

## Prices and life cycle costs of comparable energy efficient products in Europe

Deliverable D7  
due in month 18

Freiburg, July 2010

**Author:**

Dietlinde Quack

**Öko-Institut e.V.**

**Freiburg Head Office**

P.O. Box 50 02 40

79028 Freiburg, Germany

**Street Address**

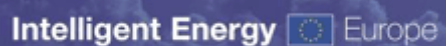
Merzhauser Str. 173

79100 Freiburg, Germany

**Tel.** +49 (0) 761 – 4 52 95-0

**Fax** +49 (0) 761 – 4 52 95-88

Supported by



**Darmstadt Office**

Rheinstr. 95

64295 Darmstadt, Deutschland

**Tel.** +49 (0) 6151 – 81 91-0

**Fax** +49 (0) 6151 – 81 91-33

Coordinated by



**Berlin Office**

Novalisstr. 10

10115 Berlin, Deutschland

**Tel.** +49 (0) 30 – 28 04 86-80

**Fax** +49 (0) 30 – 28 04 86-88

#### Disclaimer

The sole responsibility for the content of this paper lies within the authors. It does not represent the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained herein.

## Table of contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Approach and Methodology</b>	<b>2</b>
<b>3</b>	<b>Selection of the countries and the product groups to be analysed</b>	<b>3</b>
<b>3.1</b>	<b>Rationale for the selection of the countries</b>	<b>3</b>
<b>3.2</b>	<b>Rationale for the selection of the product groups</b>	<b>5</b>
<b>4</b>	<b>Proceeding</b>	<b>6</b>
<b>4.1</b>	<b>Product group household refrigeration appliances</b>	<b>6</b>
4.1.1	Selection of product types	6
4.1.2	System boundaries	6
4.1.3	Assumptions concerning use phase and data base	7
<b>4.2</b>	<b>Product group washing machines</b>	<b>8</b>
4.2.1	Selection of product types	8
4.2.2	System boundaries	9
4.2.3	Assumptions concerning use phase and data base	9
<b>4.3</b>	<b>Product group computer monitors</b>	<b>11</b>
4.3.1	Selection of product types	11
4.3.2	System boundaries	11
4.3.3	Assumptions concerning use phase and data base	12
<b>4.4</b>	<b>Product group passenger cars</b>	<b>13</b>
4.4.1	Selection of product types	13
4.4.2	System boundaries	13
4.4.3	Assumptions concerning use phase and data base	14
<b>5</b>	<b>Results</b>	<b>16</b>
<b>5.1</b>	<b>Product group household refrigeration appliances</b>	<b>16</b>
<b>5.2</b>	<b>Product group washing machines</b>	<b>18</b>
<b>5.3</b>	<b>Product group computer displays</b>	<b>21</b>
<b>5.4</b>	<b>Product group passenger cars</b>	<b>23</b>
<b>6</b>	<b>Conclusions</b>	<b>25</b>
<b>7</b>	<b>Literature</b>	<b>26</b>
<b>8</b>	<b>Annex: Results for the analysed product groups in detail</b>	<b>28</b>

<b>8.1</b>	<b>Household refrigeration appliances</b>	<b>28</b>
<b>8.2</b>	<b>Washing machines</b>	<b>30</b>
<b>8.3</b>	<b>Computer monitors</b>	<b>32</b>
<b>8.4</b>	<b>Passenger cars</b>	<b>34</b>

## Tables

Table 3-1	Overview of the selected product groups and the referred countries of the analyses	3
Table 3-2	Comparative price levels of EU 27 in 2007, availability of Topten websites and region4	
Tabelle 3-3	Overview of the .....	5
Table 4-1	Product type and data base of purchase costs and specification of household refrigeration appliances. As Poland and Norway are not part of the Eurozone the following currency exchange rates were used: Poland (Zloty) 1 PLN = 0,242 Euro; Norway 1 NOK = 0,123 Euro	6
Table 4-2	Assumptions and data base concerning the use phase and end-of life ..	7
Table 4-3	Electricity demand of the analysed models in kWh for 15 years per litre net volume.	8
Table 4-4	Product type and data base of purchase costs and specification of washing machines. As Poland and Norway are not part of the Eurozone the following currency exchange rates were used: Poland (Zloty) 1 PLN = 0,242 Euro; Norway 1 NOK = 0,123 Euro	8
Table 4-5	Assumptions and data base concerning the use phase and end-of life ..	9
Table 4-6	Electricity and water demand of the analysed models. For Norway two columns are shown: one with 200 cycles per year and the other with a reduced number of cycles assuming that the overall amount of washed clothes needs less cycles due to the higher rated capacity of 7 and 8 kg.....	10
Table 4-7	Product type and data base of purchase costs and specification of computer monitors. As Poland is not part of the Eurozone the following currency exchange rate was used: Poland (Zloty) 1 PLN = 0,242 Euro .....	11
Table 4-8	Assumptions and data base concerning the use phase and end-of life	12
Table 4-9	Electricity demand of the analysed models in kWh for 5 years. ....	12
Table 4-10	Product type and data base of purchase costs and specification of passenger cars. As Poland is not part of the Eurozone the following currency exchange rate was used: Poland (Zloty) 1 PLN = 0,242 Euro .....	13
Table 4-12	Average car age in Europe and derived from average car age according to ANFAC / ACEA (2010) and life time of passenger cars in Germany according to kba (2007)	14
Table 4-13	Fuel demand and CO2 emissions of analysed cars.....	14
Table 4-11	Assumptions and data base concerning the use phase and end-of life	15
Table 5-1	Overview of life cycle cost structure for household refrigeration appliances. Assumed life time: 15 years .....	16

Table 5-2	Relation of the life cycle costs per net volume of the average Topten model and the inefficient model .....	17
Table 5-3	Overview of life cycle cost structure for washing machines. Assumed life time: 15 years	19
Table 5-4	Sensitivity analyses concerning the life time of the analysed washing machines. The purchase costs below are standardised for 15 years. E.g. with a life time of 5 years the original purchasing price must be multiplied by 3 to achieve the overall purchasing costs for 15 years.	21
Table 5-5	Overview of life cycle cost structure for computer monitors. Assumed life time: 5 years	22
Table 5-6	Overview of life cycle cost structure for passenger cars. Assumed life time: 12 years	24
Table 8-1	Results for household refrigeration appliances in detail .....	28
Table 8-2	Results for washing machines in detail .....	30
Table 8-3	Results for computer monitors in detail .....	32
Table 8-4	Results for compact cars in detail.....	34

**Figures**

Figure 5-1	Overview of the life cycle costs of Topten and inefficient household refrigeration appliances in Euro per litre net volume differentiated by purchase and electricity costs.	17
Figure 5-2	Share of the purchase and the energy costs of Topten and inefficient household refrigeration appliances in Euro per litre net volume. ....	18
Figure 5-3	Share of the different cost elements of the Topten washing machines and the inefficient models in the different countries. ....	20
Figure 5-4	Purchase prices for Topten washing machines and the inefficient models in the different countries.....	20
Figure 5-5	Share of total costs of the life cycle phases of computer monitors, differentiated by private and office use. ....	23
Figure 5-6	Share of total costs of the life cycle phases of compact cars, differentiated by cost elements. Due to the available data base the costs of the annual circulation tax are not displayed separately for Germany. It has also to be added for Germany that the total costs include more cost elements than in the other countries: insurance as well as maintenance and repair.....	24

## 1 Introduction

Topten is a consumer-oriented online search tool, which presents the most energy efficient appliances in Europe in various categories of products. Crucial precondition for the meaningful and well accepted Topten market surveys are appropriate selection criteria.

Obviously the market offers in European member States differ significantly in terms of price level, configuration, finishing as well as shares of energy classes and energy consumption corresponding to levels of purchasing power and behavioural aspects (mentality, customs, etc.). From the perspective of the enhancement of the European wide Topten project, however, the higher the level of congruency within the national websites the higher will be awareness (consideration) amongst manufacturers since supply side markets are rather focused on the entire EU market or even on the international market (especially for consumer electronics and ICT).

Gearing purchasing behaviour to life-cycle costs and not only to the initial purchasing cost is essential to achieve a faster market penetration for energy-saving products. In most cases, such products do have higher purchasing prices than conventional products, but this higher price is compensated or over-compensated by lower costs during use (for more information see e.g. market surveys and life cycle costs: [www.ecoTopten.de](http://www.ecoTopten.de)). There are various barriers on the consumer side. One arises in low-income groups because of the higher 'up-front' financing. Another barrier is presented by psychological attitudes (additional costs today are weighted more strongly than equivalent savings later (including interest)). But the main barrier is the lack of knowledge concerning the concept of life-cycle costs and, in many member countries an inconsistency of the denotation: life cycle costs are named total costs of ownership, etc..

The concept and the relevance of life cycle costs will be shown in general in the following. Aim of the herewith presented paper is also to give an overview on and to compare (largely) identical products in four different countries (representative choice of regions) in terms of initial purchasing price, costs of use and total life-cycle costs.

After the introduction in chapter 1, in chapter 2 the objectives and the scope of the paper are specified. In chapter 3 the approach and the used methodology are explained including the rationale concerning the choice of countries and the choice of analysed products. Chapter 4 shows the results differentiated by products and countries. In the final chapter 5 then conclusions are drawn.

## 2 Approach and Methodology

The core methodology that will be applied to calculate the costs and benefits of energy efficient products in Europe versus inefficient products is the methodology of life cycle costing (LCC). LCC is generally defined as assessment of all costs which are connected with a certain product, directly covered by one or several actors in the life cycle of this product (Hunkeler et al. 2007). In the study at hand the costs for the consumer are assessed. Life cycle costing (in contrast to only focusing on the purchase price) is especially useful if a relevant share of costs incurs during the use or end-of-life phase of the analysed products or services.

LCC considers the entire (physical) life cycle of a product, from production to disposal. Depending on the perspective taken in an LCCA, the costs of the different stages can be calculated more or less detailed. For example, in the study at hand the production costs of the products to be purchased are not calculated in detail, as the relevant cost element for the consumer is the price for the final product. However, the purchasing price (usually) comprises all costs for producing the respective product plus a certain profit margin.

The LCC analysis will be conducted under the perspective of a consumer. This means that all costs which are connected to the defined product types, and which have to be borne by the consumer are included in the LCC. In general the following cost elements are included:

- Purchase and installation: The cost of purchase is relevant. Additional installation costs might incur in some cases, e.g. in case of heating devices.
- Costs during the use phase of the products: In many cases the costs during the use phase are at least as important as the purchase or installation costs. Costs which are relevant during the use phase are for example costs for
  - electricity: e.g. for refrigeration, IT devices;
  - fuel: e.g. for passenger cars;
  - consumables: e.g. for washing machines (detergents);
  - service and maintenance, e.g. possibly applicable to passenger cars; or
  - other: e.g. taxes, insurance costs, etc.
  - Disposal costs: For some of the product groups the costs (or fees) for the disposal of waste strongly depend on current regulations. For example, waste electrical and electronic equipment (WEEE) can be disposed free of charge in the EU if this waste is similar in nature and quantity to that of private households.

