

## **Preparatory Studies for Eco-design Requirements of Energy-using Products**

### **Lot 24: Professional Washing Machines, Dryers and Dishwashers**

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**Final Report, Part: Dishwashers**

**Task 2: Economic and Market Analysis**

**Öko-Institut e.V.**  
**Institute for Applied Ecology, Germany**  
Ina Rüdener  
Eva Brommer  
Markus Blepp  
Carl-Otto Gensch  
Kathrin Graulich

**BIO Intelligence Service, France**  
Shailendra Mudgal  
Raul Cervantes  
Thibault Faninger  
Lorcan Lyons

**Büro Ö-Quadrat, Germany**  
Dieter Seifried

**Öko-Institut e.V.**  
**Freiburg Head Office**  
P.O. Box 17 71  
79017 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

**Darmstadt Office**  
Rheinstr. 95  
64295 Darmstadt, Germany  
**Tel.** +49 (0) 6151 – 81 91-0  
**Fax** +49 (0) 6151 – 81 91-33

**Berlin Office**  
Schicklerstr. 5-7  
10179 Berlin, Germany  
**Tel.** +49 (0) 30 – 40 50 85-0  
**Fax** +49 (0) 30 – 40 50 85-388

For reasons of better readability, two Task 2 reports were prepared.

The report at hand covers ***professional dishwashers***.

The Task 2 report on *professional washing machines and dryers*  
is published separately.

## **Part: Professional Dishwashers**

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## **1 Introduction**

### **1.1 Objective of Task 2**

The purpose of this task is to present the economic and market analysis related to professional dishwashers. The aim is, firstly, to place this product group within the total of the European Union (EU) industry and trade policy. Secondly, it provides market and cost inputs for the EU-wide environmental impacts of the product group. Thirdly, it aims to provide insights into the latest market trends. This will be an input for the subsequent tasks such as improvement potential. Finally, practical data on consumer prices and rates is provided to be used later in the Life Cycle Costs (LCC) calculations.

Note that the report at hand only covers professional dishwashers. The Task 2 report on professional washing machines and dryers is published separately.

## **2 General economic data**

The PRODCOM database is useful for an initial analysis as it is transparent and publicly available data provided by Member States of the EU on manufacturing and production information within the EU.

### **2.1 Production**

#### **2.1.1 Unit volume**

In 2007, 378 800 professional dishwashers were produced according to Prodcom data. Table 1 shows the number of units produced for 2005-2008, indicating where large manufacturing centres are located. However, it is important to note that data is missing for several Member States and therefore the total has to be considered with caution.

Table 1 Production of professional dishwashing machines by Member State in units, 2005-2008 (thousand units)

Country	2005	2006	2007	2008	% change 2005-2008
Belgium	-	-	-	-	
Bulgaria	-	-	-	-	
Czech Republic	-	-	-	-	
Denmark	1.4	1.4	1.5	1.3	-7%
Germany	62.9	66.2	84.2	83.2	+32%
Estonia	0	0	0	0	
Ireland	0	0	0	0	
Greece	-	-	-	-	
Spain	31.2	36.7	37.0	36.8	+18%
France	2.9	-	2.5	-	
Italy	230.8	218.6	236.1	222.4	-4%
Cyprus	0	0	0	0	
Latvia	0	0	0	0	
Lithuania	0	0	0	0	
Luxembourg	0	0	0	0	
Hungary	0	0	0	0	
Malta	0	0	0	0	
Netherlands	0	-	-	-	
Austria	-	-	0	0	
Poland	-	-	-	-	
Portugal	0.6	-	0.5	0	
Romania	0	0	0	0	
Slovenia	0	-	0	0	
Slovakia	-	-	-	-	
Finland	0	0	0	0	
Sweden	-	-	-	-	
UK	5.8	6.6	7.2	2.3	-60%
<b>EU-27</b>	<b>346.2</b>	<b>343.7</b>	<b>378.8</b>	<b>357.1</b>	<b>+3%</b>

'-' signifies that the information is unavailable either because it is confidential or estimated or both.  
Source: Prodcop.

The Prodcop data suggests that Italy, Germany and Spain are the largest centres of professional dishwasher manufacturing. The UK and France also produce professional dishwashers but a much smaller amount. While this is not an exhaustive or comprehensive analysis, it gives an overview of the professional dishwasher market and indicates in which Member States the analysis can fruitfully be pursued. As for confidential data, 11 100 units were unaccounted for in 2008, produced across nine different Member States. Stakeholders



have commented that Sweden contributes a significant number of units to the market and is thought to have the largest share of the unaccounted units. However, this information is not available in Prodcom. Electrolux is an example of a major international domestic and professional appliance manufacturer based in Sweden.

Based on the above, 97% of total reported unit production in the EU in 2008 is non-confidential and non-estimated data. This means that a very significant share of the total EU-27 market is accounted for by Prodcom data and shows that:

- Italy represents 62% of the units produced in the EU in 2008;
- Germany represents 23%;
- Spain represents 10%.

Therefore, 96% of the dishwasher market in Europe is produced in Italy, Germany or Spain (difference in sum total due to rounding).

### 2.1.2 Sales value

Figure 1 shows the value of professional dishwashers produced according to PRODCOM.

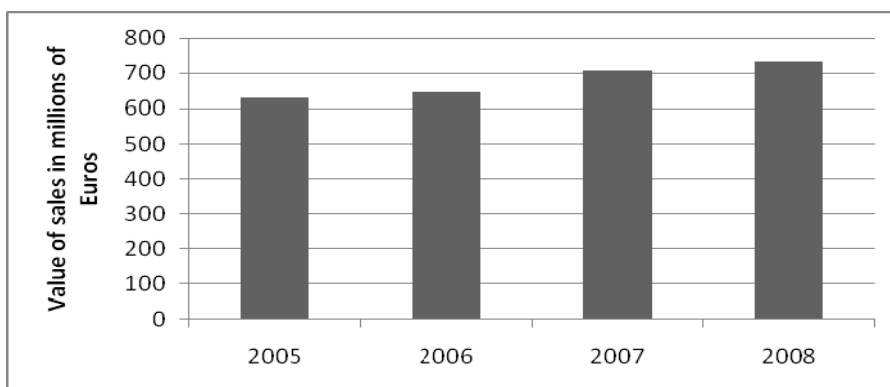


Figure 1 Value of EU-produced professional dishwashers in EU-27, 2005-2008<sup>1</sup>

The sales value of professional dishwashers produced in the EU amounted to about 735 million Euro in 2008. This is almost three times higher than the sales value of professional washing machines and almost four times the sales value of professional dryers. The average annual growth in sales over the past four years is 5.1%. This will be elaborated further in the market trend section (Section 4).

The sales data by Member State show a key distinction between the volume of units produced and the value of the sales. Table 2 shows Germany as having the highest sales in the EU, surpassing Italy, which was shown in Table 1 to produce over twice as many

<sup>1</sup> PRODCOM statistics based on NACE 2 Rev. accessed at: [http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables\\_excel](http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables_excel), 18 Jan 2010.

machines. This difference can be explained by the difference in the value of the machines. Germany tends to produce larger, more sophisticated conveyor-type dishwashers while Italy tends to produce simpler undercounter professional dishwashers with lower sales value (cf. Section 3.2).

Table 2 Value of professional dishwashing machines produced in EU-27 by Member State (thousand Euro)<sup>1</sup>

Member State	2005	2006	2007	2008
Belgium	-	-	-	-
Bulgaria	-	-	-	-
Czech Republic	-	-	-	-
Denmark	8 769	10 198	10 837	9 400
Germany	260 683	274 972	311 249	351 575
Estonia	0	0	0	0
Ireland	0	0	0	0
Greece	-	-	-	-
Spain	33 010	38 463	40 208	58 458
France	26 557	-	24 385	-
Italy	262 439	253 760	272 578	237 856
Cyprus	0	0	0	0
Latvia	0	0	0	0
Lithuania	0	0	0	0
Luxembourg	0	0	0	0
Hungary	0	0	0	0
Malta	0	0	0	0
Netherlands	0	-	-	-
Austria	-	-	0	0
Poland	-	-	-	-
Portugal	405	-	358	0
Romania	0	0	0	0
Slovenia	0	-	0	0
Slovakia	-	-	-	-
Finland	0	0	0	0
Sweden	-	-	-	-
UK	10 051	10 872	12 894	16 690
<b>EU-27</b>	<b>631 421</b>	<b>645 554</b>	<b>706 463</b>	<b>732 456</b>

<sup>1</sup> '-' signifies that the information is unavailable either because it is confidential or estimated or both.

Source: Prodcorn

Germany and Italy have the largest market value, followed by Spain and the UK. Germany is the most prominent market here despite the fact that in Table 1 Italy had a much larger volume of sales. This can be explained by the difference in unit values reported by Prodcorn.

### 2.1.3 Unit value

Dishwashers have a unit value which is highly dependent on the Member State in question. Table 3 shows the range of unit values for non-domestic dishwashers as reported by Prodcum for the Member States where information is available.

Table 3 Unit value of non-domestic dishwashing machines by Member State reporting <sup>1</sup>

Member State	Unit value (Euro)
Germany	4 227
Spain	1 587
Italy	1 069
United Kingdom	7 375
<b>EU-27</b>	<b>2 051</b>

The EU average unit value of 2 051 Euro has been fairly stable for several years. It is a weighted average of several market segments and is heavily weighted to smaller and simpler machines which sell in higher numbers. Section 5.1 further elaborates unit prices for the life cycle cost data for this study.

Overall, Prodcum statistics are not complete for each product and each Member State, so they can only provide a rough overview. Further detail specific to the professional dishwasher market is provided in the following section.

## 2.2 Trade

### 2.2.2 PRODCOM Imports and Exports

Table 4 shows imports and exports of professional dishwashers by Member State for the year 2008. In terms of quantity, Germany, Italy and Spain appear as the largest exporters of professional dishwashers while France, the United Kingdom and Spain are the most important importers.

Table 4 Quantity and value of exports and imports of professional dishwashers, 2008<sup>2</sup>

Non-domestic dish-washing machines				
Member State	Exports		Imports	
	Quantity	Value (Euro)	Quantity	Value (Euro)
Austria	1 360	2 280 980	7 911	15 757 830
Belgium	1 626	2 794 570	6 245	11 112 560
Bulgaria	1 051	935 360	4 564	1 930 410
Cyprus	0	0	734	684 130
Czech Republic	785	1 770 820	4 126	7 857 190
Denmark	4 249	6 658 400	19 007	10 703 250
Estonia	247	124 970	2 005	1 075 560
Finland	1 304	4 572 570	4 807	14 755 180
France	3 028	3 398 840	49 579	68 127 490
Germany	52 035	166 952 720	19 621	28 887 900
Greece	2 519	1 455 480	6 976	7 478 230
Hungary	115	400 940	971	1 749 090
Ireland	50	94 100	2 750	3 422 440
Italy	174 377	215 360 610	3 243	7 471 940
Latvia	142	152 590	303	572 870
Lithuania	783	1 270 070	765	1 510 130
Luxemburg	73	70 880	484	831 840
Malta	0	0	225	267 700
Netherlands	2 177	3 061 610	6 986	17 100 450
Poland	372	623 590	8 013	9 540 370
Portugal	345	521 490	8 731	7 265 100
Romania	13	22 550	5 988	2 968 310
Slovakia	31	429 100	2 109	2 319 600
Slovenia	1 008	2 652 050	3 315	4 052 980
Spain	14 424	15 371 910	25 729	19 845 600
Sweden	5 431	24 830 100	7 018	12 423 650
United Kingdom	8 365	5 664 240	35 064	53 789 180

### 2.2.3 INTRA and EXTRA databases

The Eurostat trade databases INTRA and EXTRA also contain import and export data albeit using the CN8 codification (Combined Nomenclature, which was established to meet the requirements both of the Common Customs Tariff and of the external trade statistics of the European Union), using 8-digit codes. The value of products traded by Member States with other Member States (INTRA) and the value of products traded by Member States with non-Member States (EXTRA) in 2009 are presented in Table 5.

