based on local test methodologies |
| 3. Normalisation of test data | • Calculation of adjusted volumes  
• Assignment Unit Energy Consumption to individual compartments  
• Normalisation for test temperature differentials |
| 4. Production of Benchmarking outputs | • Post processing of benchmarking results  
• Production of benchmarking report |

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](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-domestic⁸.

Section 3. Major Policy Interventions

3.1 Pan-European Policy

3.1.1 Mandatory Legislation:

COMMISSION REGULATION (EC) No 1060/2010

Program Type: Mandatory Label

Year Published: 28/09/2010

Year Effective: 30/11/2011

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.


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 appliances.


10 Implementation of some requirements delayed to 30/3/2012

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

<table>
<thead>
<tr>
<th>Application date</th>
<th>EEI</th>
<th>Equivalent EU Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 July 2010</td>
<td>EEI &lt; 55</td>
<td>A</td>
</tr>
<tr>
<td>01 July 2012</td>
<td>EEI &lt; 44</td>
<td>A+</td>
</tr>
<tr>
<td>01 July 2014</td>
<td>EEI &lt; 42</td>
<td>A+¹²</td>
</tr>
</tbody>
</table>

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

**Commission Directive 2003/66/EC¹³**

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/EC¹⁴**

Program Type: Minimum Energy Performance Standard - Mandatory

Product: Refrigerator-freezers

Economy: EU Member Countries

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

Year Effective: Applicable from 2002-2010

Section 4. Cultural Issues

No additional notes.