The decision, which cost elements are considered in the LCCA, is described more detailed in the sections on the regarded product groups and types (chapter 4.1 to 4.4).



An LCCA is always conducted for a certain function which has to be fulfilled by the analysed system. This function is quantified by the functional unit, which provides a reference to which all costs are related (e.g. washing machines: 200 washing cycles in the declaration program per year over a period of 15 years). The functional unit has to be equivalent for all product types in the four countries.

### 3 Selection of the countries and the product groups to be analysed

The analysis of the life cycle costs of efficient Topten products shall be conducted for four product groups and four countries. As basis for all product groups Norway, Germany, Spain and Poland were selected. Due to and data reasons the choice of countries was not kept up through the whole analysis but Finland was taken instead of Norway in two cases and Portugal resp. Greece instead of Spain. The details for the selection of the countries can be found in chapter 3.1.

Concerning the product groups household refrigeration appliances, washing machines, computer monitors and passenger cars were selected. The details for the selection of the product groups can be found in chapter 3.2.

Table 3-1 Overview of the selected product groups and the referred countries of the analyses

	Northern Europe	Western Europe	Southern Europe	Central / Eastern Europe
Abbreviation	North	West	South	CEE
Household refrigeration appliances	Norway	Germany	Spain	Poland
Washing machines	Norway	Germany	Spain	Poland
Computer monitors	Finland	Germany	Portugal	Poland
Passenger cars	Finland	Germany	Greece	Poland

#### 3.1 Rationale for the selection of the countries

The selection of the four countries Norway (Finland), Germany, Spain (Portugal / Greece) and Poland was based on the comparative price-levels and two other additional aspects: the region (geographical coverage) and the availability of a Topten website with cost data of Topten models in the selected product groups.

Table 3-2 shows the comparative price levels for EU 27 countries in 2007 with Norway and Switzerland. The data is expressed in relation to EU 27 = 100. For the selection four

categories were built: a very high price level (more than 115) can be found in Norway, Denmark, Switzerland, Ireland, Finland and Sweden, followed by eight countries with price levels between 100 and 112. For those countries with price levels lying below the European average, a subdivision into two groups was carried out, i.e. price level between 75 and 99 and price level of 74 and below.

Table 3-2 Comparative price levels of EU 27 in 2007, availability of Topten websites and region

	Comparative price levels 2007	Availabiliy of Topten website	Region
Norway	139	yes	Northern Europe (North)
Denmark	137,7	no	
Switzerland	126,1	yes	
Ireland	124,5	no	
Finland	122,5	yes	
Sweden	117,3	no	
Luxembourg	112,4	yes	Western Europe (West)
United Kingdom	110,3	no	
France	108,3	yes	
Belgium	106,3	yes	
Italy	103,9	yes	
Netherlands	103,4	yes	
Germany	103,1	yes	
Austria	101,4	yes	
EU (27 countries)	100		
Spain	92,4	yes	Southern Europe (South)
Greece	89,4	yes	
Cyprus	88,8	no	
Portugal	84,6	yes	
Slovenia	77,8	no	
Malta	73,3	no	Central Eastern Europe (CEE)
Estonia	71,5	no	
Hungary	66,1	no	
Latvia	65,8	no	
Poland	63,7	yes	
Slovakia	63,5	no	
Czech Republic	62,4	yes	
Romania	61,5	yes	
Lithuania	59,6	no	
Bulgaria	46,5	no	

### 3.2 Rationale for the selection of the product groups

The following aspects were considered for selecting the product groups to be analysed:

1. Availability of the product group and of purchase cost data on the Topten partner websites.
2. Relevance of the product group concerning overall energy demand and greenhouse gas emissions.
3. Variety of operation media and emissions of the product group (e.g. water demand, CO<sub>2</sub>-emissions).

As a result the following product groups were chosen

1. household refrigeration appliances
2. Washing machines
3. Computer monitors
4. Passenger cars

Tabelle 3-3 gives an overview of the availability

Tabelle 3-3 Overview of the

Product group	Availability on Topten websites	Relevance concerning overall energy demand and greenhouse gas emissions	Relevant operation media
Household refrigeration appliances	Yes, on most websites represented	high	Electricity demand
Washing machines	Yes, on most websites represented	middle	Electricity and water demand
Computer monitors	Partly represented (not in Norway and Spain)	low / middle (private / office use)	Electricity demand
Passenger cars	Partly represented (not in Norway and Spain)	high	Fuel demand, CO <sub>2</sub> emissions

## 4 Proceeding

### 4.1 Product group household refrigeration appliances

#### 4.1.1 Selection of product types

For the life cycle analyses a specific product type within the product group household refrigeration appliances was chosen: As was shown in the EuP preparatory study on household refrigeration appliances (ISIS 2007a) the product type fridge freezer experienced a strong increase concerning the number of offered models on the market. The average net volume of these appliances is 275 litres. Against this background the product type chosen for the life cycle cost analyses – fridge freezers with a net volume of less than 300 litres – seems absolutely adequate.

The subsequent table shows the product type and the data base for purchase costs and specification of household refrigeration appliances.

Table 4-1 Product type and data base of purchase costs and specification of household refrigeration appliances. As Poland and Norway are not part of the Eurozone the following currency exchange rates were used: Poland (Zloty) 1 PLN = 0,242 Euro; Norway 1 NOK = 0,123 Euro

Parameters	Product type	Source	Number of Topten models	Number of inefficient models	Date
Purchase costs and specification of household refrigeration appliances	2-doors-fridge-freezers with a net volume of less than 300 litres.	Topten websites: Norway: www.besteprodukter.no	11	1	05/2010
		Poland: www.Topten.info.pl	10	1	06/2009
		Germany: www.ecoTopten.de	27	1	11/2009
		Spain: www.euroTopten.es	10	1	11/2009

#### 4.1.2 System boundaries

The life cycle analysis includes the following cost factors:

Purchasing of the household refrigeration appliance	purchase price incl. VAT
Use of the household refrigeration appliance	electricity costs
End-of-life	due to WEEE no costs for consumers occur

Maintenance and repair will not be included as no data are available and it is to be expected that the situation is very different in the different countries / regions.

The LCC analysis addresses the life cycle costs from the perspective of the consumer.

#### 4.1.3 Assumptions concerning use phase and data base

Table 4-2 Assumptions and data base concerning the use phase and end-of life

Parameter	Specification	Source
Product life	15 years	CECED 2006, assuming that the product life time of a fridge freezer lays in-between the life time of a fridge (14) and a freezer (17).
Electricity price	Norway: 0,17 Euro/kWh Poland: 0,13 Euro/kWh Germany: 0,22 Euro/kWh Spain: 0,156 Euro/kWh	Eurostat 2009
Maintenance and repair	Will be neglected due to lack of data. A large variety between the countries and regions is to be expected.	
Disposal	No costs for consumers	WEEE

Concerning the assumed life time of 15 years some variety is to be expected in real life depending on the manufacturer and the model. Concerning differences between countries and regions ISIS (2007a) showed that the average age of household refrigeration appliances standing in the households is quit similar throughout Europe.

The following table shows the actual electricity demand that was achieved by the analysed models. It is striking that in Poland the electricity demand of the least efficient Topten model (energy efficiency class A+) is higher then the one of the inefficient model (energy efficiency class A). A closer look shows that the least efficient Topten model offers as well the function *no frost* as also *bioFresh* (0°C zone). Both increase the electricity demand. Additionally in Poland the electricity demand of the most efficient Topten model is 1,3 to 1,8 kWh/litre net volume higher in the other countries. In general it is noticeable that the least efficient Topten model in Germany has a significantly lower electricity demand than the least efficient models in the other countries.

Table 4-3 Electricity demand of the analysed models in kWh for 15 years per litre net volume.

Electricity demand	Unit	CEE (Poland)	North (Norway)	West (Germany)	South (Spain)
Average Topten models	kWh/15 years*litre	15,67	11,36	10,19	12,58
Most efficient Topten model	kWh/15 years*litre	11,14	9,84	9,31	9,77
Least efficient Topten model	kWh/15 years*litre	18,59	15,82	11,88	16,31
Inefficient model	kWh/15 years*litre	17,81	17,89	15,58 €	23,26

## 4.2 Product group washing machines

### 4.2.1 Selection of product types

For the life cycle analyses a specific product type within the product group washing machines was chosen: As the EuP preparatory study on household washing machines and dish washers (Lot 14; ISIS 2007b) stated that the average rated capacity was 5,4 in 2005, it still seemed reasonable to choose frontloader washing machines with a rated capacity of 5-6 kg for the life cycle cost analyses. The subsequent table shows the product type and the data base for purchase costs and specification of washing machines.

Table 4-4 Product type and data base of purchase costs and specification of washing machines. As Poland and Norway are not part of the Eurozone the following currency exchange rates were used: Poland (Zloty) 1 PLN = 0,242 Euro; Norway 1 NOK = 0,123 Euro

Parameters	Product type	Source	Number of Topten models	Number of inefficient models	Date
Purchase costs and specification of washing machines	Frontloaders with a rated capacity of 5-6 kg	Topten websites: Norway: <a href="http://www.besteprodukter.no">www.besteprodukter.no</a>	10	1	05/2010
	Exception: Norway: 7-8 kg Topten Norway does not recommend washing machines with a capacity of 5-6 kg	Poland: <a href="http://www.Topten.info.pl">www.Topten.info.pl</a>	14	1	01/2008
		Germany: <a href="http://www.ecoTopten.de">www.ecoTopten.de</a>	23	1	04/2009
		Spain: <a href="http://www.euroTopten.es">www.euroTopten.es</a>	3	1	11/2009

#### 4.2.2 System boundaries

The life cycle analysis includes the following cost factors:

Purchasing of washing machine purchase price incl. VAT

Use of the washing machine electricity costs

water costs

detergent costs

End-of-life due to WEEE no costs for consumers occur

Maintenance and repair will not be included as no data are available and it is to be expected that the situation is very different in the different countries / regions.

The LCC analysis addresses the life cycle costs from the perspective of the consumer.