<sup>2</sup> PRODCOM statistics based on NACE 2 Rev. accessed at [http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables\\_excel](http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables_excel), 18 Jan 2010.

Table 5 Value of exports and imports of professional dishwashers to and from non-Member States (EU-27 EXTRA) and to and from other Member States together (EU-27 INTRA), 2009<sup>3</sup>

Member State	EU-27 EXTRA (Value in Euros)		EU-27 INTRA (Value in Euros)	
	Imports	Exports	Imports	Exports
<b>CN8 84221900 Non-domestic dish-washing machines</b>				
Austria	122 043	863 816	13 989 762	481 141
Belgium	68 275	507 712	9 427 580	2 061 292
Bulgaria	23 370	215 738	810 046	520 357
Cyprus	10 481	:	630 748	:
Czech Republic	7 419	73 738	5 039 819	1 051 605
Denmark	58 818	1 214 430	8 923 394	4 832 103
Estonia	15 010	71 651	370 446	5 564
Finland	5 270	1 733 111	11 781 556	2 253 052
France	626 901	2 055 975	64 799 436	1 481 337
Germany	15 547 330	45 402 587	13 223 612	103 893 536
Greece	181 983	237 862	5 328 585	770 559
Hungary	63 619	32 078	4 921 157	357 584
Ireland	177 592	44 023	2 003 128	19 528
Italy	1 431 372	36 548 332	6 904 378	130 633 774
Latvia	21 586	67 885	192 401	28 307
Lithuania	9 166	602 863	423 787	23 921
Luxembourg	:	11 700	1 091 679	66 391
Malta	:	:	141 834	:
Netherlands	38 216	298 099	12 694 390	2 051 227
Poland	296 061	268 504	6 929 418	230 334
Portugal	:	642 756	6 794 160	530 285
Romania	65 984	17 854	1 392 699	36 981
Slovakia	2 124	308	2 247 409	870 831
Slovenia	39 363	1 168 394	2 709 291	807 032
Spain	265 969	4 715 122	12 786 413	3 192 840
Sweden	80 804	3 417 530	9 255 173	18 209 828
United Kingdom	166 800	1 058 789	44 422 066	3 236 509
<b>EU-27</b>	<b>19 325 556</b>	<b>101 270 857</b>	<b>249 234 367</b>	<b>277 645 918</b>

### 2.3 Apparent EU-consumption

Apparent consumption as shown in Table 6 provides information on the total quantity sold by manufacturers in the EU. It is calculated as follows:

$$\text{Apparent consumption}_{EU-27} = \text{Imports}_{EU-27} - \text{Exports}_{EU-27} + \text{Production}_{EU-27}$$

<sup>3</sup> Source: Eurostat trade database EXTRA and INTRA

Apparent consumption can be calculated in currency (Euro) or in physical units. In order to have consistent categories, PRODCOM trade data is used. Note that for several countries, import and export data is reported in PRODCOM but production is reported as zero, or not reported at all (in which case '-' is indicated in the table). These figures should thus be considered with caution (e.g. the apparent consumption of Slovenia in 2007 is negative which is in theory impossible).

Table 6 Apparent consumption of non-domestic dishwashers at EU level<sup>41</sup>

Member State	2005		2006		2007		2008	
	Quantity (in units)	Value (in m€)	Quantity (in units)	Value (in m€)	Quantity (in units)	Value (in m€)	Quantity (in units)	Value (in m€)
Austria	-	-	-	-	6 350	12.11	6 551	13.48
Belgium	-	-	-	-	-	-	-	-
Bulgaria	-	-	-	-	-	-	-	-
Cyprus	744	0.47	725	0.72	754	1.03	734	0.68
Czech Rep.	-	-	-	-	-	-	-	-
Denmark	4 060	9.94	3 810	12.48	7 299	14.16	16 092	13.44
Estonia	399	0.54	116	0.70	6 327	0.72	1 758	0.95
Finland	2 584	4.65	2 848	7.21	3 258	7.85	3 503	10.18
France	36 739	73.98	-	-	61 995	81.22	-	-
Germany	44 953	174.42	43 348	176.10	55 414	188.25	50 751	213.51
Greece	-	-	-	-	-	-	4 457	6.02
Hungary	2 061	2.23	3 289	1.98	1 049	-0.24	856	1.35
Ireland	7 343	4.82	5 163	4.55	5 121	3.87	2 700	3.33
Italy	39 518	83.98	24 671	62.37	59 324	70.80	51 260	29.97
Latvia	423	0.35	436	0.71	289	0.46	161	0.42
Lithuania	452	0.70	361	0.47	498	0.35	-18	0.24
Luxembourg	426	0.65	340	0.95	656	1.13	411	0.76
Malta	5 457	0.25	284	0.19	151	0.15	225	0.27
Netherlands	8 163	9.79	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-	-
Portugal	9 044	5.94	-	-	12 069	7.49	8 386	6.74
Romania	0	1.33	1 572	2.82	2 912	3.48	5 975	2.95
Slovakia	-	-	-	-	-	-	-	-
Slovenia	1 215	0.71	-	-	-1 742	1.17	2 307	1.40
Spain	17 231	40.72	30 483	47.87	70 186	48.04	48 123	62.93
Sweden	-	-	-	-	-	-	-	-
UK	13 309	52.63	30 007	49.75	4 825	54.49	35 019	62.18
<b>EU-27</b>	<b>256 608</b>	<b>552.81</b>	<b>284 881</b>	<b>558.02</b>	<b>298 755</b>	<b>603.45</b>	<b>301 093</b>	<b>609.54</b>

<sup>4</sup> PRODCOM statistics based on NACE 2 Rev. accessed at [http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables\\_excel](http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables_excel), 18 Jan 2010.

The Eurostat PRODCOM database has the advantage of being an official EU source that is used and referenced in other EU policy documents regarding trade and economic policy. However, it is not always complete or of high enough quality to serve as a useful market data source for this study. Table 7 shows the number of professional dishwashers by inhabitant and Member State in 2008. For MS where the data is available, the figures show large variation yet this figure is not expected to vary much across countries: between 340 for Denmark and 14 105 for Latvia. This highlights the uncertainties existing about Eurostat data in certain countries. However, several Member States present one machine for approximately 1 000 – 2 000 inhabitants (e.g. Austria, Finland, Germany, Italy, Ireland, Portugal, UK), which also turns out to be the EU-27 average (1 653 inhabitants per machine).

Table 7 Number of professional dishwasher by inhabitant, by Member State in 2008<sup>5</sup>

Member State	2008	
	Population (in inhabitants)	Number of inhabitants for one professional dishwasher
Austria	8 318 592	1 270
Belgium	10 666 866	-
Bulgaria	7 640 238	-
Cyprus	789 269	1 075
Czech Republic	10 381 130	-
Denmark	5 475 791	340
Estonia	1 340 935	763
Finland	5 300 484	1 513
France	64 004 333	-
Germany	82 217 837	1 620
Greece	11 213 785	2 516
Hungary	10 045 401	11 735
Ireland	4 401 335	1 630
Italy	59 619 290	1 163
Latvia	2 270 894	14 105
Lithuania	3 366 357	-187 020
Luxemburg	483 799	1 177
Malta	410 290	1 824
Netherlands	16 405 399	-
Poland	38 115 641	-
Portugal	10 617 575	1 266
Romania	21 528 627	3 603

<sup>5</sup> PRODCOM statistics based on NACE 2 Rev. accessed at [http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables\\_excel](http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables_excel), 18 Jan 2010

Member State	2008	
	Population (in inhabitants)	Number of inhabitants for one professional dishwasher
Slovakia	5 400 998	-
Slovenia	2 010 269	871
Spain	45 283 259	941
Sweden	9 182 927	-
United Kingdom	61 191 951	1 747
<b>EU-27</b>	497 683 272	1 653

To double check these statistics, it was necessary to investigate other sources of sales and stock data. Additional information was gathered through questionnaires sent to stakeholders, mainly manufacturers, and is presented in the next section.

### 3 Market data

Based on the product definition of Task 1, six broad categories have been defined for professional dishwashers that can be used here for market and stock data definition. Based on the market data collected, further refinement will allow the key representative products (or product features) to be analysed in the later stages of the study.

#### 3.1 Market structure

The professional dishwasher market is above all a business-to-business (B2B) market and has some key characteristics:

##### 3.1.1 Sales and distribution

- The majority of smaller manufacturers typically sell and distribute their products to catering equipment dealers/distributors who stock and sell several brands of professional dishwashers and usually other types of catering equipment supplies (ovens, refrigerators, plates, utensils, etc). This is particularly applicable for smaller machines such as the undercounter and hood-type machines. The catering equipment distribution and supplier network for small professional dishwasher machines is very convoluted as several supply routes are available depending on the type of end user, the end application and the type of machine bought. Because of the competition and the saturation of the market, the choice of distribution strategies is very important which is why many different ones have been developed. Machines may be purchased directly from the manufacturers, via wholesalers, various kinds of retailers or on the second-



hand market. For this reason, manufacturers of small appliances generally do not keep close track of where their products end up.

- Professional dishwashers sold directly to users from the manufacturer tend to be larger dishwashers (conveyor-type) and are usually tuned to customer-specific specifications or requirements upon purchase. They indeed require more intensive support services (training, servicing).
- A UK study estimated that the warewashing industry sales in 2007 occurred according to the proportions presented in Figure 2. This figure is also in agreement with German stakeholder comments. A dealer is a company that buys from a manufacturer or importer (sometimes under an exclusive contract), and sells to the end user or operator<sup>6</sup>. A wholesaler is a company that buys equipment in large quantities from manufacturers and generally sells to other retailers/dealers rather than to end users. In practice, the situation may be more complicated as a company can act as a wholesaler for one manufacturer/distributor, while having the role of a dealer for another manufacturer/distributor. Direct distribution arises when a manufacturer negotiates with and sells equipment directly to the end user.

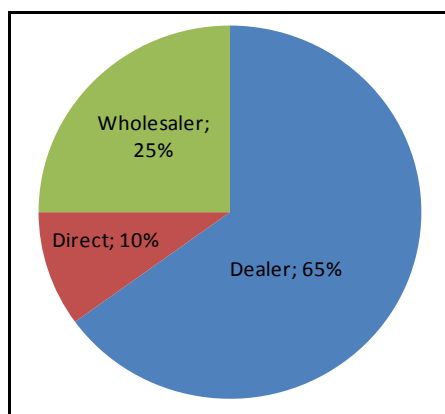


Figure 2 Distribution channels in the UK for warewashing equipment in 2007<sup>7</sup>

- Catering equipment dealers often service and maintain the dishwasher products and can also be dedicated (affiliate) suppliers of one or a few particular dishwasher brands. They do not operate walk in shops but make site visits to the customers. Companies include mostly SMEs with large businesses as well comprising the operators.

<sup>6</sup> Because of the European single market, a product manufactured within the EU is 'distributed' to other MS, not 'exported'.

<sup>7</sup> Catering Equipment Suppliers' Association (CESA) 2007, *The UK Market for Foodservice Equipment – The authoritative report on the UK market*

Equipment may be sold through several channels depending on the company: in dedicated retail outlets, online or as part of a full project management service.