#### 4.2.3 Assumptions concerning use phase and data base

Table 4-5 Assumptions and data base concerning the use phase and end-of life

Parameter	Specification	Source
Product life	15 years	EuP preparatory study Lot 14 (ISIS 2007b)
Cycles per year	200	EU Energy Label (EU Commission 1995) For 7 and 8 kg machines (Norway) a sensitivity analyses will be done with 171 resp. 150 washing cycles per year referring to an overall amount of washed clothes of 1.200 kg/year..
Water price	3,70/m <sup>3</sup>	EuP preparatory study Lot 14 (ISIS 2007b) The water price includes costs for water supply and sewage.
Detergent costs	0,22 Euro/wash	EuP preparatory study Lot 14 (ISIS 2007b)
Electricity price	Norway: 0,17 Euro/kWh Poland: 0,13 Euro/kWh Germany: 0,22 Euro/kWh Spain: 0,156 Euro/kWh	Eurostat 2009
Maintenance and repair	Will be neglected due to lack of data. A large variety between the countries and regions is to be expected.	
Disposal	No costs for consumers	WEEE

Concerning the assumed life time of 15 years a large variety is to be expected in real life: depending on the manufacturer and the model the life time may vary between 5 and 20 years. Obviously this largely influences the life cycle costs.

Concerning the number of washing cycles the draft of the new energy labelling foresees 220 washing cycles per year. It includes at the same time 40°C programs as well as half load. As no data are available yet concerning electricity and water demand under these new conditions, 200 cycles with the 60°C standard program as specified in the current EU Energy label will be used for the calculation.

The following table shows the actual electricity and water demand that was achieved by the models under consideration.

Table 4-6 Electricity and water demand of the analysed models. For Norway two columns are shown: one with 200 cycles per year and the other with a reduced number of cycles assuming that the overall amount of washed clothes needs less cycles due to the higher rated capacity of 7 and 8 kg.

Electricity and water demand	Unit	CEE (Poland)	North (Norway)		West (Germany)	South (Spain)
			200 cycles/year	7 kg: 171 cycles/year 8 kg: 150 cycles/year		
Average Topten models electricity demand	kWh/15 years	3.060	3.225	2.518	3.029	2.890
most efficient Topten model	kWh/15 years	3.060	3.120	2.340	2.700	2.550
least efficient Topten model	kWh/15 years	3.060	3.600	2.700	3.060	3.060
Inefficient models electricity demand	kWh/15 years	3.150	3.420	3.420	3.420	4.140
<b>Water demand</b>						
Average Topten models water demand	l/15 years	132.429	164.700	128.313	136.696	134.000
Water demand most efficient Topten model	l/15 years	111.000	144.000	123.120	111.000	126.000
Water demand least efficient Topten model	l/15 years	141.000	177.000	141.175	147.000	141.000
Inefficient models water demand	l/15 years	159.000	156.000	156.000	147.000	174.000



### 4.3 Product group computer monitors

#### 4.3.1 Selection of product types

For the life cycle analyses a specific product type within the product group computer monitors was chosen: 19" monitors.

The subsequent table shows the product type and the data base for purchase costs and specification of computer monitors. Unfortunately, the Finish Topten website did not display any purchase prices at all and the Portuguese Topten website displayed only purchase prices for models from EIZO. Therefore an internet research on comparison shopping sites was done concerning the missing data. The results of the LCC analyses must be seen against this background.

Table 4-7 Product type and data base of purchase costs and specification of computer monitors. As Poland is not part of the Eurozone the following currency exchange rate was used: Poland (Zloty) 1 PLN = 0,242 Euro

Parameters	Product type	Source (limitations see above)	Number of Topten models	Number of inefficient models	Date
Purchase costs and specification of computer monitor	19" computer monitors	Topten websites: Finland: www.Topten-suomi.fi	13	1	08/2008
		Poland: www.Topten.info.pl	7	1	01/2010
		Germany: www.ecotopten.de	17	3	02/2009
		Portugal: www.Topten.pt	10	1	10/2008

#### 4.3.2 System boundaries

The life cycle analysis includes the following cost factors:

Purchasing of the computer monitor                      purchase price incl. VAT

Use of the computer monitor                                    electricity costs

End-of-life    due to WEEE no costs for consumers occur

Maintenance and repair will not be included as no data are available and it is to be expected that the situation may be different in the different countries / regions.

The LCC analysis addresses the life cycle costs from the perspective of the consumer.

### 4.3.3 Assumptions concerning use phase and data base

Table 4-8 Assumptions and data base concerning the use phase and end-of life

Parameter	Specification	Source
Product life	5 years	Assumption according to Topten
Private use	On mode: 3 hours/day Standby: 3 hours/day Off mode: 8 hours/day	Own assumption
Office use	On mode: 8 hours/day Standby: 2 hours/day Off mode: 14 hours/day	Own assumption
Electricity price	Finland: 0,127 Euro/kWh Poland: 0,13 Euro/kWh Germany: 0,22 Euro/kWh Portugal: 0,153 Euro/kWh	Eurostat 2009
Maintenance and repair	Will be neglected due to lack of data. A large variety between the countries and regions is to be expected.	
Disposal	No costs for consumers	WEEE

Concerning the assumed life time of 5 years some variety is to be expected in real life depending on the manufacturer and the model.

The following table shows the actual electricity demand that was achieved by the analysed models.

Table 4-9 Electricity demand of the analysed models in kWh for 5 years.

Electricity demand	Unit	CEE (Poland)	North (Finland)	West (Germany)	South (Portugal)
Average Topten models - private use	kWh/5 years	25,34	38,10	32,72	32,12
Average Topten models - office use	kWh/5 years	59,56	91,90	77,19	79,22
Inefficient models - private use	kWh/5 years	68,99	68,99	42,16	68,33
Inefficient models - office use	kWh/5 years	165,71	167,17	101,35	166,66

## 4.4 Product group passenger cars

### 4.4.1 Selection of product types

For the life cycle analyses a specific product type within the product group passenger cars was chosen: compact cars.

The subsequent table shows the product type and the data base for purchase costs and specification of passenger cars. Concerning the purchase price of the inefficient model an approximation had to be done for Finland, Poland and Greece due to lack of data: the average of the purchase price of the Topten models was taken as purchase price of the inefficient model.

Table 4-10 Product type and data base of purchase costs and specification of passenger cars. As Poland is not part of the Eurozone the following currency exchange rate was used: Poland (Zloty) 1 PLN = 0,242 Euro

Parameters	Product type	Source (limitations see above)	Number of Topten models	Number of inefficient models	Date
Purchase costs and specification of compact cars	Compact cars	Topten websites: Finland: www.Topten-suomi.fi	11	1	07/2010
		Poland: www.Topten.info.pl	11	1	07/2007
		Germany: www.ecoTopten.de	13	1	12/2008
		Greece: www.ecoTopten.gr	8	1	09/2009

### 4.4.2 System boundaries

The life cycle analysis includes the following cost factors:

Purchasing of car	purchase price incl. VAT registration tax
Use of car	fuel costs annual circulation tax
End-of-life	no costs are assumed for consumers

Maintenance and repair are not included as no data are available and it is to be expected that the situation may be different in the different countries / regions.

Exception:

For Germany cost data were available on [www.ecotopten.de](http://www.ecotopten.de) that also cover insurance, maintenance and repair. Therefore the LCC cost data from Germany are systematically different and higher than for the other three countries. On the same time they include the overall cost of a car that are in principle also valid for the other countries /regions.

The LCC analysis addresses the life cycle costs from the perspective of the consumer.

#### 4.4.3 Assumptions concerning use phase and data base

An overview of the assumptions concerning the use phase and the data base is given in Table 4-13 on the next page.

Concerning the assumed life time of 12 years some variety is to be expected in real life depending on the country / region. The following table gives an idea on the possibly achieved life times of passenger cars in the different countries / regions.

Table 4-11 Average car age in Europe and derived from average car age according to ANFAC / ACEA (2010) and life time of passenger cars in Germany according to kba (2007)

	EU average	Slovakia	Finnland	Germany	Greece
Average car age	8,2	11,6	11	8,2	10,5
Average life time, derived from average car age and life time of passenger cars in Germany 2005	12	16,98	16,10	12	15,37
Relation average care age to DE	1,00	1,41	1,34	1,00	1,28

The following table shows the actual fuel demand and CO2 emission that were achieved by the analysed models.

Table 4-12 Fuel demand and CO2 emissions of analysed cars.

	Unit	CEE (Poland)	North (Finnland)	West (Germany)	South (Greece)
<b>Fuel demand</b>					
Average Topten models	Litre /100 km	5,18	4,15	4,98	5,50
Most efficient Topten model	Litre /100 km	4,60	3,83	4,10	4,40
Least efficient Topten model	Litre /100 km	6,40	4,60	5,90	6,30
Inefficient model	Litre /100 km	7,00	7,00	6,80	7,00
<b>CO2-emissions</b>					
Average Topten models	g CO2/km	132,64	101,91	125,60	131,25
Topten model with lowest emissions	g CO2/km	109,0	89,0	109,0	101,0
Topten model with highest emissions	g CO2/km	155,0	109,0	140,0	147,0
Inefficient model	g CO2/km	189,0	189,0	163,0	189,0

Table 4-13 Assumptions and data base concerning the use phase and end-of life

Parameter	Specification	Source
Product life	12 years	Own estimate on basis of the average car age in Europe in 2008 according to ANFAC / ACEA (2010) and the life time of passenger cars in Germany kba (2007)
Use	10.000 km/year	Own assumption
Average amount in euro per one liter of Super Unleaded or SUPERPLUS 98	Finland: 1,50 Euro/litre Poland: 1,25 Euro/litre Germany: 1,50 Euro/litre Greece: 1,56 Euro/litre	<a href="http://www.energy.eu">www.energy.eu</a> , calendar week 17 2010
Average amount in euro per one liter of Diesel.	Finland: 1,17 Euro/litre Poland: 1,09 Euro/litre Germany: 1,22 Euro/litre Greece: 1,31 Euro/litre	<a href="http://www.energy.eu">www.energy.eu</a> , calendar week 17 2010
Registration tax	Finland: 1,50 Euro/litre Poland: 1,25 Euro/litre Germany: 1,50 Euro/litre Greece: 1,56 Euro/litre	Finland: Tax base is price excl. VAT and CO2 emissions Tax % = 4.88 + (0.122 x CO2), Min. 12.2%, max. 48.8 % ACEA (2010a) Poland: own calculation basing on ACEA (2010), assumption: mean value between 3,1% and 18,6% Germany: - Greece: European Commission 2002
Annual circulation tax	Finland: Poland: - Germany: included in total costs Greece:	Finland: After 35cents/day for every 100kg. Assumption that vehicle weight is 1.500 kg (e.g. Golf) ( Poland: ACEA (2010a) Germany: <a href="http://www.ecoTopten.de">www.ecoTopten.de</a> , according to ADAC car costs Greece: European Commission 2002
Insurance	Will be neglected due to lack of data. Exception: Germany	Germany: <a href="http://www.ecoTopten.de">www.ecoTopten.de</a> , basing on ADAC car costs
Maintenance and repair	Will be neglected due to lack of data. A large variety between the countries and regions is to be expected. Exception: Germany	Germany: <a href="http://www.ecoTopten.de">www.ecoTopten.de</a> , basing on ADAC car costs
Disposal	No costs for consumers	

## 5 Results

### 5.1 Product group household refrigeration appliances

The results of the life cycle cost analyses of household refrigeration appliances show that the average total costs of the Topten models are lower than the total cost for the inefficient model, except for Poland (see Table 5-1). The total energy costs are always lower for the Topten average than for the inefficient model. The last two lines in the table show that there is a very broad range between the total costs for the least and the most expensive Topten model. The range is rather similar in the different countries. The detailed results can be found in chapter 8.1.

Table 5-1 Overview of life cycle cost structure for household refrigeration appliances. Assumed life time: 15 years

		CEE (Poland)		North (Norway)		West (Germany)		South (Spain)	
	unit	Topten models	inefficient model	Topten models	inefficient model	Topten models	inefficient model	Topten models	inefficient model
Average purchase price	Euro	828 €	290 €	1.014 €	1.107 €	877 €	679 €	587 €	650 €
Average total energy costs	Euro/15 years	526 €	606 €	522 €	1.010 €	658 €	1.155 €	566 €	1.212 €
<b>Average total costs</b>	<b>Euro/15 years</b>	<b>1.354 €</b>	<b>897 €</b>	<b>1.536 €</b>	<b>2.117 €</b>	<b>1.535 €</b>	<b>1.834 €</b>	<b>1.152 €</b>	<b>1.862 €</b>
Min total costs Topten models	Euro/15 years	793 €		970€		1.090 €		889 €	
Max total costs, Topten models	Euro/15 years	2.433 €		2.241 €		2.089 €		1.551 €	

Although the net volume of the analysed household refrigeration appliances is under 300 litres net volume they differ concerning their net volume. The comparability of these results therefore is restricted. Against this background in Figure 5-1 the life cycle costs are shown in Euro per litre net volume. The principal results are the same as shown before: the average of the Topten models' total costs per net volume vary between 4 and 5,65 Euro/litre and are lower than for the inefficient model except for Poland (variation between 3,42 and 6,38 Euro/litre). The purchase costs for the inefficient model are always lower than the average

purchase costs of the Topten models (see also Table 5-2) and than its total energy costs except for Norway. The purchase costs for the average of the Topten models are higher as or equal to (Spain) the average of the average of the total energy costs.

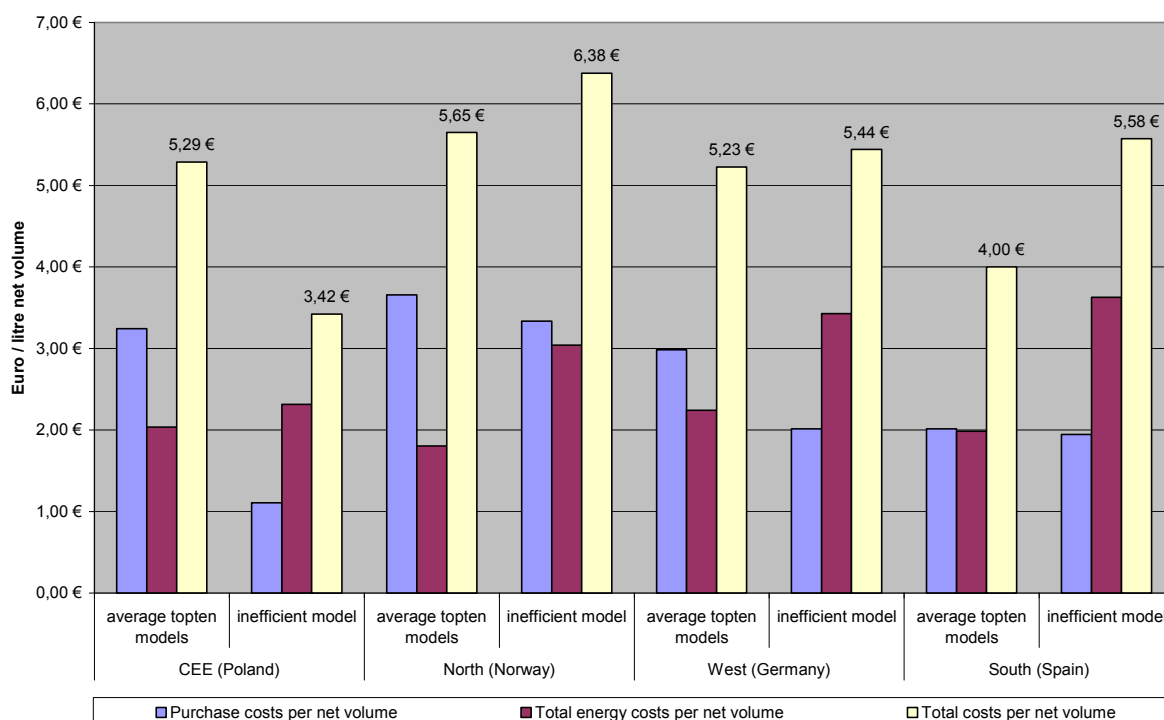


Figure 5-1 Overview of the life cycle costs of Topten and inefficient household refrigeration appliances in Euro per litre net volume differentiated by purchase and electricity costs.

Table 5-2 summarises again the relation of the total costs and the cost elements of the average of the Topten models to the inefficient model. The energy costs of the Topten average only mounts up to 55 to 88 percent compared to the inefficient model. In contrast to this the purchase costs are slightly (Norway and Spain) to significant higher then the one for the inefficient model. Still it has to be mentioned that the range is very broad, there are Topten models in each country that have lower purchase costs then the analysed inefficient model, e.g. in Poland with purchase costs of 1,01 to 7,17 Euro/litre net volume for Topten models.

Table 5-2 Relation of the life cycle costs per net volume of the average Topten model and the inefficient model

	CEE (Poland)	North (Norway)	West (Germany)	South (Spain)
Purchase costs per net volume	292,5%	109,7%	148,2%	103,6%
Total energy costs per net volume	88,0%	59,3%	65,4%	54,7%
<b>Total costs per net volume</b>	<b>154,5%</b>	<b>88,6%</b>	<b>96,0%</b>	<b>71,8%</b>

As shown in the following Figure 5-2 the share of the purchase costs varies between 32 percent (inefficient model in Poland) and 65 percent (average Topten models in Norway). In general it can be stated that the share of the electricity costs is higher than the share of the purchase costs for the inefficient model (63 to 68 percent), except for Norway (48 percent). For the average of the Topten models it is the other way round (electricity costs lay between 32 and 43 percent), with the exception of Spain (50 percent).

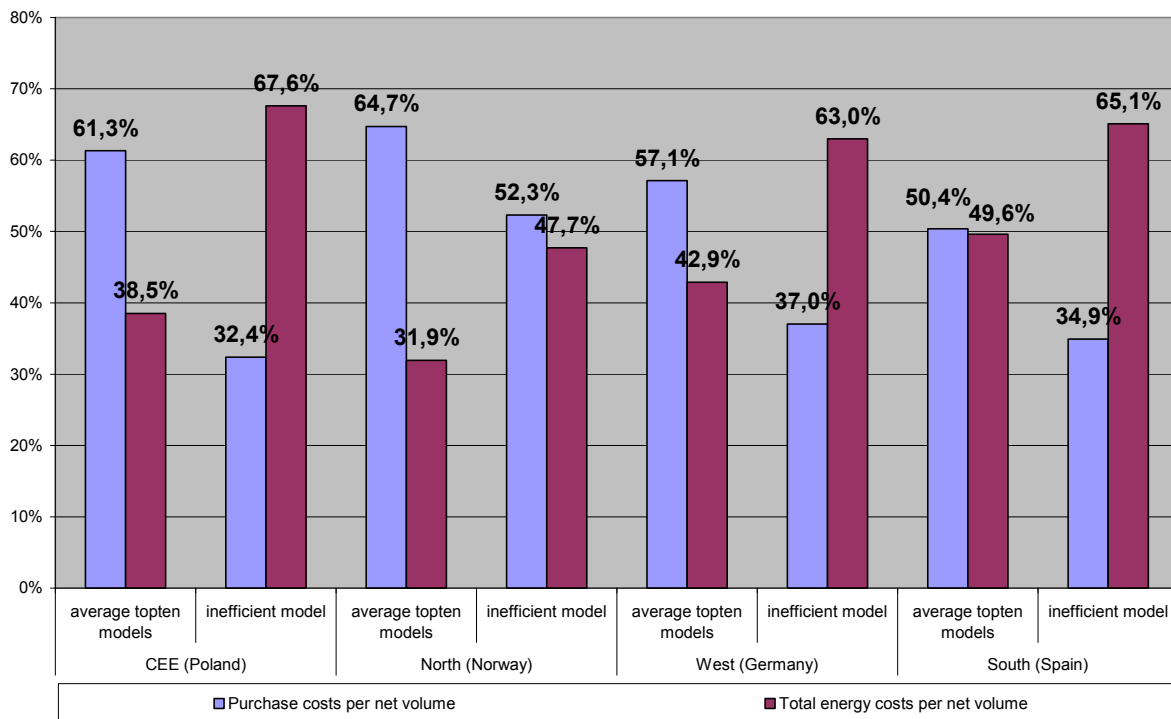


Figure 5-2 Share of the purchase and the energy costs of Topten and inefficient household refrigeration appliances in Euro per litre net volume.

## 5.2 Product group washing machines

The results of the life cycle cost analyses of washing machines show that the average total costs of the Topten models are always higher than the total cost for the inefficient model, (see Table 5-3). The total energy costs are always lower for the Topten models' average than for the inefficient model. Norway is an exception, but only because the rated capacity of the models in Norway is 7-8 kg instead of 5-6 kg as for the other countries. A single washing cycle of a 7 or 8 kg machine needs more electricity than one of a 5 or 6 kg machine. On the other hand more clothes can be washed at the same time in the bigger machines therefore a lower number of washing cycles per year is to be expected. Unfortunately studies (e.g. ISIS 2007b) show that people do not use the full capacity but put less clothes in. In average the loading is about 3,5 kg/washing cycle.



The total costs of the average of the Topten models amount to 2.459 to 3015 Euro. The last two lines in the table show that there is a difference of 600 to 1000 Euro between the total costs for the least and the most expensive Topten model. The total costs of the inefficient model amount to 1919 to 2.532 Euro. The detailed results can be found in chapter 8.2.