### 3.1.2 International trade

- Professional dishwasher imports are not a major market presence in Europe. Foreign brands (Whirlpool, Maytag, etc.) are predominantly American and have established subsidiary manufacturing plants within the EU. Very few sales of professional dishwashers are expected to be direct imports: main provenance countries mentioned by stakeholders are the USA, China, Canada, Turkey, and South Korea. Some machines can be assembled to a certain degree outside EU countries and finalised within EU countries so that they are considered as manufactures in the EU. Without considering these machines as imports, stakeholders have estimated that total EU imports are of the order of 1-2% of total annual production (around 6 000 units).
- Exports outside of the EU are estimated to represent approximately 25-30% of the manufacturing capacity in the EU. While each of the three main EU manufacturing Member States exports their products, it is expected that the majority (approximately 70%) of this trade is done on an intra-EU level. Russia is the largest extra-EU professional dishwasher export market according to stakeholders.

## 3.2 Manufacturers

The B2B nature of the professional dishwasher market makes it much less transparent than the household dishwasher market. This poses difficulties when attempting to characterise the market in terms of sales, stock, prices and even brands. As there is not a large number of professional dishwasher manufacturers, it is considered relevant to list them for the sake of characterising the market.

The following manufacturers have been identified in the professional dishwasher market in the EU:

Table 8 (Non-exhaustive) list of professional dishwasher manufacturers relevant to the European market

Manufacturer	Country	Manufacturer	Country
Comenda	International (IT)	Eurowash (Eurotek)	Italy
Meiko	International (DE)	Zanussi	Italy
Winterhalter	International (DE)	Mach	(Italy)
Hobart	International (DE)	Jemi	Spain
Fagor Industrial	International (ES)	Difri	Spain
Electrolux	International (SE)	Edesa	Spain
Whirlpool Commercial	International (US)	Linea Blanca	Spain
Miele	International (DE)	Ni-Krom	Spain

Manufacturer	Country	Manufacturer	Country
Rhima	Austria	Sammic	Spain
Jeros	Denmark	Macfrin Grup	Spain
Ken	Denmark	Linea Blanca	Spain
Thirode	France	Sammic	Spain
Solymac International	France	Adler / Crystalline	(Spain)
Bonnet	France	Granuldisk	Sweden
Rosinox	France	Wexiodisk	Sweden
Metos	France	Dc	UK
Jeros	France	Classeq	UK
Palux	Germany	Breakline	(UK)
Stierlen	Germany	Ime – Omniwash	UK
Kreff	Germany	Clenaware	UK
Elviomex "ALFA"	Greece	Chef King	UK
Silanos	Italy	Sherwood	UK
Mareno	Italy	Maidaid Halcyon	UK
Hoonved	Italy	Husky	(UK)
Lasa	Italy	Toucan	(UK)
Lamber	Italy	Diamond	(UK)
Sencotel	Italy	Dexion	(UK)
Nuova Simonelli /	Italy	Alder	(UK)
Univerbar	Italy	Newsan	(UK)
Hemerson	Italy		
Rancilio	Italy	Project Dishwashers	-
Hilta /	Italy	Tiekos	-
Angelo Po	Italy	Futurmat	-
Hilta	Italy	Marels	-
Kromo	Italy	Chef Equip	-
Colged	Italy	Aristarco	-
Elettrobar / Wolk	Italy	Prodis	-
Dihl	Italy	Classic	-
Fabar	Italy	Eurotec	-
Sowebo	Italy	NOSEM Omniwash	-
Ata	Italy	Cimsa	-
Elframo	Italy	ASKO	-

*(brackets for country signify apparent country head quarters, '-' signifies that the country was not determined)*

The above list is not intended to be exhaustive but it should include a majority of the manufacturers relevant to the European market with a vast majority of the market share covered. It can be seen by the number of manufacturers operating in the Member States that Germany, Spain, Italy, the UK, France and Sweden are the major manufacturing countries in the EU, which confirms the Prodcum data presented in Section 2.1. The 'international' brands listed above tend to be large manufacturers as they are actively operating in multiple Member States and are expected to have large market shares in each country in which they operate.

The Italian market is the most difficult to characterise because of the large number of small- or medium-size (SME) manufacturers operating which are not associated with any national or European manufacturing association.

The key manufacturing Member States, as previously described (Section 2), are Germany, Italy and Spain, accounting for approximately 96% of the manufacturing market in Europe.

There are commercial catering equipment manufacturing associations at the Member State level (e.g. HKI in Germany, CESA in the UK, CECED in Italia). At the European level, the European Federation of Catering Equipment Manufacturers (EFCEM) represents manufacturers of commercial kitchen equipment. It was founded in 1969 and includes the key European national associations in its membership. The national trade associations operate independently and pay a fee to be a member of EFCEM. The total turnover of the 550 companies represented by EFCEM national associations amounts to over 3.6 billion Euro and their products range from utensils to full professional kitchen schemes. EFCEM is the only commercial kitchen equipment group represented in Brussels (via Orgalime of which it is a member). The federation is active in the formulation of standards for the industry and through its meetings seeks to identify and act on issues of common interest.

### 3.2.1 Germany

Germany exports a very large share of its professional dishwashers. Most exports from German manufacturers are to other EU countries. According to Prodcem, the German market is the largest professional dishwasher market in Europe by value; however, it produces fewer units than the Italian market. Prodcem data suggests that approximately 85 000 units are manufactured in Germany per year, and German data shown in Table 9 and in previous tables 4 and 5 suggest that 50 to 60% of these products are exported, of which about 73% to other EU Member States.

Table 9 Major German professional dishwasher export destinations, 2009<sup>8</sup>

Export destination	Percentage of total export	Units exported
<b>Total</b>	<b>100%</b>	<b>44 553</b>
<b>EU-27 total</b>	<b>73%</b>	<b>32 408</b>
Belgium	3%	1 492
Denmark	6%	2 804
Finland	2%	814
France	11%	4 973
Italy	5%	2 011
Latvia	0%	3

<sup>8</sup> Warenverzeichnis Außenhandelsstatistik WA 8422 19 00 Geschirrspülmaschinen – German Commodity Export Statistics for 2009.

Export destination	Percentage of total export	Units exported
Malta	0%	3
Netherlands	7%	3 187
Austria	7%	3 111
Poland	2%	763
Sweden	3%	1 448
UK	21%	9 433
<b>Extra-EU</b>	<b>27%</b>	<b>12 125</b>
Norway	4%	1 670
Switzerland	8%	3 749
Australia	2%	1 091
Japan	2%	670
China	1%	482
United States	0.4%	191

Imports of professional dishwashers into Germany are significantly less than exports, meaning that Germany has a large trade surplus. Import totals were 17 000 units in the same year, showing that Germany exported approximately 27 000 professional dishwasher units more than it imported in 2009. The total value of German professional dishwasher exports in 2009 was 149 million Euros.

For the purposes of this study, German professional dishwasher manufacturing capacity is estimated at **85 000 units per year**, with a much larger proportion of these products being large conveyor-type dishwashers when compared to the Italian market.

The German market is characterised by large, international, consolidated and vertically integrated manufacturers who often manufacture several types of appliances and machines besides professional dishwashers.

Based on the 2008 General Economic Data presented in Section 2, the value of German manufacturing is the largest of any Member State, just over 350 million Euros.

Two catering equipment manufacturing associations represent the German industry. They are totally independent (no cooperation in general) and manufacturers are split between the two associations (Hobart is not a member of either group):

- HKI (Industrieverband Haus-, Heiz und Küchentechnik e.V. – German association of domestic heating and cooking appliances, represented at European level by EFCM and Orgalime) (Electrolux Professional GmbH, Miele Professional, PALUX Aktiengesellschaft, Stierlen GmbH, Granuldisk, Scandisk); and
- VGG (Vereinigung Gewerbliches Geschirrspülen – Association of commercial dishwashing) (Meiko, Winterhalter)

Small German professional dishwasher products are typically sold to catering equipment dealers, both in Germany and other Member States. Direct sales from the manufacturer to

the end users are mainly larger conveyor-type dishwashers. However, precise data were not found.

### 3.2.2 Italy

Italy manufactures the largest number of professional dishwashers of any Member State in Europe. As with the German manufacturing market, many of these units are produced for export within the EU. However, when compared to the German production base, a smaller number of Italian products are manufactured for export, as Italian manufacturers tend to be a mix of SMEs and large multinationals. The Federazione Nazionale Imprese Elettrotecniche ed Elettroniche (National Federation of Electrotechnical and Electronics Industries) collects and surveys market statistics on the entire catering equipment industry in Italy. The statistics for Italian catering equipment exports, as reported in the annual report of 2008<sup>9</sup> is shown in. While this information is aggregated for the entire catering industry, it can be considered a representation of the dishwasher manufacturing situation in Italy. Professional dishwasher equipment is a significant part of the catering equipment industry, and therefore these numbers are relevant to help characterise the Italian market.

Table 10 Exports of catering equipment from Italy by destination, 2008 (%)<sup>9</sup>

Destination	Percentage
<b>Europe</b>	<b>72</b>
EU 27	58.7
France	10.7
Germany	8.5
Spain	7
UK	6.6
Non-EU European countries	13.3
<b>Africa</b>	<b>5.5</b>
<b>America</b>	<b>9.3</b>
<b>Asia</b>	<b>11.6</b>
<b>Australia</b>	<b>1.6</b>

The total manufacturing capacity of Italian professional dishwasher products is difficult to discern, as there are several conflicting sources of data. Prodcorn estimates that around 220 000 units are produced yearly, while stakeholders have estimated an annual manufacturing capacity of 120 000 units. Italy exported 80% more professional catering equipment (not only professional dishwashers, but all catering equipment) in 2008 than it imported. The

<sup>9</sup> Rapporto annual – L’Industria Elettrotecnica ed Elettronica in Italia Dati di settore e attività (2008), accessed 20 March 2010, [http://www.anie.it/download.asp?tm=2009\\_6\\_30\\_15\\_53\\_36](http://www.anie.it/download.asp?tm=2009_6_30_15_53_36)

large difference between stakeholder input and Prodcom data is expected to arise from the nature of the Italian manufacturing market. There are many SMEs in Italy, each with a small proportion of total Italian manufacturing capacity. This market is difficult to characterise and gives rise to greater uncertainty when attempting to estimate the total manufacturing capacity of Italian professional dishwashers.

The value of Italian professional dishwasher production is expected to be slightly less than German professional dishwasher production (Prodcom estimates approximately 30% less), while Italian manufacturers produce approximately twice as many units per year as Germany.

For the purposes of this study, the Italian market will be estimated to produce **170 000 professional dishwashing units per year** (this estimate is a simple average of the two sources). A large proportion of these appliances are smaller undercounter or hood-type dishwashers (one-tank pass through dishwashers), which is in contrast to the German production base of larger, more expensive (conveyor-type) machines. This helps to explain the large difference in value per product produced in these two Member States.

Italy has several large multinational manufacturing facilities owned by foreign manufacturers (Electrolux, Meiko, etc.) and many SMEs, which can be independent or affiliates, subsidiaries or groups of larger multinational corporations (e.g. Ali group). It is expected that due to the convoluted and disorganised nature of the distribution and supply chain of professional dishwasher equipment (especially smaller appliances), many of the products exported to other EU Member States are not put to final use there, but are shipped through other distribution channels, and the final point of use is unknown.