Table 5-3 Overview of life cycle cost structure for washing machines. Assumed life time: 15 years

	CEE (Poland)		North (Norway)		West (Germany)		South (Spain)	
	Topten models	inefficient models	Topten models	inefficient models	Topten models	inefficient models	Topten models	inefficient models
Average purchase price	911 €	261 €	1.198 €	554 €	771 €	399 €	1.392 €	582 €
Average total energy costs	398 €	410 €	548 €	581 €	666 €	752 €	451 €	646 €
Average total water costs	490 €	588 €	609 €	577 €	506 €	544 €	496 €	644 €
Average total detergent costs	660 €	660 €	660 €	660 €	660 €	660 €	660 €	660 €
<b>Average total costs</b>	<b>2.459 €</b>	<b>1.919 €</b>	<b>3.015 €</b>	<b>2.372 €</b>	<b>2.604 €</b>	<b>2.355 €</b>	<b>2.998 €</b>	<b>2.532 €</b>
Min total costs Topten models	1.945 €		2.723 €		2.335 €		2.554 €	
Max total costs, Topten models	3.699 €		3.677 €		3.054 €		3.223 €	

Besides the purchase costs that contribute with 30 to 46 percent (average of Topten models) resp, 14 to 23 percent (inefficient models) to the total life cycle costs of washing machines the share of the costs during the use phase is also significant (see Figure 5-3): the electricity costs, the water costs and the detergents costs. Their share is between 15 and 32 percent each. Together they amount to 54 to 86 percent of the total life cycle costs, being highest for the inefficient models (77 to 86 percent). In most of the cases the detergent costs have the highest absolute value and share of total costs. As for all countries the same costs were assumed for the detergents (0,22 Euro/washing cycle, ISIS 2007) there will be some variance in reality. Concerning the water costs, for some countries they are higher then the electricity costs (Poland; Germany; Norway, Topten models), only for Spain and Norway (inefficient model) they are lower resp. equal. For the water costs it must be stated that the same water price was assumed throughout Europe (3,70 Euro/m<sup>3</sup>, ISIS 2007). As the water price mostly is organised on the level of the municipalities (see e.g. EUREAU 2009) it may vary and therefore the results for one specific city may deviate significantly from the above calculations.

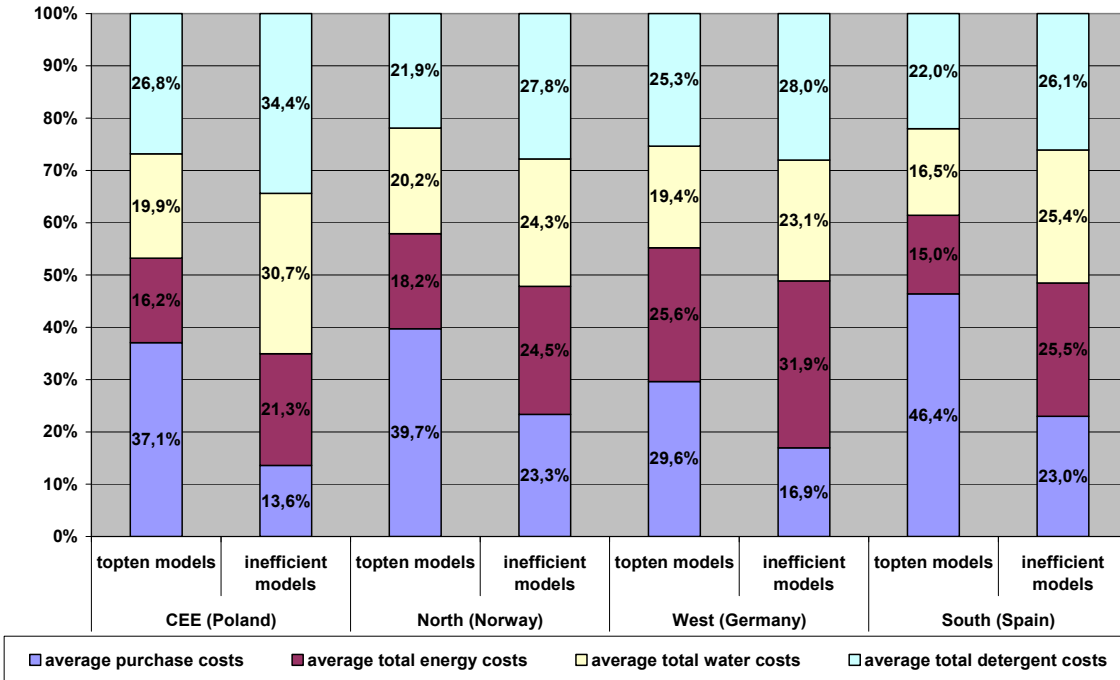


Figure 5-3 Share of the different cost elements of the Topten washing machines and the inefficient models in the different countries.

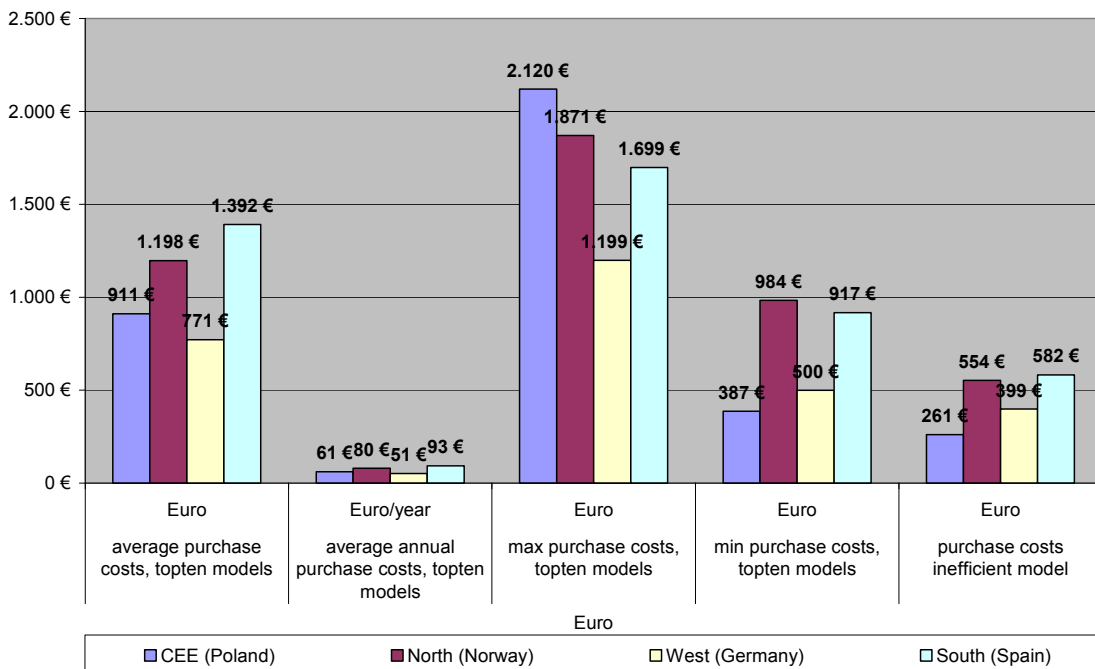


Figure 5-4 Purchase prices for Topten washing machines and the inefficient models in the different countries.

It is striking that the variation of purchase prices for washing machines is large (see Figure 5-4): largest in Poland: with the inefficient model only costing 261 Euro and the maximum price of the Topten models being 2.120 Euro. The smallest range was identified in Germany with 399 Euro for the inefficient and 1.199 Euro as maximum purchase price of the Topten models. In general it can be stated that the inefficient models have lower purchase prices than the Topten models.

Against the background of the identified large range of the purchase prices and the knowledge that, depending on model, manufacturer and purchase price, the life time of washing machines varies between 5 and 20 years a sensitivity analyse was performed:

In the subsequent Table 5-4 it is shown which purchase prices must be taken into account over a time period of 15 years if the real life time of the models is only 5 or 10 years (inefficient models, minimum Topten model) in comparison to 20 years (maximum of Topten models). The results show that with a life time of only 5 years the initial cheaper purchase price of the inefficient and the minimum Topten models adds up to more then the purchase price for the maximum Topten models assuming that these last for 20 years (as proven by single manufacturers), except for Poland. For an assumed life time of 10 years this is not the case, except for Norway.

Table 5-4 Sensitivity analyses concerning the life time of the analysed washing machines. The purchase costs below are standardised for 15 years. E.g. with a life time of 5 years the original purchasing price must be multiplied by 3 to achieve the overall purchasing costs for 15 years.

Purchase costs	unit	CEE (Poland)	North (Norway)	West (Germany)	South (Spain)
Max Topten model, 20 years lifetime	Euro	1.590 €	1.404 €	899 €	1.274 €
Average Topten models, 15 years life time	Euro	911 €	1.198 €	771 €	1.392 €
Min Topten model, 10 years life time	Euro	580 €	1.476 €	750 €	1.376 €
Min Topten model, 5 years life time	Euro	1.161 €	2.952 €	1.500 €	2.751 €
Inefficient model, 10 year life time	Euro	392 €	830 €	599 €	873 €
Inefficient model, 5 year life time	Euro	783 €	1.661 €	1.197 €	1.746 €

### 5.3 Product group computer displays

The results of the life cycle cost analyses of the computer monitors show that the average total costs of the Topten models are partly lower then the total cost for the inefficient model (Poland, Germany) and partly higher (Finland, Portugal; see Table 5-5). The total energy costs are always lower for the Topten models' average then for the inefficient model. The range of the total costs as well as the one of the purchase and even the electricity cost are

very similar in all countries for both private and office use. The same is true for the range of total costs of the Topten models (maximum / minimum). It can be added that the purchase costs strongly relate to the manufacturer, EIZO being the most expensive with about 400 to 500 Euro and others like Philips, Lenovo and Fujitsu in lower price regions. Due to the low electricity demand the differences between private and office use are small (22 to 75 Euro in 5 years. The detailed results can be found in chapter 8.3.

Table 5-5 Overview of life cycle cost structure for computer monitors. Assumed life time: 5 years

	CEE (Poland)		North (Finland)		West (Germany)		South (Portugal)	
	Topten models	inefficient models	Topten models	inefficient models	Topten models	inefficient models	Topten models	inefficient models
average purchase costs	233 €	218 €	296 €	218 €	258 €	301 €	302 €	200 €
average total energy costs, private use	16 €	45 €	24 €	44 €	36 €	46 €	25 €	52 €
average total energy costs, office use	39 €	108 €	58 €	106 €	85 €	111 €	61 €	127 €
average total costs, private use	249 €	263 €	320 €	262 €	294 €	347 €	326 €	252 €
average total costs, office use	271 €	326 €	354 €	324 €	343 €	412 €	362 €	327 €
min total costs Topten models private use	133 €		185 €		180 €		182 €	
min total costs Topten models office use	152 €		215 €		230 €		215 €	
max total costs, Topten models private use	479 €		565 €		564 €		543 €	
max total costs, Topten models office use	507 €		599 €		615€		576 €	

Figure 5-5 shows the share of the purchase costs and the electricity costs for computer monitors. In contrast to the product groups household refrigeration appliances and washing machines analysed before in the case of the computer monitors the purchase costs dominate clearly: The share of the purchase costs varies between 80 and 93 percent for private use resp. 61 and 86 percent for office use. For inefficient models the electricity demand and the therewith connected costs used to be significantly higher some years ago when CRT monitors still were sold. As this virtually not the case any more the differences between efficient and inefficient computer monitors – both being LCD - significantly diminished. With the spreading of LED backlights in flat screens this might change slightly in future as they are more efficient than the fluorescent lamps used at the moment as backlights.