The only Italian manufacturers' association for professional dishwashers is:

- CECED Italia (national association of producers of domestic and professional appliances), representing approximately 60-80% of Italian professional dishwasher manufacturing.<sup>10</sup>

Based on the General Economic Data for 2008 presented in Section 2, the Italian manufacturing sector is the second largest in the EU, at just over 237 million Euros.

Italian professional dishwasher products are sold to catering equipment suppliers, both in Italy as well as in other Member States. No information has been gathered to characterise what proportion of sales occur by other means than catering equipment suppliers (for example directly to customers).

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<sup>10</sup> Normally CECED is dedicated to domestic appliances; however in this specific case they represent professional appliance manufacturers. <http://www.ceceditalia.it/jsp/index.jsp?id=default&id=default>

### 3.2.3 Spain

The Spanish manufacturing base of professional dishwashers had traditionally been built upon domestic sales, but has continued to increase export sales within the EU and even, to a certain extent, beyond the EU. Overall, the balance of exported products outside the EU is expected to be small. Spanish manufacturers are a mix of SMEs and large multinationals.

Stakeholders estimate that the Spanish manufacturing sector produces **40 000 professional dishwasher units per year**, which is very much in line with Prodcom data and will be the estimated Spanish professional dishwashing manufacturing capacity used in this study.

The only Spanish manufacturers' association for professional dishwashers is:

- FELAC (Federación Española de Asociaciones de Fabricantes de Maquinaria para Hostelería, Colectividades e Industrias Afines – Spanish Federation of Associations of Manufacturers of Machinery for Hospitality, Collectivities and Allied Industries), representing approximately 80% of the Spanish professional dishwasher manufacturing market.

Based on 2008 General Economic Data presented in Section 2, the Spanish manufacturing sector is the third largest in Europe, at just over 58 million Euro.

Spanish professional dishwasher products are sold to catering equipment dealers both in Spain as well as in other Member States. The extent of Spanish exports has not been determined but is not expected to be a significant share of total Spanish production. Looking back at Eurostat data (Table 2 and Table 5), 4.7 millions Euro of professional dishwashers were exported outside the EU-27 in 2008, while 3.2 million Euro were exported to other MS which sums up to 7.9 millions Euro. Compared to the production value of 58.5 million Euros in 2008, exports represent around 14% of production.

### 3.3 Sales

The aim of this section is to assess the sales volume (number of units sold) for different types of professional dishwashers. Based on the previous market structure data, Table 11 summarises professional dishwasher manufacturing capacity in the EU. Over the period 2005-2008, Germany, Spain and Italy represent 94.4% of the EU-27 professional dishwasher production according to Table 1. The EU-27 total production in 2009 was therefore estimated from the previous figures presented in Germany, Spain and Italy, and from this production share.



Table 11 Estimated production of professional dishwashers by Member State, 2009

EU manufacturing Member State	Professional dishwashers produced per year
Italy	170 000
Germany	85 000
Spain	40 000
Others (UK, France, Sweden, Greece, Denmark, Portugal, Austria, etc.)	17 500
<b>EU total</b>	<b>312 500</b>

In total, it is estimated that 312 500 professional dishwashers are manufactured in the EU, and 73% are sold for use within the EU: exportations outside the EU-27 in Euro in 2008 (101 million Euro, Table 5) represent 14% of the total EU production value in 2008 (732 million Euro, Table 2) but these figures come from different databases (PRODCOM and EXTRA) so that the manufacturers estimate of 25-30% exports outside the EU is considered more relevant. Including a small proportion of professional dishwasher imports from outside the EU (approx. 2% of the production), the estimated professional dishwasher sales in Europe are **234 600 units per year**. Table 12 summarises this data.

Table 12 EU professional dishwasher sales, 2009 (estimate)

	Professional dishwashers sold in 2009
EU manufacturing estimate	312 500
minus units exported	- 84 400
plus units imported	+ 6 500
<b>Total EU sales</b>	<b>234 600</b>

The distribution of these sales is estimated to be roughly in accordance with each Member State's respective size but is also expected to vary with the different cultural habits of the Member State. The average dishwashing needs per customer in each Member State are not expected to vary much from one region of Europe to another. However, the number of customers per catering establishment and thus the type of machine that is most appropriate for the average catering establishment is expected to vary from region to region in Europe.

The range of products according to the definition of the scope in Task 1 is included in this estimate.

### 3.3.1 Sales by product type

In general, very little market data on EU professional dishwasher manufacturing and trade exists. This poses several difficulties for an eco-design preparatory study, as the lack of information will prevent clear and informed regulatory decisions from being made. On an

international scale, even fewer data sources are available regarding professional dishwashers; however, in North America, NAFEM (North American Foodservice Equipment Manufacturers) publishes the “Size and Shape” study of the North American market every two years by surveying members of their organisation. Approximately 50% of the market is represented in the survey, with the other 50% extrapolated from observed trends.

Since there should not be significant differences between the US and the EU markets with regards to the number of restaurants or canteens using professional dishwashers, it is useful for approximating how many of each type of product are sold as a proportion of the total (categories as defined in the Task 1 report). This total is assumed to be similar to European sales per capita. European stakeholders have also estimated that the proportions of EU sales by product category are quite similar to those in North America.

Figure 3 shows stakeholder estimates of the shares of product sales in the EU (rounded numbers, further calculations with exact numbers).

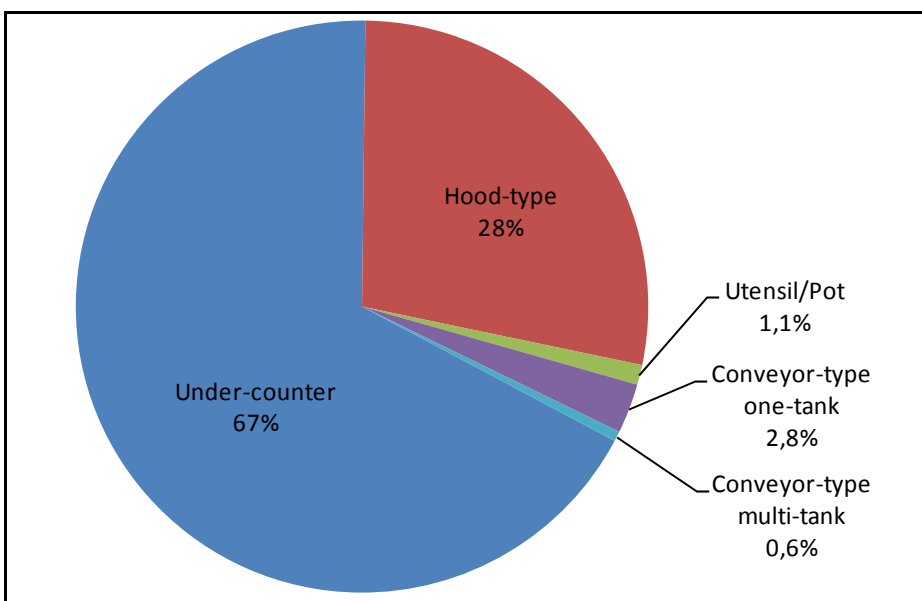


Figure 3 European professional dishwasher sales by product type (estimate)

The NAFEM size and shape study agrees with the above shown proportions very well. The NAFEM information cannot be published here due to copyright issues but the close agreement between the NAFEM size and shape study and European stakeholder comments allows a good level of confidence that such a distribution of product sales accurately reflects actual sales.

The following analysis is divided by the categories of dishwasher as segregated in Task 1 for undercounter water-change/one-tank (categories 1 and 2), hood-type (category 3), utensil/

pot (category 4), conveyor-type one-tank (category 5) and conveyor-type multi-tank (category 6) professional dishwashers.

### **3.3.1.1 Undercounter water-change and one-tank dishwashers (categories 1 and 2)**

These categories of professional dishwashers account for the largest number of dishwashers sold. 'Manually loaded program automats, with water-change operation', 'Manually loaded program automats, with one-tank', and 'Glasswashers' are considered to be part of these categories. 'Manually loaded program automats, water-change operation' have been identified as professional appliances as their intended use concern commercial and semi-commercial customers. These models are thus compliant with the Machinery Directive (see Task 1).

Undercounter dishwashers represent the largest sales volumes for all product groups because they are the smallest and the least expensive, and because they are very flexible and suitable for many commercial catering applications. The customers of these products are the most diverse and have a wide variety of dishwashing needs. Based on the aggregated sales estimate and proportion of products sold in this category as estimated by stakeholders, the yearly sales of undercounter one-tank professional dishwashers (category 2) in the EU are estimated to be **138 200 units per year** (including glasswashers). Undercounter water-change professional dishwashers (category 1) are estimated to be **20 000 units per year**, giving a total of **158 200 units per year** for all undercounter type machines.

### **3.3.1.2 Hood-type dishwashers (category 3)**

Hood-type dishwashers are a middle range product category that represent a dishwashing solution for customers with higher capacity needs than what the typical front load type dishwasher is capable of, but not a high enough capacity need (or spatial possibility) to justify or allow the use of a conveyor-type dishwasher. Most commercial restaurants, in turn estimated to be the largest proportion of customers in this market, use hood-type dishwasher products. Based on the aggregated sales estimate and proportion of products sold in this category as estimated by stakeholders, annual sales of this product type in the EU are **65 900 units per year**.

### **3.3.1.3 Utensil / pot dishwashers (category 4)**

Utensil / pot dishwasher is a mid-range capacity product category which represents a dishwashing solution for customers with larger or more irregular washing needs than the typical front load type dishwasher is capable of. These washers are sold in smaller volumes, as their function is specific to odd-shaped bakeware or large pots and pans that cannot be properly washed in smaller, more typical dishwashers. Based on the aggregated sales

estimate and proportion of products sold in this category as estimated by stakeholders and NAFEM, the sales of this product type are estimated to be **2 600 units per year**.

### 3.3.1.4 Conveyor-type one-tank and multi-tank dishwashers (categories 5 and 6)

These products are considered by stakeholders to have one of the smallest market shares by number of units sold, but one of the largest by value. The market here is characterised by the type of customer, which is almost exclusively a large restaurant or institutional cafeteria. It is neither cost effective, nor functionally better to implement these types of dishwashers in smaller dishwashing operations, and therefore the conveyor-type dishwasher market is restricted exclusively to large eating establishments with high capacity cleaning requirements. Based on the aggregated sales estimate and proportion of products sold in this category as estimated by stakeholders and NAFEM, yearly sales of this product type are estimated to be **7 900 units** in the EU, of which 6 600 are one-tank conveyor-type dishwashers and 1 300 units are multi-tank conveyor-type dishwashers. Table 13 summarises the sales estimated by product type.

Table 13 Estimated sales of professional dishwashers by category

Product type	Estimated number of units sold per year
Category 1: Undercounter water-change	20 000
Category 2: Undercounter one-tank	138 200
Category 3: Hood-type	65 900
Category 4: Utensil/Pot	2 600
Category 5: Conveyor-type one-tank	6 600
Category 6: Conveyor-type multi-tank	1 300
<b>Total</b>	<b>234 600</b>

### 3.3.2 Sales by customer

Stakeholder responses to questionnaires and interviews have given estimations for the customer profile of professional dishwashers in the EU which is shown in Table 14.<sup>11</sup>

<sup>11</sup> Responses received from: Hobart, Winterhalter, Fagor, Granuldisk

Table 14 Share of professional dishwasher sales by type of purchaser

Type of purchaser	Estimated share of unit sold (%)
Commercial service – Restaurants and hotels	65
Hospitals and other institutional service	23
Commercial food sales – Bakeries, butchers, grocers, other commercial service	10
Other catering activities	2

(Source: Stakeholder interviews and questionnaire responses)

The purchasing habits of each consumer type can be estimated through stakeholder interviews. Institutional service and commercial food preparation businesses are purchasers of larger conveyor-type or utensil/pot dishwashers, while restaurants, hotels and other catering services are purchasers of smaller undercounter and hood-type dishwashers.