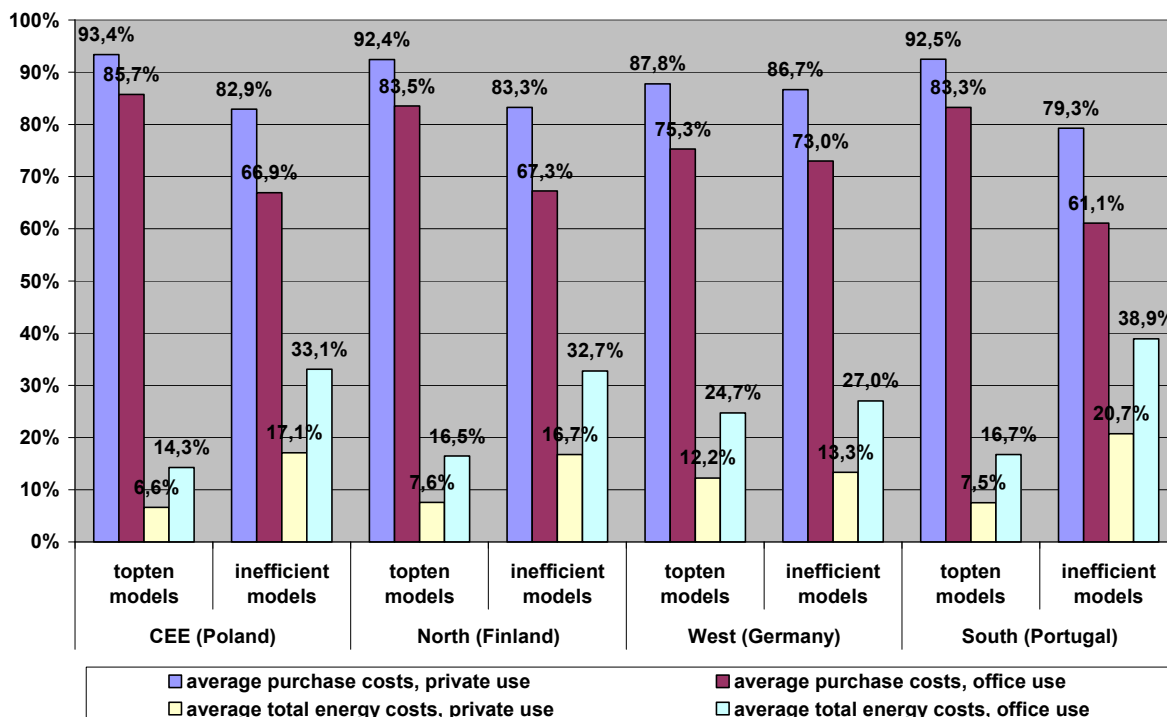


Figure 5-5 Share of total costs of the life cycle phases of computer monitors, differentiated by private and office use.

## 5.4 Product group passenger cars

The results of the life cycle cost analyses of the passenger cars show that the average total costs of the Topten models are always lower than the total cost for the inefficient model (see Table 5-6). The total fuel costs are always lower for the Topten models' average than for the inefficient model. The range of the total costs is large with lowest average costs for the Topten models of 25.736 Euro (Poland) and the highest of 41.878 Euro (Finland). Obviously the results for Germany stand out: the total costs are significantly higher than in the other countries. This is due to the fact that more cost elements were taken into account. Besides purchase, fuel costs and annual circulation tax (no registration tax applies in Germany) also insurance as well as maintenance and repair were considered. As these cost elements principally also apply in the other countries the results for Germany better reflect the life cycle costs for passenger cars than the cost data of the other countries. Still they are not able to reflect the possible differences occurring between the countries due to different price levels.

It must be added that the representation of the costs for registration tax and annual circulation tax is restricted as an approximation had to be done (see Table 4-13).

The detailed results can be found in chapter 8.4.

Table 5-6 Overview of life cycle cost structure for passenger cars. Assumed life time: 12 years

	CEE (Poland)		North (Finland)		West (Germany)		South (Greece)	
	Topten models	inefficient models	Topten models	inefficient models	Topten models	inefficient models	Topten models	inefficient models
average purchase costs	17.044 €	17.361 €	25.615 €	23.847 €	20.669 €	25.960 €	21.301 €	21.301 €
average total fuel costs	7.176 €	10.500 €	6.714 €	9.828 €	8.067 €	12.240 €	10.530 €	13.104 €
registration tax	1.516 €	1.516 €	3.616 €	5.461 €	-	-	2.667 €	2.667 €
annual circulation tax	-	-	5.934 €	5.934 €	included in total costs		1.596 €	1.596 €
<b>total costs</b>	<b>25.736 €</b>	<b>29.405 €</b>	<b>41.878 €</b>	<b>45.070 €</b>	<b>74.039 €</b>	<b>86.694 €</b>	<b>36.094 €</b>	<b>38.668 €</b>
min total costs Topten models	21.956 €		34.263 €		51.510 €		30.028 €	
max total costs, Topten models	32.349 €		52.476 €		79.487 €		40.508 €	

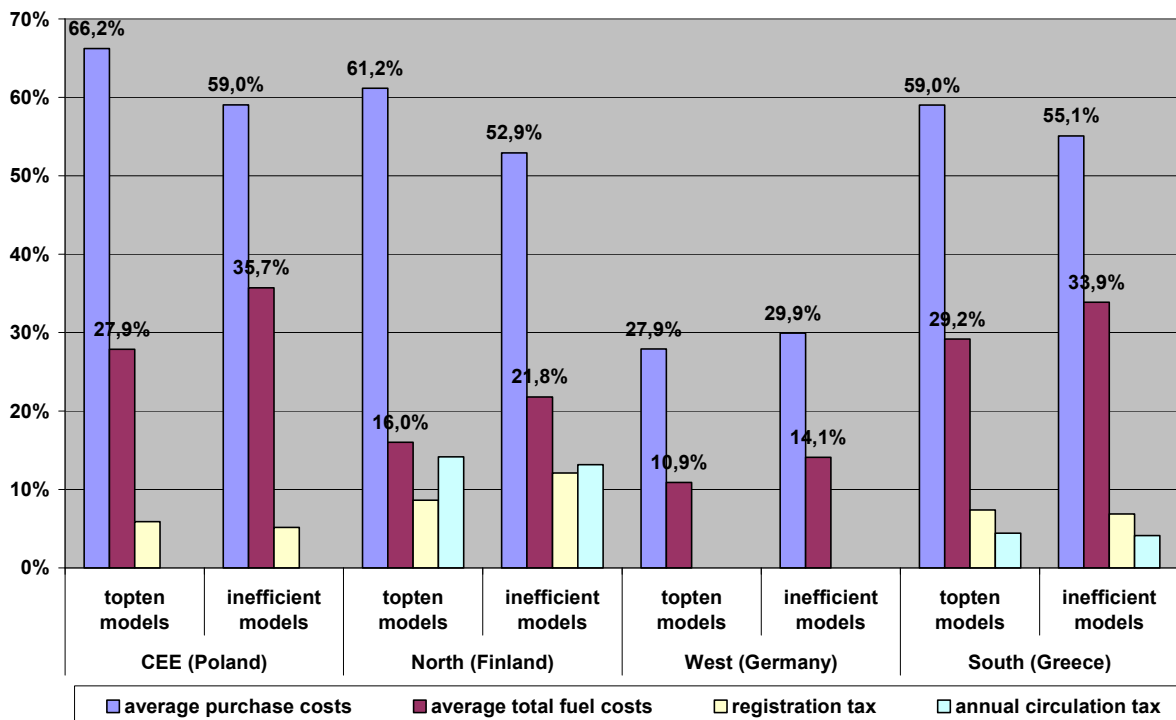


Figure 5-6 Share of total costs of the life cycle phases of compact cars, differentiated by cost elements. Due to the available data base the costs of the annual circulation tax are not displayed separately for Germany. It has also to be added for Germany that the total costs include more cost elements than in the other countries: insurance as well as maintenance and repair.

Figure 5-6 shows the share of the single cost elements. It is obvious that the share of the purchase costs is higher than the fuel costs in all countries as well for the Topten models (59 to 66 percent) as for the inefficient models (53 to 59 percent). Due to the additional cost elements that were considered in Germany the figures for Germany are not comparable. For the inefficient models the share of the fuel costs than for the inefficient models, largest in Poland with a share of 28 percent for the Topten models and 36 Percent for the inefficient model.

## 6 Conclusions

The range of the **total costs** of the Topten models is rather large in three of the four considered product groups and all countries. Except for the product group washing machine the total costs of the inefficient models lay within this range. This means that - if consumers consider life cycle costs - they are very well able to decide to purchase an efficient Topten model without experiencing any financial disadvantages compared to an inefficient model. In contrary: They are even able to save money even though the purchase costs usually are higher for the Topten models!

For washing machines the total costs of the inefficient models are similar to the minimum total costs of the Topten models. This means that practically all Topten models have higher total costs than the inefficient models. There are several reasons for this: on the one hand electricity and water demand of washing machines in general improved a lot in the last 15 to 20 years, also in the lower price categories. Therefore the differences between the machines diminished, possible savings (electricity water, costs) were reduced. On the other hand possible environmental advantages of the machines in higher price categories – e.g. longer product life time, better quantity control, low electricity demand also in the other programs not only in the declaration program - are not represented in the cost figures yet. With the new EU energy label, taking into account also the 40°C program and half load, this will change, enlarging again the differences between the different models at least for some time.

The range of the **purchase prices** of the Topten models is also large, giving consumers the choice to spend more or less money. Still, the purchase prices of the considered inefficient models usually are lower than the one for the cheapest Topten model. Obviously this situation represents a significant obstacle for consumers to decide to buy an efficient Topten model with a higher purchase price! Against this background it would be very helpful for consumers if retailers would show the life cycle costs at the point of sale and not only the purchase price!

Concerning the **share of the operating media** (electricity, water, detergents, fuel) the situation is different for the four considered product groups: the lowest share was found in the product group computer monitors, the highest in the product group washing machines with electricity, water and detergents demand. Concerning the product group passenger cars

the figures for Germany show that share the fuel costs with an average for the Topten models of 11 percent is rather low. Lower than identified at the moment for the other countries (16 to 29 percent).

Of course also the *prices of electricity etc.* are relevant for the overall life cycle costs: in Germany electricity is most expensive and 73% higher then in Finland, the country with the cheapest electricity.