It is expected that the variation between Member States of the type of purchaser and the type of professional dishwashing product purchased is small. While there are differences in the number of institutional versus small restaurants between Member States, the dishwashing needs for each customer type are similar and therefore dishwashing product purchases are expected to be quite similar.

A study conducted by CECED Italia shows the ownership rate of different dishwashing machine types in Table 15.

Table 15 Ownership in a survey of 1 000 catering establishments in Italy (%)<sup>12</sup>

Type of appliance	Total	Bar / Cafe	Restaurant	Pizzeria / Pubs	Hotels
Glasswasher	75.2	86.5	74.0	59.6	54.2
Undercounter	23.0	20.8	26.8	27.4	23.1
Conveyor-type	23.0	13.2	35.0	22.6	32.5
Hood-type	21.4	2.1	38.7	22.1	33.9
Utensil/Pot	6.8	3.0	11.1	2.7	9.8
None	6.6	3.2	1.6	21.8	8.0

(The sum in each column can be greater than 100% due to multiple possible answers)

Though the categories used in the table above do not exactly match that given in Task 1, the trends presented above agree with the general assumptions and estimations derived from stakeholder interviews and comments: most bars and restaurants have glasswashers (which can have a rather low capacity), conveyor-types are mainly used in restaurants (cafeterias) and hotels, while utensil/pot dishwashers are not very common.

<sup>12</sup> CECED Italy presentation material

### 3.4 Average product life

The lifetime of the appliances is of interest in this study as it is a key parameter in assessing life cycle environmental impacts and the LCCs (Life cycle Costs) of the appliances in the later stages of the study (Task 5 and 7). Lifetime can also be used to estimate the stock data based on sales. In the context of the study, the focus is on ‘active lifetime’, meaning the time in service. Based on responses from the stakeholder questionnaire and discussions during the interim stakeholder meeting, the lifetimes of the products in this study are estimated in Table 16.

Table 16 Estimated lifetimes of products in this study based on stakeholder responses

Type of appliance	Average product life time (in years)
Category 1: Undercounter water-change	12
Category 2: Undercounter one-tank	8
Category 3: Hood-type	8
Category 4: Utensil/Pot	8
Category 5: One-tank conveyor-type	12
Category 6: Multi-tank conveyor-type	17

### 3.5 Stock

The aim of this section is to assess the total stock of dishwashing appliances in use today for different types of professional dishwashers. No information has been obtained from market studies or stakeholders regarding the stock of professional dishwasher appliances in the EU. Two methods were used to determine the stock. The first method refers to values found from Eurostat<sup>13</sup> for apparent sales in the past years.

#### First method: based on Eurostat

While it is understood that Eurostat data can often be incomplete, the indication given is useful for comparison and validation of other sources of data.

Eurostat presents the sales in recent years for non-domestic dishwashers (Product code: 28295000). It is assumed that the total sales stated by Eurostat correspond to the six categories considered in the project. Although the statistics are presented from 1995, the first five years were considered non relevant for EU-27 Member States because the data was too irregular and incomplete. The total stock of appliances for 2009 as calculated from Eurostat data is shown in Table 17. The data below corresponds to the ‘Volume of Production’ +

<sup>13</sup> <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/>

'Imports' – 'Exports' given as 'Apparent Sales' in EU-27, reported from 2000 to 2008, where an increasing trend on apparent sales is shown. The stock is considered as the accumulated value of sales during the lifetime of each product (e.g. 12 years for undercounter equipments – category 1) and is indicated by grey cells in the table. The calculation and extrapolation (for the years 1990-1999) does not take into account the progressive enlargement of the EU. The figures are thus representative of a virtual EU-27 from 1990 onwards.

Table 17 Calculated stock using Eurostat reported values

Year	Sales (units)*	<u>Cat. 1 sales</u> Under-counter water-change (8.51%)	<u>Cat. 2 sales</u> Under-counter one-tank (58.91%)	<u>Cat. 3 sales</u> Hood-type (28.09%)	<u>Cat. 4 sales</u> Utensil/Pot (1.12%)	<u>Cat. 5 sales</u> One-tank conveyor-type (2.81%)	<u>Cat. 6 sales</u> Multi-tank conveyor-type (0.56%)	Total stock (units)*
1990	<i>230 017</i>	19 567	135 500	64 611	2 584	6 461	1 292	<i>1 832 982</i>
1991	<i>233 284</i>	19 845	137 425	65 529	2 621	6 553	1 311	<i>1 861 341</i>
1992	<i>236 550</i>	20 123	139 349	66 447	2 658	6 645	1 329	<i>1 889 699</i>
1993	<i>239 817</i>	20 401	141 273	67 364	2 695	6 736	1 347	<i>1 918 058</i>
1994	<i>243 084</i>	20 679	143 198	68 282	2 731	6 828	1 366	<i>1 946 416</i>
1995	<i>246 351</i>	20 957	145 122	69 200	2 768	6 920	1 384	<i>1 974 775</i>
1996	<i>249 617</i>	21 235	147 046	70 117	2 805	7 012	1 402	<i>2 003 133</i>
1997	<i>252 884</i>	21 513	148 971	71 035	2 841	7 103	1 421	<i>2 031 492</i>
1998	<i>256 151</i>	21 791	150 895	71 952	2 878	7 195	1 439	<i>2 059 850</i>
1999	<i>259 417</i>	22 069	152 820	72 870	2 915	7 287	1 457	<i>2 088 209</i>
2000	278 788	23 716	164 231	78 311	3 132	7 831	1 566	<i>2 116 567</i>
2001	263 941	22 453	155 484	74 141	2 966	7 414	1 483	<i>2 144 926</i>
2002	273 215	23 242	160 948	76 746	3 070	7 675	1 535	<i>2 173 284</i>
2003	277 386	23 597	163 405	77 917	3 117	7 792	1 558	<i>2 201 643</i>
2004	247 146	21 025	145 591	69 423	2 777	6 942	1 388	<i>2 230 001</i>
2005	256 608	21 830	151 165	72 081	2 883	7 208	1 442	2 258 360
2006	284 881	24 235	167 820	80 023	3 201	8 002	1 600	2 286 718
2007	298 755	25 415	175 993	83 920	3 357	8 392	1 678	2 315 077
2008	301 040	25 609	177 339	84 562	3 382	8 456	1 691	2 334 189
2009	<i>292 085</i>	24 848	172 064	82 046	3 282	8 205	1 641	2 363 737
<b>Stock 2009</b>		<b>279 829</b>	<b>1 314 323</b>	<b>626 718</b>	<b>25 069</b>	<b>92 399</b>	<b>25 400</b>	<b>2 363 737</b>

\*Values in red/italic are extrapolated from figures presented by Eurostat.

Second method: based on H&C sector trend

According to stakeholders, the Hotel and Catering (H&C) sector represents 65% of dishwashing machines sales. It is logical to conclude that the evolution of this industry has a big impact on the evolution of dishwashing machines.

The number of establishments for H&C is shown in Figure 4.<sup>14</sup>

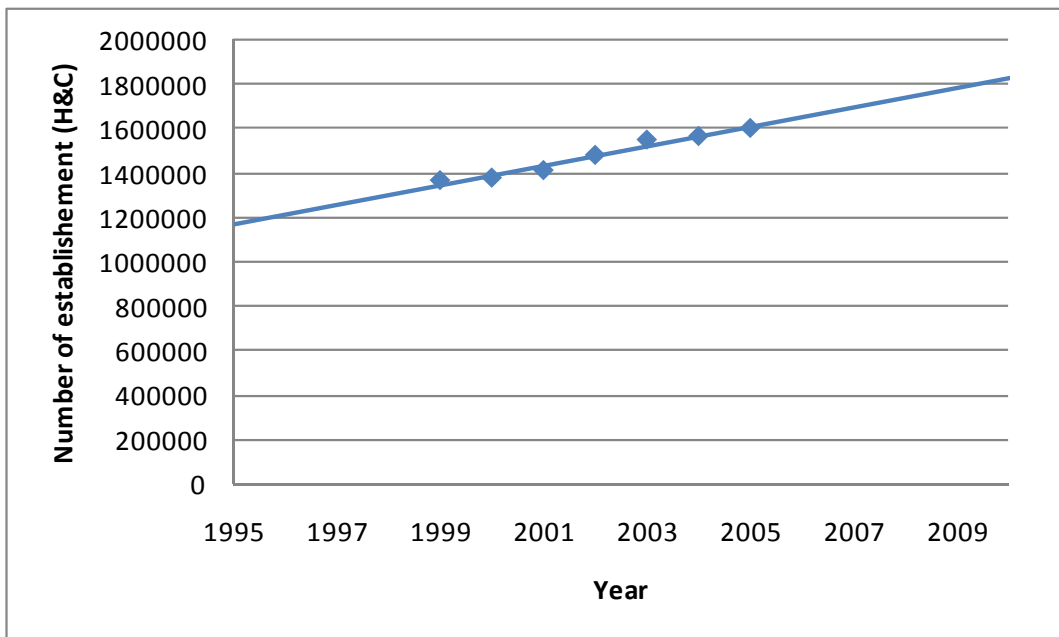


Figure 4 Number of Hotel and Catering establishments in EU-25 according to Oxford Research study.

The trend of consumption of dishwashing machines is likely to be similar to the trend followed by H&C establishments. The market share for each category was considered constant for all equipments. These values are shown in Table 18. The total stock of professional dishwashers has been calculated from sales estimations and in this model it is thus assumed that all the professional dishwashers sales are represented by the H&C sector (Table 13): the calculated demand is considered proportional to the number of H&C establishments (with a rate of proportionality set thanks to the annual sales in 2009), and the growth rate of the H&C sector is used as the average growth rate for all dishwashers sold.

<sup>14</sup> Oxford Research. *Comprehensive sectoral analysis of emerging competencies and economic activities in the European Union. Lot 12 – Restaurants and Hotels.* 2009.



Table 18 Total stock of professional dishwashers (2010), using H&C trends

Year	H&C Establish.*	Calculated demand (i.e. annual sales in units)*	Cat. 1 sales Under-counter water-change (8.51%)	Cat. 2 Sales Under-counter one-tank (58.91%)	Cat. 3 sales Hood-type (28.09%)	Cat. 4 sales Utensil/Pot (1.12%)	Cat. 5 sales One-tank conveyor-type (2.81%)	Cat. 6 sales Multi-tank conveyor-type (0.56%)	Total stock (units)*
1993	<i>1 085 973</i>	<i>142 656</i>	12 136	84 037	40 072	1 603	4 007	801	<i>1 023 931</i>
1994	<i>1 129 718</i>	<i>148 402</i>	12 625	87 422	41 686	1 667	4 169	834	<i>1 072 795</i>
1995	<i>1 173 464</i>	<i>154 149</i>	13 113	90 807	43 300	1 732	4 330	866	<i>1 121 659</i>
1996	<i>1 217 209</i>	<i>159 895</i>	13 602	94 192	44 914	1 797	4 491	898	<i>1 170 522</i>
1997	<i>1 260 955</i>	<i>165 642</i>	14 091	97 578	46 529	1 861	4 653	931	<i>1 219 386</i>
1998	<i>1 304 701</i>	<i>171 388</i>	14 580	100 963	48 143	1 926	4 814	963	<i>1 268 250</i>
1999	1 366 670	<i>179 529</i>	15 272	105 758	50 429	2 017	5 043	1 009	<i>1 319 508</i>
2000	1 378 144	<i>181 036</i>	15 401	106 646	50 853	2 034	5 085	1 017	<i>1 366 526</i>
2001	1 411 853	<i>185 464</i>	15 777	109 255	52 097	2 084	5 210	1 042	<i>1 412 226</i>
2002	1 481 050	<i>194 554</i>	16 551	114 609	54 650	2 186	5 465	1 093	<i>1 461 269</i>
2003	1 550 247	<i>203 644</i>	17 324	119 964	57 203	2 288	5 720	1 144	<i>1 513 656</i>
2004	1 566 668	<i>205 801</i>	17 507	121 235	57 809	2 312	5 781	1 156	<i>1 562 453</i>
2005	1 603 148	<i>210 593</i>	17 915	124 058	59 155	2 366	5 916	1 183	<i>1 610 296</i>
2006	<i>1 654 665</i>	<i>217 360</i>	18 491	128 044	61 056	2 442	6 106	1 221	<i>1 659 160</i>
2007	<i>1 698 411</i>	<i>223 107</i>	18 980	131 430	62 670	2 507	6 267	1 253	<i>1 705 914</i>
2008	<i>1 742 156</i>	<i>228 853</i>	19 468	134 815	64 285	2 571	6 428	1 286	<i>1 756 404</i>
2009	<i>1 785 902</i>	234 600	19 957	138 200	65 899	2 636	6 590	1 318	<i>1 808 056</i>
<b>Stock 2009</b>			<b>207 223</b>	<b>1 012 355</b>	<b>482 728</b>	<b>19 309</b>	<b>68 425</b>	<b>18 015</b>	<b>1 808 056</b>

\*Values in red/italic are extrapolated from those presented in the Oxford Research study or calculated from figures provided by stakeholders.

The actual number of dishwashing units is likely to be between these two figures (1 808 056 – 2 363 737). The second method is considered more reliable due to the sources of data for market trends and annual sales (Eurostat 2008): statistics on the number of H&C establishments are considered more reliable the production of non-household dishwashers reported (which shows important variations from one year to another). Therefore the figures presented in Table 18 will be used within the study. A sensitivity analysis in Task 8 will study the influence of the uncertainty of these market figures.

### 3.6 Summary of market data

Table 19 summarises the market data presented in the previous sections. This data will be useful in later tasks (Task 5-7-8) for estimating life cycle properties of these products and build scenarios at the EU level.

Table 19 Market data summary, by product type

Product type	Estimated number of units sold per year (2009)	Estimated stock (2009)	Average product lifetime (in years)
Undercounter water-change	20 000	207 223	12
Undercounter one-tank	138 200	1 012 355	8
Hood-type	65 900	482 728	8
Utensil/Pot	2 600	19 309	8
Conveyor-type one-tank	6 600	68 425	12
Conveyor-type multi-tank	1 300	18 015	17
<b>Total</b>	<b>234 600</b>	<b>1 808 056</b>	-

## 4 Market trends

### 4.1 General market trends

This subtask aims to provide market trends indicating market structures and relevant trends in product design. The analysis is done following two different methods. In the first method, historical sale figures from Eurostat<sup>15</sup> are considered and their linear trends are set. The second method considers information provided by stakeholders regarding the biggest market sector (hotel and catering industry) for the appliances. This method assumes that the sales trend for dishwashers will be directly related to the trend for H&C.

#### First method based on Eurostat:

Eurostat presents past annual sales for non-domestic dishwashers (Product code: 28295000). The total sales are assumed to represent only the six main categories presented in the study. Although the statistics are presented from 1995, the first five years were considered not relevant for EU-27 Member States because the data was too irregular and incomplete. The red line in the figure below corresponds to the volume of Apparent Sales (Production + Imports – Exports) in EU-27, reported from 2000 to 2008, and an increasing trend is shown.

<sup>15</sup> <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/>

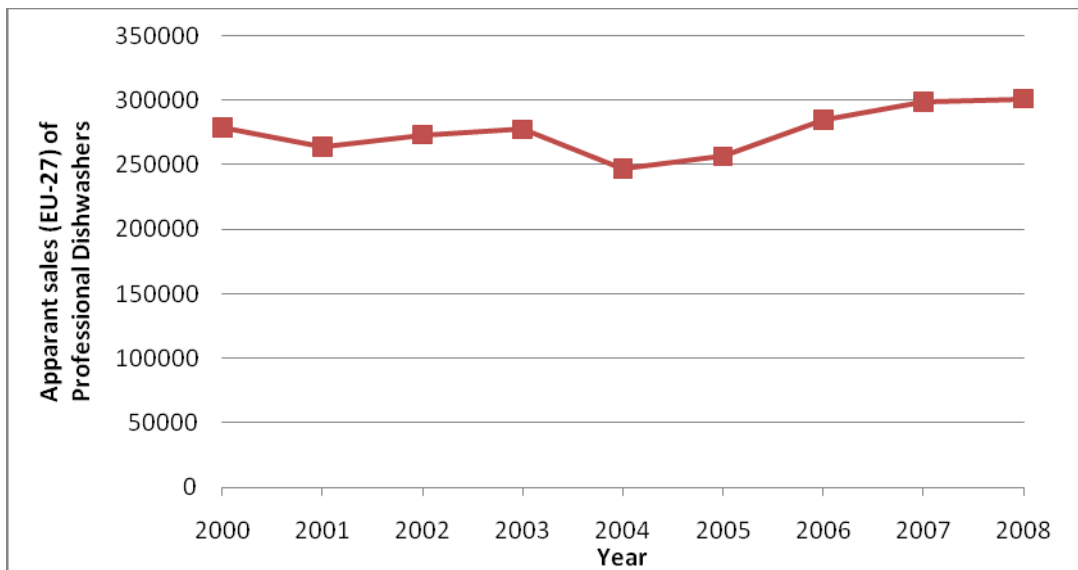


Figure 5 Market sales values according to Eurostat

Based on Eurostat values it is also possible to establish a linear sales trend for the years until 2025. This is shown in Figure 6. Stakeholder estimates for 2009 (see Section 3.2) are not considered for the trend, since they are not directly extracted from Eurostat. Instead, they are expressed as a single point in the graph.

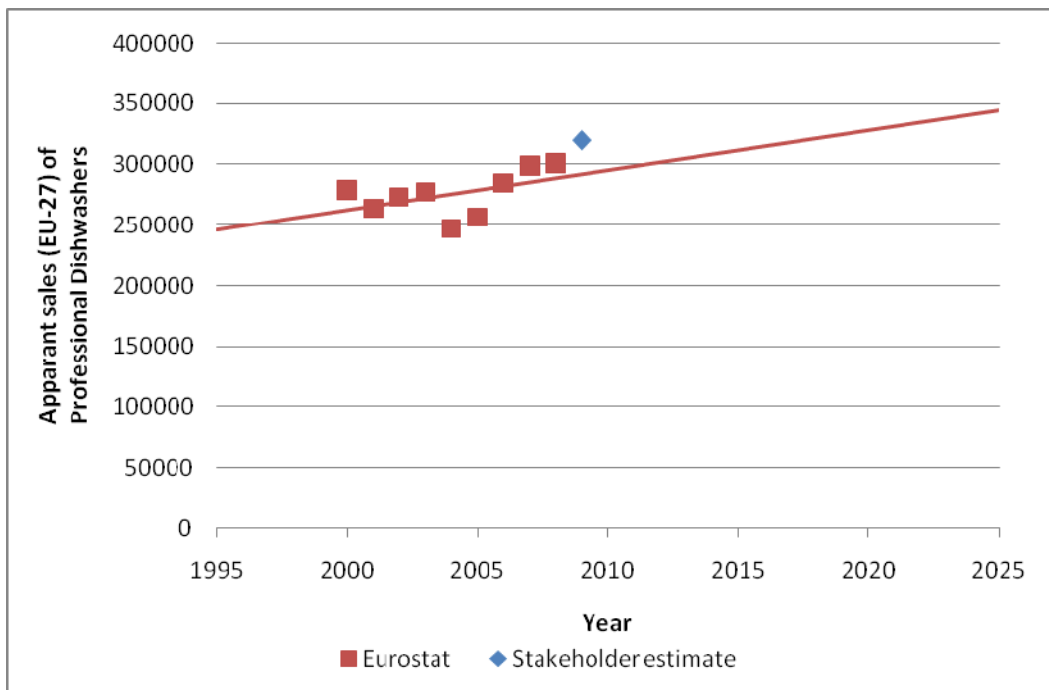


Figure 6 Sales trend of non-domestic dishwashers until year 2025, based on data from Eurostat and stakeholders

According to this result, around 340 000 units are expected to be sold per year in 2025. The yearly increase is estimated around 1%.

Second method (based on H&C sector trend):

According to the information provided by stakeholders, the main market for professional dishwashers is hotels and catering/restaurant services (around 65%). The second biggest market share for dishwashers is institutions such as hospitals (see Table 14). It is logical to expect that the evolution in the market of these machines is closely related to the evolution of these two sectors.

The market is also changing as environmental awareness increases. This concern for the environment is producing technology change in the machines used within the hotel and catering sector – machines that consume less energy are increasing their market share.<sup>16</sup> Several companies have already started to produce appliances with energy efficiency features, some of them claiming to save up to 80% of energy.<sup>17</sup> The current trend for the hotel industry is to outsource tasks in order to simplify internal processes,<sup>18</sup> e.g. cooking, cleaning and administrative tasks. However, dishwashing (not requiring skilled personnel) is not likely to follow this path, as the transport of crockery can represent an additional cost and be unpractical. Regarding competition in the hotels market, the same study mentions that regardless of the size of the company, new technologies including environmentally-friendly products and IT systems must be adopted in order to maintain market share. This means that market demand for environmentally-friendly products exists and is probably growing.

Based on the feedback of stakeholders, the market share of large-capacity (conveyor-type) appliances has been increasing in recent years.

In a study conducted by Oxford Research,<sup>19</sup> the growth trend of the hotel and catering sector was estimated to be 1% per year for the combination of different scenarios and considering an estimated total of 1 750 000 enterprises in 2008 (Table 20).

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<sup>16</sup> European Foundation for the Improvement of Living and Working Conditions (2005) *Policies, issues and the future. The hotels and catering sector.*

<sup>17</sup> Source: Fagor Industrial brochure,  
[www.fagorindustrial.com/upload/productos/subcategorias/catalogos/fr/advance\\_def\\_ENG\\_FRA\\_.pdf](http://www.fagorindustrial.com/upload/productos/subcategorias/catalogos/fr/advance_def_ENG_FRA_.pdf)

<sup>18</sup> European Foundation for the Improvement of Living and Working Conditions (2005) *Visions of the future. The hotels and catering sector.*

<sup>19</sup> Oxford Research (2009). *Comprehensive sectoral analysis of emerging competencies and economic activities in the European Union Lot 12: Hotels and restaurants.*

Table 20 Hotel and catering enterprises, assuming 1% increase per year

Year	Estimated number of hotel and catering enterprises
2008	1 750 000
2010	1 785 000
2015	1 875 000
2020	1 970 000

This matches a CESA study of the UK foodservice industry where warewashing equipment was found to represent 9% of the overall foodservice equipment industry in 2007, which grew annually by 1.7%.<sup>20</sup>

Since no studies presenting the actual size of the dishwasher sector have been identified, the trend for the hotel and catering sector and hospitals is assumed to reflect the behaviour of dishwasher sales for the coming years.