## 7 Literature

ACEA 2009	Association of European Automobile Manufacturers: Tax Guide 2009.
ACEA 2010a	Association of European Automobile Manufacturers: Tax Guide 2010, Motor Vehicle Taxation:EU, 2010.
ACEA 2010b	Association of European Automobile Manufacturers: Overview of CO <sub>2</sub> based motor vehicle taxes in the EU, 2010.
ANFAC / ACEA 2010	The Automobile Industry Pocket Guide: Vehicles in use, key figures, 2010.
CECED 2006	CECED: White paper Energy efficiency a Short cut to Kyoto targets. The vision of European home appliances manufacturers. 2006 <a href="http://www.ceced.org/ICECED/easnet.dll/GETDoc?APPL=1&amp;DAT_IM=203E64&amp;eas:display=White%20Paper_Energy%20efficiency_Feb%202006_Final.pdf">http://www.ceced.org/ICECED/easnet.dll/GETDoc?APPL=1&amp;DAT_IM=203E64&amp;eas:display=White%20Paper_Energy%20efficiency_Feb%202006_Final.pdf</a>
Europe's Energy Portal 2010	online on: <a href="http://www.energy.eu/">http://www.energy.eu/</a> , retrieved on 18.07.2010.
EUREAU 2008	EUREAU: Statistics Overview on Water and Wastewater in Europe 2008. Country Profiles and European Statistics. European Federation of National Associations of Water & Wastewater Services. Brussels. 2009
European Commission 2002	European Commission – DG Taxation and Customs Union: Study on vehicle taxation in the member states of the European Union, Consultores em Transportes Inovacao e Sistemas, S.A., INFRAS – Consulting, Analysis, Research, Erasmus Universitiy Rotterdam, Deutsches Institut für Wirtschaftsforschung, 2002.
European Commission 1995	Commission Directive 95/12/EC of 23 May 1995 implementing Council Directive 92/75/EEC with regard to energy labelling of household washing machines. Official Journal L 136 , 21/06/1995 P. 0001 - 0027
Eurostat 2009	Eurostat Pocketbooks: Energy, transport and environment indicators, European Commission, Luxembourg: Publications Office of the European Union 2009.



EURO-TOPTEN PLUS 2010	Extension and strengthening of the European Topten Initiatives and of the market for innovative and efficient products, Market monitoring and web frequentation note No. 1 (month 10), prepared by Wuppertal Institute for Climate, Environment and Energy Germany, 2010.
Hunkeler et al. 2007	Hunkeler, D.; Lichtenvort K.; Rebitzer, G. (Hg): Andreas Ciroth, David Hunkeler, Gjalte Huppel, Kerstin Lichtenvort, Gerald Rebitzer, Ina Rüdener, Bengt Stehen (Lead authors): Environmental Life Cycle Costing. SETAC Publications, to be published in 2007.
ISIS 2007a	Preparatory studies for Eco-design requirements for EuPs. Lot 13: domestic refrigerators and freezers. Final report draft version task 3-5. Lead contractor: Istituto di Studi per l'Integrazione dei Sistemi (ISIS). December 2007
ISIS 2007b	Preparatory studies for Eco-design requirements for EuPs. Lot 13: domestic washing machines and dish washers. Final report draft version task 3-5. Lead contractor: Istituto di Studi per l'Integrazione dei Sistemi (ISIS). December 2007
kba 2007	<a href="http://www.kba.de">www.kba.de</a>
Kunert et al. 2005	Kunert, U.; Kalinowska, D.; Kuhfeld, H.; Rülcke, O.: Die Abgaben auf Kraftfahrzeuge im Jahr 2005, DIW Berlin, Politikberatung kompakt, Berlin 2005.
Navarro 2008	Navarro, X.: A summary of CO <sub>2</sub> -based tax schemes in Europe, 2008.
Rüdener et al. 2007	Rüdener, I.; Dross, M.; Eberle, U.; Gensch, C.; Graulich, K.; Hünecke, K.; Koch, Y.; Möller, M.; Quack, D.; Seebach, D.; Zimmer, W.; Hidson, M.; Defranceschi, P.; Tepper, P.: Costs and Benefits of Green Public Procurement in Europe, Öko-Institut e.V. / ICLEI, Freiburg 2007.
Rüdener et al. 2010	Rüdener, I.; Brommer, E.; Mudgal, S.; Lyons, L.; Kuwahara, I.; Cervantes, R.; Seifried, D.: Preparatory Studies for Eco-Design Requirements of Energy-using-Products, Lot 24: Professional dishwashers, Draft Version Task 2 Report, Öko-Institut e.V. / Bio Intelligence Service / Büro Ö-Quadrat, 2010.
Topten 2010	Topten info Polen: Kryteria wyboru samochodów online unter: <a href="http://Topten.info.pl/index.php?page=kryteria_wyboru_samochodow">http://Topten.info.pl/index.php?page=kryteria_wyboru_samochodow</a> , abgerufen am 31.05.2010.
UBA 2008	Dross, M.; Hermann, A.; Rüdener, I.; Möller, M.; Quack, D.; Dageförde, A.; Günther, E.; Bemme, J.: Umweltforschungsplan des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit: Nationale Umsetzung der neuen EU-Beschaffungs-Richtlinien, Texte 33/08.

VCS Magazin 2010

Auto / Umweltliste 10, Sondernummer VCS Magazin: Die 500 ökologischsten Fahrzeuge, 2010.

## 8 Annex: Results for the analysed product groups in detail

### 8.1 Household refrigeration appliances

Table 8-1 Results for household refrigeration appliances in detail

	unit	CEE (Poland)	North (Norway)	West (Germany)	South (Spain)
<b>Purchase costs</b>					
average purchase costs, Topten models	Euro	827,64 €	1.013,83 €	876,63 €	586,70 €
annual purchase costs, Topten models	Euro/year	55,18 €	67,59 €	58,44 €	39,11 €
average purchase costs Topten models per Liter net volume	Euro/Liter	3,24 €	3,66 €	2,99 €	2,02 €
max purchase costs, Topten models	Euro	1.863,40 €	1.720,77 €	1.409,00 €	917,00 €
min purchase costs Topten models	Euro	266,20 €	429,89 €	449,99 €	370,00 €
purchase costs inefficient model	Euro	290,40 €	1.107,00 €	679,00 €	650,00 €
purchase costs inefficient model per Liter net volume	Euro/Liter	1,11 €	3,33 €	2,01 €	1,95 €
average Topten net volume	Liter	258,40	270,10	293,59	288,30
<b>Energy costs</b>					
average total energy costs, Topten models	Euro/15 years	526,31 €	521,73 €	657,92 €	565,58 €
average annual energy costs, Topten models	Euro/year	35,09 €	34,78 €	43,86 €	37,71 €
average energy costs, Topten models per Liter net volume	Euro/Liter*15 years	2,04 €	1,80 €	2,24 €	1,99 €
max total energy costs, Topten models	Euro	575,25 €	540,60 €	716,10 €	657,54 €
min total energy costs Topten models	Euro	405,60 €	499,80 €	603,90 €	458,64 €
total energy costs inefficient model	Euro/15 years	606,45 €	1.009,80 €	1.155,00 €	1.212,12 €
total energy costs inefficient model per Liter net volume	Euro/Liter*15 years	2,31 €	3,04 €	3,43 €	3,63 €
electricity costs	Euro/kWh	0,13 €	0,17 €	0,22 €	0,156

	unit	CEE (Poland)	North (Norway)	West (Germany)	South (Spain)
average Topten energy demand, 15 years per Liter net volume	kWh/Liter	15,67	11,36	10,19	12,58
most efficient Topten model	kWh/Liter	11,14	9,84	9,31	9,77
least efficient Topten model	kWh/Liter	18,59	15,82	11,88	16,31
inefficient energy demand, 15 years per Liter net volume	kWh/Liter	17,81	17,89	15,58 €	23,26
<b>Total life cycle costs</b>					
average total costs, Topten models	Euro/15 years	1.353,95 €	1.535,56 €	1.534,55 €	1.152,28 €
average annual costs, Topten models	Euro/year	90,26 €	102,37 €	102,30 €	76,82 €
average total costs Topten models per Liter net volume	Euro/Liter*15 years	5,29 €	5,65 €	5,23 €	4,00 €
max total costs, Topten models	Euro/15 years	2.432,80 €	2.240,97 €	2.088,70 €	1.551,14 €
min total costs Topten models	Euro	792,70 €	970,49 €	1.090,19 €	888,74 €
total costs inefficient model	Euro/15 years	896,85 €	2.116,80 €	1.834,00 €	1.862,12 €
total costs inefficient model per liter net volume	Euro/Liter*15 years	3,42 €	6,38 €	5,44 €	5,58 €
total costs best model, (hypothetically)	Euro/15 years	671,80 €	929,69 €	1.053,89 €	828,64 €
<b>Share purchase costs, total</b>					
average Topten	percent	61,1%	66,0%	57,1%	50,9%
inefficient model	percent	32,4%	52,3%	37,0%	34,9%
<b>Share purchase costs, per liter net volume</b>					
average Topten	percent	61,3%	64,7%	57,1%	50,4%
inefficient model	percent	32,4%	52,3%	37,0%	34,9%
<b>Share electricity costs, total</b>					
average Topten	percent	38,9%	34,0%	42,9%	49,1%
inefficient model	percent	67,6%	47,7%	63,0%	65,1%
<b>Share electricity costs, per liter net volume</b>					
average Topten	percent	38,7%	35,3%	42,9%	49,6%
inefficient model	percent	67,6%	47,7%	63,0%	65,1%