An estimation of the future market for dishwashers must consider the following aspects:

- growth of the hotel and catering industry (accounting for 65% of the dishwasher market): the estimation of this figure is between 1% and 3% per year; in order to be conservative with the projection it has been decided to use 1% per year;
- evolution of sales for big capacity equipments (one-/multi-tank conveyor-type) provided by stakeholders: this evolution indicates that the sales have increased more importantly for these appliances than for the others, over the past 5 years;
- overall market growth provided by CESA (1.7%).

By assuming that the market growth is **1%** for undercounter, hood-type and pot/utensil dishwashers, and **2%** for conveyor-types dishwashers, the estimation of sales and stock for 2015, 2020 and 2025 are obtained and presented in Table 21. Water-change appliances are included within undercounter units. Total sales of professional dishwashers in 2009 were estimated at 234 600 units (Table 12).

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<sup>20</sup> Catering Equipment Suppliers' Association (CESA) 2007, *The UK Market for Foodservice Equipment – The authoritative report on the UK market.*

Table 21 Projected market for different types of dishwashers 2009-2025

Type of equipment	2009	Estimation 2015		Estimation 2020		Estimation 2025	
	Sales	Sales	Stock	Sales	Stock	Sales	Stock
Undercounter	158 200	165 600	1 294 600	174 100	1 360 600	182 900	1 430 100
Hood-type	65 900	69 200	512 400	72 700	538 600	76 400	566 000
Utensil/Pot	2 600	2 800	20 500	2 900	21 500	3 100	22 600
Conveyor-type one-tank	6 600	7 900	77 100	8 800	85 100	9 700	93 900
Conveyor-type multi-tank	1 300	1 600	20 300	1 800	22 400	1 950	24 700
<b>Total</b>	<b>234 600</b>	<b>249 000</b>	<b>1 924 900</b>	<b>261 700</b>	<b>2 028 200</b>	<b>274 785</b>	<b>2 137 400</b>

## 4.2 Employment figures

The employment figures concerning direct jobs in the manufacturing companies were estimated during the stakeholder meeting, after consultation of all manufacturers: around 7 500 people are employed in dishwasher manufacturing companies, of which 5 000 in Italy, 2 500 in Germany, 1 000 in Spain, 300 in France, 300 in Sweden, 200 in the UK and 150 in Denmark.

## 4.3 Redesign cycle

According to information provided by stakeholders, the redesign cycle varies with the category of equipment and the objective of the process. Designing equipment “from scratch” with completely new characteristics can take between 12 to 13 years for bigger units (categories 5 and 6) and from 5 to 10 years for categories 1 to 4.

Redesigning a single part of the appliance, such as sprinklers, baskets, etc. can take between 6 and 36 months depending on its complexity: the required time is very specific to the design changes so that it is not realistic to indicate an average or typical timing. Normally these redesign processes are intended to improve the water or energy efficiency.

## 4.4 Product-specific trends

Manufacturer brochures and websites were analysed to identify important product-specific developments and trends in professional dishwashers. Furthermore a short questionnaire was sent to stakeholders to confirm the identified market trends and developments and also to receive some quantitative data.

#### 4.4.1 Development over the past five to ten years

##### 4.4.1.1 Energy and water consumption

In general, the market has changed towards dishwashers with reduced energy and water use in recent years. According to manufacturers, customers today pay more attention to low energy consumption compared to five years ago. This applies to all market segments.

As the following table shows, the average energy consumption of dishwashers has decreased by approximately 20 to 30% over the last ten years. The energy consumption of the best available products today compared to an average product ten years ago has decreased by more than 50% in some categories. The figures are based on estimations by stakeholders that are not measured according to a common standard as currently no European applicable measurement standard for professional dishwashers exists (see also Task 1).<sup>21</sup>

Table 22 Development of energy consumption of professional dishwashers in the past 10 years

Dishwasher (DW) category	Consumption of a ten year old DW in kWh/100 dishes <sup>22</sup>	Consumption of an average new DW in kWh/100 dishes	Consumption of the best DW in kWh/100 dishes	Improvement between ten year old and new product
Undercounter water-change	-	3.7	2.3	-
Undercounter one-tank	2.3	1.6	1.2	30%
Hood-type	2.4	1.7	1.2	29%
Utensil/Pot	0.7 (per cycle)	0.5 (per cycle)	0.4 (per cycle)	29%
Conveyor-type one-tank	3.1	2.0	1.0	37%
Conveyor-type multi-tank	3.1	2.0	0.8	37%

Also, the average water consumption of professional dishwashers sold decreased by approx. 20%, as the following table shows. When considering BAT products, this decrease is even greater.

<sup>21</sup> ASTM as well as NSF/ANSI standards (being basis for US ENERGY STAR requirements) only apply to sanitizing dishwashers widespreadly used at the US market. Sanitizing dishes by hot water generally requires higher (sanitizing) temperatures compared to the (cleaning) temperatures of dishwashers in Europe. Thus, the thresholds of the US ENERGY STAR label and consumption values of US dishwashers are not particularly ambitious compared to the performance of the European dishwashers

<sup>22</sup> "Standard" dish/plate: material: China, 24 cm diameter and 600 g weight. In case of utensil/pot-dishwashers the figures apply to an average dishwashing cycle. No accepted measuring standard exists yet.

Table 23 Development of water consumption of dishwashers over the past 10 years

Dishwasher (DW) category	Consumption of a ten year old DW in litres/100 dishes <sup>22</sup>	Consumption of an average new DW in litres/100 dishes	Consumption of the best DW in litres/100 dishes	Improvement between ten year old and new product
Undercounter water-change		58	28	-
Undercounter one-tank	19 (= 3.4 per cycle)	16 (=2.9 per cycle)	9 (=1.6 per cycle)	16%
Hood-type	19 (=3.4 per cycle)	16 (=2.9 per cycle)	13 (=2.3 per cycle)	16%
Utensil/Pot	6.5 per cycle	5.2 per cycle	5.2 per cycle	20%
Conveyor-type one-tank	20	13 11-15	6	35%
Conveyor-type multi-tank	18	12 11-13	5	33%

In most cases, the water savings are directly connected with savings of detergent and rinse aid.

One reason for the observed reductions in energy and water demand is that manufacturers increasingly offer special features like heat recovery from exhaust air, heat recovery from waste water, heat pump or enhanced rinsing systems for their dishwashers. It is assumed that this trend will continue in the future.

#### 4.4.1.2 Detergents

Companies in the industrial and institutional (I&I) market provide a variety of detergent products and services that make their business fundamentally different from the household products market. The products and services that are offered cater for specialised cleaning and hygiene needs.

According to A.I.S.E.<sup>23</sup> the large majority of the market uses liquid detergents, while a minority uses powders and tablets. There is a market for powder detergents particularly for the larger machines, but the dosing point needs to be close to the machine whereas liquids can be dosed from a further distance.

<sup>23</sup> International Association for Soaps, Detergents and Maintenance Products. Its memberships currently totals 37 National Associations in 42 countries, comprising more than 900 companies – ranging from small- and medium sized enterprises (SMEs) to multinationals, primarily in Europe.



There is a growing market for multi component systems offerings which depend on the country, water conditions and the type of soil in order to use the correct chemicals at optimum concentrations.

In most processes a separate rinse aid is used to provide proper drying and good visual appearance of the substrates. First products are entering the commercial market in which the rinse aid function is built in the main wash detergent. Besides simplicity, this would also provide product, packaging and transport savings to the customer.

Machine operations have changed in recent times to techniques using less water. At the same time the detergents have become more concentrated, leading to less detergent consumption for the same cleaning performance. More concentrated products also lead to reduced packaging waste. Further, there are trends towards more environmentally friendly types of packaging, like e.g. bag-in-box or reusable packs.

#### **4.4.1.3 Changes on the demand side**

The demand for professional dishwashers has also changed significantly over the last five years:

- Today, energy and partly also water consumption are important arguments for many customers. End-users pay more attention to energy consumption than they did five years ago. Water consumption does not play as important a role as energy consumption (the prices for water differ a lot within the EU and thus also the pressure for low water consumption of dishwashers).
- Today, life cycle costs play a more important role than five years ago. Life cycle costs have become a stronger criterion in sales pitches, especially for high value products. Growing consumer awareness has led some to be willing to pay more for energy-saving features if the investment pays back within a reasonable time span (usually around three to five years).
- In some markets however, the purchase price of the dishwasher on its own is still more important than the more comprehensive life cycle cost. Therefore, products with a low purchase price are preferred, even though their life cycle costs might be higher than the life cycle costs of more expensive (but more efficient) products. A reason for this is that the purchase of a professional dishwasher usually happens at the end of the process of installing a professional kitchen, when most other purchasing decisions have already been made.
- Due to budget cuts, life cycle costs play a lower role in governmental installations compared to private companies, although governmental institutions are obliged to consider not only investment cost but the whole life cycle cost. This relationship has not changed over the last five years. Governmental installations are expected to make up a small share of the total.

According to stakeholders, consciousness of climate change and the environment in purchase decisions will further rise, but only if technological features result in corresponding monetary savings.

Especially in the case of premium products, life cycle cost calculation will become more important. This will be even more the case if prices for energy, water and detergent rise.

The importance of life cycle considerations to commercial and public customers obviously depends on the general economic environment (both the economy in general and customers in particular).

#### **4.4.1.4 Marketing of professional dishwashers and technological features**

In relation to influencing customer behaviours, important aspects of manufacturers' communications regarding professional dishwashers are:

- functionality,
- economic and environmental aspects of the use phase (i.e. costs of energy and water consumption),
- comfort / ergonomics,
- health / sanitation.

When analysing the most recent brochures, it was observed that functional aspects in combination with their energy and water consumption, and resulting economic saving potential, are used to advertise the latest generation of dishwashers. Some examples of technological features in high-end appliances:

- Optimised rinse system
- Rinse with steam
- Automatic load adjustment systems
- Heat recovery systems: waste-water heat recovery and exhaust heat recovery
- Heat pumps

The detailed descriptions, further best available technologies and a more detailed analysis of the market shares of improvement options are provided in Task 6.

#### **4.4.2 Development over the next ten years**

Regarding the next ten years, the reduction of energy and water consumption is assumed to continue. According to only one stakeholder responding to our questionnaire, the average energy and water consumption of the future sold dishwashers (over all product categories in EU in comparison to stock) is expected to further decline between 2010 and 2020 by approximately 20%. Detergent consumption is also expected to decrease by a similar degree

as it is correlated to the water consumption. This rough estimation will be counterchecked by further calculations within Task 7 (improvement potential compared to current base cases).

## 5 Consumer expenditure base data

Based on the categories defined in Task 1, average consumer prices including VAT (in Euro), as well as applicable rates for running costs (e.g. electricity, water, repair and maintenance, disposal) and other financial parameters (e.g. taxes, interest and inflation rates) will be determined.

The total lifetime costs of a dishwasher can be divided into five relevant categories:

- Purchase costs – the cost incurred to purchase the dishwasher
- Installation costs – the costs required to install a professional dishwasher
- Running costs – the costs incurred to operate the dishwasher throughout a typical lifetime. They may include electricity costs and costs of consumables (detergents, water, filters, etc.)
- Repair and maintenance costs – the costs incurred by the owner of the professional dishwashers throughout the lifetime of the machines to ensure their proper and effective operation
- Disposal costs – the quantifiable costs (or benefits) borne by the owner of the machine at the end of life of professional machines
- Labour costs are neglected as they are assumed to be not relevant for the study at hand.

### 5.1 Purchase costs

In the context of this study, average appliance consumer prices are of interest as they are required as an input for the LCC calculations that will be performed in Task 5.

Prices within an appliance category can vary widely. Parameters that are the most critical for fixing the price are the capacity, followed by the technical features and functional options chosen by the end-user.