## 8.2 Washing machines

Table 8-2 Results for washing machines in detail

	unit	CEE (Poland)	North (Norway)	West (Germany)	South (Spain)
<b>Purchase costs</b>					
average purchase costs, Topten models	Euro	911,15 €	1.197,59 €	771,47 €	1.391,67 €
annual purchase costs, Topten models	Euro/year	60,74 €	79,84 €	51,43 €	92,78 €
max purchase costs, Topten models	Euro	2.119,92 €	1871,445	1.199,00 €	1.699,00 €
min purchase costs Topten models	Euro	386,96 €	984	499,90 €	917,00 €
purchase costs inefficient model	Euro	261,12 €	553,50 €	399,00 €	582,00 €
<b>Energy costs</b>					
average total energy costs, Topten models	Euro/15 years	397,80 €	548,25 €	666,31 €	450,84 €
average annual energy costs, Topten models	Euro/year	26,52 €	36,55 €	44,42 €	30,06 €
max total energy costs, Topten models	Euro	397,80 €	612	673,20 €	477,36 €
min total energy costs Topten models	Euro	397,80 €	530,4	594,00 €	397,80 €
total energy costs inefficient model	Euro/15 years	409,50 €	581,40 €	752,40 €	645,84 €
electricity costs	Euro/kWh	0,13	0,17	0,22 €	0,156
average Topten models electricity demand	kWh/15 years	3.060	3.225	3.029	2.890
most efficient Topten model	kWh/15 years	3.060	3.120	2.700	2.550
least efficient Topten model	kWh/15 years	3.060	3.600	3.060	3.060
inefficient models electricity demand	kWh/15 years	3.150	3.420	3.420	4.140
<b>water costs</b>					
average total water costs, Topten models	Euro/15 years	489,99 €	609,39 €	505,77 €	495,80 €
average annual water costs, Topten models	Euro/year	32,67 €	40,63 €	33,72 €	33,05 €
max total water costs, Topten models	Euro	521,70 €	654,9	543,90 €	521,70
min total water costs Topten models	Euro	410,70 €	532,8	410,70 €	466,2

	unit	CEE (Poland)	North (Norway)	West (Germany)	South (Spain)
total water costs inefficient model	Euro/15 years	588,30 €	577,20 €	543,90 €	643,8
water costs	Euro/m <sup>3</sup>	3,70 €	3,70 €	3,70 €	3,70 €
average Topten models water demand	l/15 years	132.429	164.700	136.696	134.000
most efficient Topten model	l/15 years	111.000	144.000	111.000	126.000
least efficient Topten model	l/15 years	141.000	177.000	147.000	141.000
inefficient models water demand	l/15 years	159.000	156.000	147.000	174.000
<b>detergent costs</b>					
total detergent costs	Euro	660,00 €	660,00 €	660,00 €	660,00 €
annual detergent costs	Euro	44,00 €	44,00 €	44,00 €	44,00 €
<b>Total life cycle costs</b>					
average total costs, Topten models	Euro/15 years	2.458,93 €	3.015,23 €	2.604	2.998,31 €
average annual costs, Topten models	Euro/year	163,93 €	201,02 €	174	199,89 €
max total costs, Topten models	Euro	3.699,42 €	3.677,45 €	3.053,90 €	3.223,00 €
min total costs Topten models	Euro	1.945,42 €	2.723,40 €	2.334,69 €	2.553,86 €
total costs inefficient model	Euro/15 years	1.918,92 €	2.372,10 €	2.355,30 €	2.531,64 €
total costs best model, (hypothetically)	Euro/15 years	1.855,46 €	2.707,20 €	2.164,60 €	2.441,00 €
<b>Share purchase costs, total</b>					
average Topten	percent	37,1%	39,7%	29,6%	46,4%
inefficient model	percent	13,6%	23,3%	16,9%	23,0%
<b>Share electricity costs, total</b>					
average Topten	percent	16,2%	18,2%	25,6%	15,0%
inefficient model	percent	21,3%	24,5%	31,9%	25,5%
<b>Share water costs, total</b>					
average Topten	percent	19,9%	20,2%	19,4%	16,5%
inefficient model	percent	30,7%	24,3%	23,1%	25,4%
<b>Share detergent costs, total</b>					
average Topten	percent	26,8%	21,9%	25,3%	22,0%
inefficient model	percent	34,4%	27,8%	28,0%	26,1%
<b>Total</b>					
average Topten	percent	100,0%	100,0%	100,0%	100,0%
inefficient model	percent	100,0%	100,0%	100,0%	100,0%

### 8.3 Computer monitors

Table 8-3 Results for computer monitors in detail

	unit	CEE (Poland)	North (Finland)	West (Germany)	South (Portugal)
<b>Purchase costs</b>					
average purchase costs, Topten models	Euro	232,67 €	295,53 €	258,18 €	301,66 €
annual purchase costs, Topten models	Euro/year	46,53 €	59,11 €	51,64 €	60,33 €
max purchase costs, Topten models	Euro	459,80 €	542,34 €	529,00 €	520,00 €
min purchase costs Topten models	Euro	118,58 €	164,03 €	139,00 €	160,00 €
purchase costs inefficient model	Euro	217,80 €	218,00 €	301,00 €	200,00 €
<b>Energy costs</b>					
average total energy costs, Topten models private use	Euro/5 years	16,47 €	24,20 €	36,00 €	24,57 €
average total energy costs, Topten models office use	Euro/5 years	38,72 €	58,36 €	84,90 €	60,60 €
average annual energy costs, Topten models private use	Euro/year	3,29 €	4,84 €	7,20 €	4,91 €
average annual energy costs, Topten models office use	Euro/year	7,74 €	11,67 €	16,98 €	12,12 €
max total energy costs, Topten models private use	Euro	19,93 €	29,20 €	40,95 €	29,49 €
max total energy costs, Topten models office use	Euro	46,88 €	68,61 €	90,74 €	71,93 €
min total energy costs Topten models private use	Euro	11,30 €	18,91 €	31,20 €	22,37 €
min total energy costs Topten models office use	Euro	26,23 €	46,17 €	76,20 €	55,01 €
total energy costs inefficient model private use	Euro/5 years	44,84 €	43,81 €	46,37 €	52,27 €
total energy costs inefficient model office use	Euro/5 years	107,71 €	106,15 €	111,48 €	127,49 €
electricity costs	Euro/kWh	0,130 €	0,127 €	0,220 €	0,153 €
average Topten models electricity demand private use	kWh/5 years	25,34	38,10	32,72	32,12
average Topten models electricity demand office use	kWh/5 years	59,56	91,90	77,19	79,22
inefficient models electricity demand private use	kWh/5 years	68,99	68,99	42,16	68,33
inefficient models electricity demand office use	kWh/5 years	165,71	167,17	101,35	166,66
<b>Total life cycle costs</b>					
average total costs, Topten models private use	Euro/5 years	249,13 €	319,73 €	294,18 €	326,23 €
average total costs, Topten models	Euro/5	271,38 €	353,89 €	343,09 €	362,26 €

	unit	CEE (Poland)	North (Finland)	West (Germany)	South (Portugal)
office use	years				
average annual costs, Topten models private use	Euro/year	49,83 €	63,95 €	58,84 €	65,25 €
average annual costs, Topten models office use	Euro/year	54,28 €	70,78 €	68,62 €	72,45 €
max total costs, Topten models private use	Euro/5 years	479,16 €	564,73 €	563,57 €	542,78 €
max total costs, Topten models office use	Euro/5 years	506,68 €	599,12 €	614,52 €	575,62 €
min total costs Topten models private use	Euro/5 years	133,31 €	184,59 €	179,95 €	182,37 €
min total costs Topten models office use	Euro/5 years	152,32 €	215,44 €	229,74 €	215,01 €
total costs inefficient model private use	Euro/5 years	262,64 €	261,81 €	347,37 €	252,27 €
total costs inefficient model office use	Euro/5 years	325,51 €	324,15 €	412,48 €	327,49 €
<b>Share purchase costs, total</b>					
average Topten, private use	percent	93,4%	92,4%	87,8%	92,5%
average Topten, office use	percent	85,7%	83,5%	75,3%	83,3%
inefficient model, private use	percent	82,9%	83,3%	86,7%	79,3%
inefficient model, office use	percent	66,9%	67,3%	73,0%	61,1%
<b>Share electricity costs, total</b>					
average Topten, private use	percent	6,6%	7,6%	12,2%	7,5%
average Topten, office use	percent	14,3%	16,5%	24,7%	16,7%
inefficient model, private use	percent	17,1%	16,7%	13,3%	20,7%
inefficient model, office use	percent	33,1%	32,7%	27,0%	38,9%

## 8.4 Passenger cars

Table 8-4 Results for compact cars in detail

	unit	CEE (Poland)	North (Finland)	West (Germany)	South (Greece)
<b>Purchase costs</b>					
average purchase costs, Topten models	Euro	17.044,15 €	25.614,84 €	20.669,00 €	21.301,25 €
annual purchase costs, Topten models	Euro/year	1.420,35 €	2.134,57 €	2.020,83 €	1.775,10 €
max purchase costs, Topten models	Euro	23.460,69 €	34.860,50 €	24.250,00 €	25.200,00 €
min purchase costs Topten models	Euro	13.830,30 €	19.441,40 €	10.280,00 €	14.720,00 €
purchase costs inefficient model	Euro	17.361,22 €	23846,75167	25.960,00 €	21.301,25 €
<b>Energy costs</b>					
average total fuel costs, Topten models	Euro/12 years	7.175,78 €	6.713,67 €	8.066,88 €	10.530,00 €
average annual fuel costs, Topten models	Euro/year	597,98 €	559,47 €	672,24 €	877,50 €
max total fuel costs, Topten models	Euro	9.600,00 €	8.280,00 €	10.620,00 €	11.793,60 €
min total fuel costs Topten models	Euro	6.147,60 €	5.709,60 €	6.002,40 €	8.236,80 €
total fuel costs inefficient model	Euro/12 years	10.500,00 €	9.828,00 €	12.240,00 €	13.104,00 €
annual fuel costs inefficient model	Euro/ year	875,00 €	819,00 €	1.020,00 €	1.092,00 €
registration tax, average Topten models	Euro	1.515,81 €	3.615,81 €	0,00 €	2.667,00 €
annual circulation tax, 15 years	Euro/15 years	0,00 €	5.934,00 €	Included in total costs	1.596,00 €
<b>Total life cycle costs</b>					
average total costs, Topten models	Euro/12 years	25.735,74 €	41.878,32 €	74.039,33 €	36.094,25 €
average annual costs, Topten models	Euro/year	2.144,65 €	3.489,86 €	6.169,94 €	3.007,85 €
max total costs, Topten models	Euro/12 years	32.348,75 €	52.476,09 €	79.486,56 €	40.507,80 €
min total costs Topten models	Euro	21.956,29 €	34.262,57 €	51.510,24 €	30.027,80 €
total costs inefficient model	Euro/12 years	29.405,23 €	45.069,66 €	86.693,76 €	38.668,25 €



	unit	CEE (Poland)	North (Finland)	West (Germany)	South (Greece)
total costs best model, (hypothetically)	Euro/12 years	21.493,71 €	34.700,81 €	16.282,40 €	27.219,80 €
Share of fuel costs, average Topten models	percent	27,9%	16,0%	10,9%	29,2%
Share of fuel costs, inefficient model	percent	35,7%	21,8%	14,1%	33,9%
Fuel consumption average Topten model	l/100 km	5,18	4,15	4,98	5,50
Max fuel consumption Topten	l/100 km	6,40	4,60	5,90	6,30
Min fuel consumption Topten	l/100 km	4,60	3,83	4,10	4,40
Fuel consumption inefficient model	l/100 km	7,00	7,00	6,80	7,00
Relation inefficient to average Topten model	percent	135,1%	168,7%	136,5%	127,3%
CO2 emissions, Topten average	g CO2/km	132,64	101,91	125,60	131,25
CO2 emissions, Topten Max	g CO2/km	155,0	109,0	140,0	147,0
CO2 emissions, Topten Min	g CO2/km	109,0	89,0	109,0	101,0
CO2 emissions, inefficient model	g CO2/km	189,0	189,0	163,0	189,0