Undercounter, front-loaded machines (categories 1 and 2) tend to start at 1 000 Euro though can vary widely by Member State and can cost more than 4 500 Euro. Glasswashers and lighter load machines tend to occupy the cheaper end of the market.

Hood-type machines (category 3) tend to be more expensive than undercounter machines as they have higher capacities and often are part of a larger integral package which includes

wash spaces, shelves, a sink and accessories. These products typically have been found to start at 2 000 Euro and can cost more than 6 000 Euro.

Appliances designed for heavier or larger wash ware (pots, bakeware, etc. as defined by category 4) tend to occupy a much more expensive portion of the market. Washing capacity and digital programmes tend to be the differentiating factors between purchasing prices of products in this study and have been found to cost approximately 10 500 Euro.

Transport machines (categories 5 and 6) are the most complex, tend to have the highest capacities and are therefore the most expensive dishwashers on the market. Their price range is much larger than other types and therefore they are more difficult to characterise on a broad European level.

The average prices for the machines within the classification are shown in the following table. The figures were obtained from manufacturers’ brochures and information provided directly by the stakeholders. An average value for machines of similar capacity was then calculated. Figures for water-change appliances are included with undercounter classification, given their small market share and comments from stakeholders indicating they are not always relevant for professional markets.

Table 24 European average price by machine of similar capacity. Figures from stakeholders and public catalogues. Prices are without VAT

Type of appliance	Approximate capacity	Average price (Euro)
Undercounter water-change	200 dishes/hour	3 200
Undercounter one-tank	550 dishes/hour	3 500
Hood-type	860 dishes/hour	4 700
Utensil/Pot	0.42 m <sup>2</sup> (rack area) 20 cycles/hour	10 500
Conveyor-type one-tank	1 750 dishes/hour	15 000
Conveyor-type multi-tank	3 600 dishes/hour	45 000

The price of conveyor-type dishwashers is influenced not only by the capacity (dishes/hour), but also a lot by its configuration (the different features, components and washing/drying stages of the appliance). The most expensive models can include: one or more pre-washing zones, two or more washing zones, two or more rinsing zones, one or more drying zones, heat recovery features, etc. The machine configuration depends very much on the intended capacity and application wanted by the customer.

The prices presented in Table 24 will be used later in the study in Task 5 during the life cycle assessment, to help determine the LCCs of these products in the base case analysis.

The results presented in the following figures show the relationship between the capacities of the machines and their prices. The relationship between these two parameters is expected to

be directly proportional. The reference prices were found all over Europe. The difference for a machine of the same capacity but purchased in a different country can reach up to 50%.

In Figure 7 to Figure 11, a single trend line shows the average of prices versus capacity for different product types. The difference in prices for the same capacity is related to the country where the equipment is sold. Southern Europe prices are less expensive than those found in Northern countries.

Figure 7 shows that the price of the machines is directly related to their capacity. The global trend line is an average of different sources and manufacturers from different countries within the EU. In comparison with this figure, the average price of 550 dishes/hour undercounter one-tank dishwashers presented in Table 24 was slightly corrected following stakeholders comments: based on the figure, a 550 dishes/hour undercounter one-tank dishwashers should cost approximately 3 100 Euro, but this estimation judged too low has been raised to 3 500 Euro.

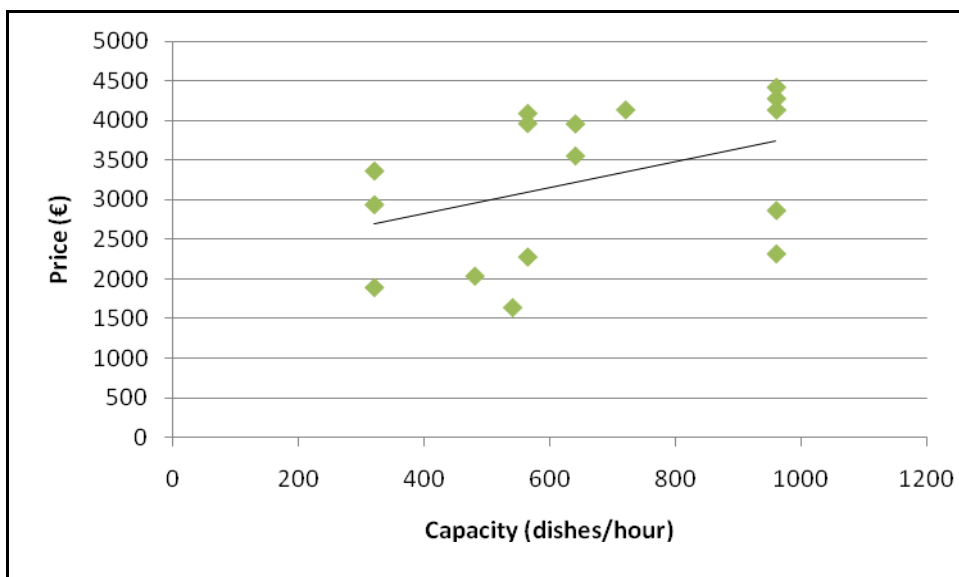


Figure 7 Price and capacity of undercounter one-tank dishwasher machines (dishes/h), 2009-2010

The trend for hood-type dishwashers matches other product types also. The price increases with the capacity. The differences in price for the same capacity correspond to the different technologies involved in the process, e.g. drainage pumps, multi rinsing, pre-rinsing, etc. and different brands on the market.

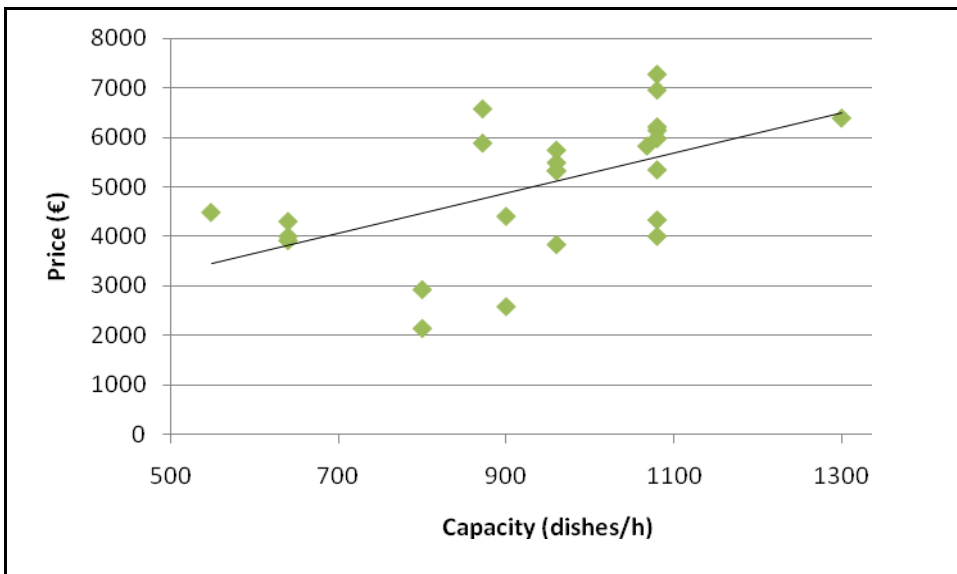


Figure 8 Price and capacity of hood-type dishwashers (dishes/h), 2009-2010

Although utensil/pot dishwashers are common, their capacities and prices remain somewhat reserved by the manufacturers. Figure 9 shows a panel of pot dishwashers prices, related to their rack surface. Among the models found, there is a relationship between price and capacity, but there can be important differences between manufacturers.

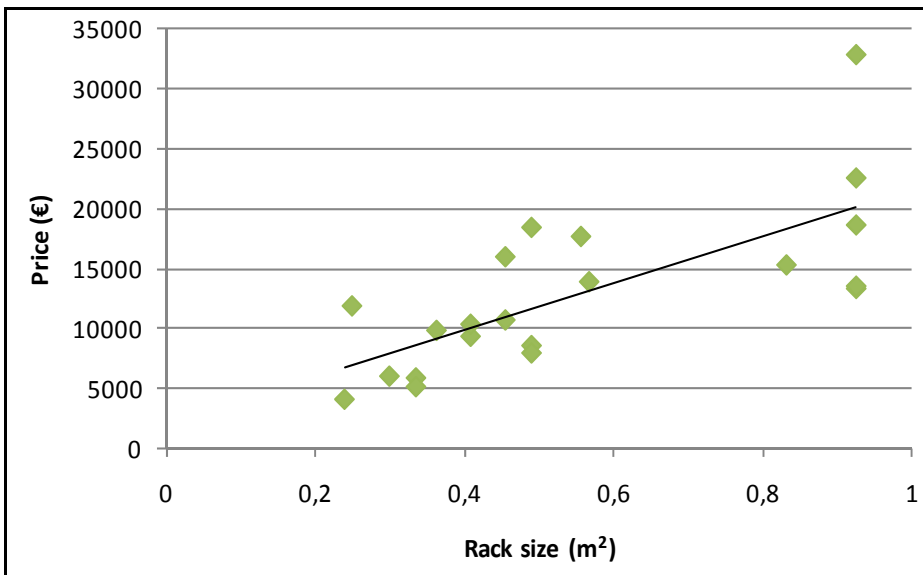


Figure 9 Price and capacity of utensil/pot dishwashers (rack size in m<sup>2</sup>), 2009-2010

One-tank and multi-tank conveyor-type dishwasher prices are shown in the following two figures (Figure 10 and Figure 11). For one-tank machines the price is related to the capacity.

The prices found for larger capacities correspond to different manufacturers, which is the main reason for the dispersion of the data.

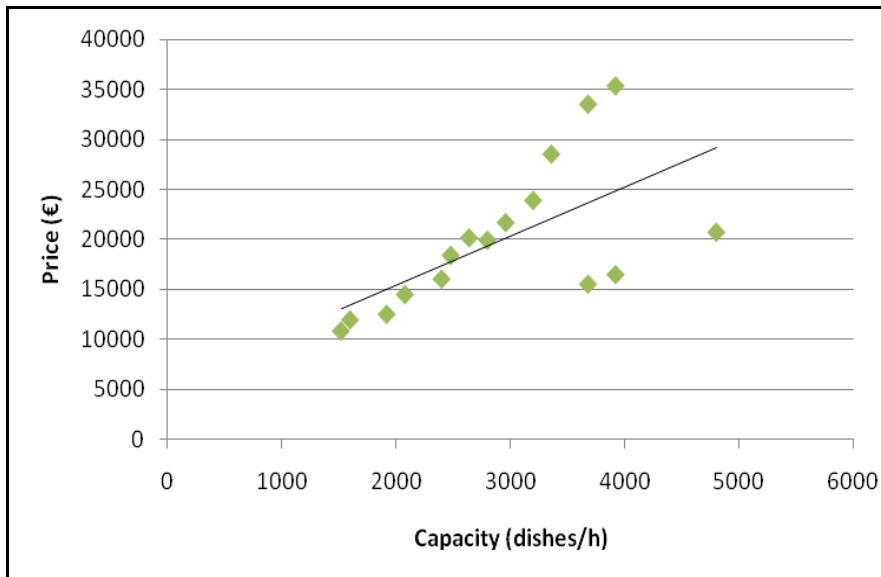


Figure 10 Price and capacity of one-tank conveyor-type dishwasher equipments (dishes/h), 2009-2010

In the case of multi-tank conveyor-type dishwasher prices, in the figure below, two sets of data are shown due to the difference in prices relative to the country (data obtained from UK and Spain manufacturers, with the lower group corresponding to Spain).

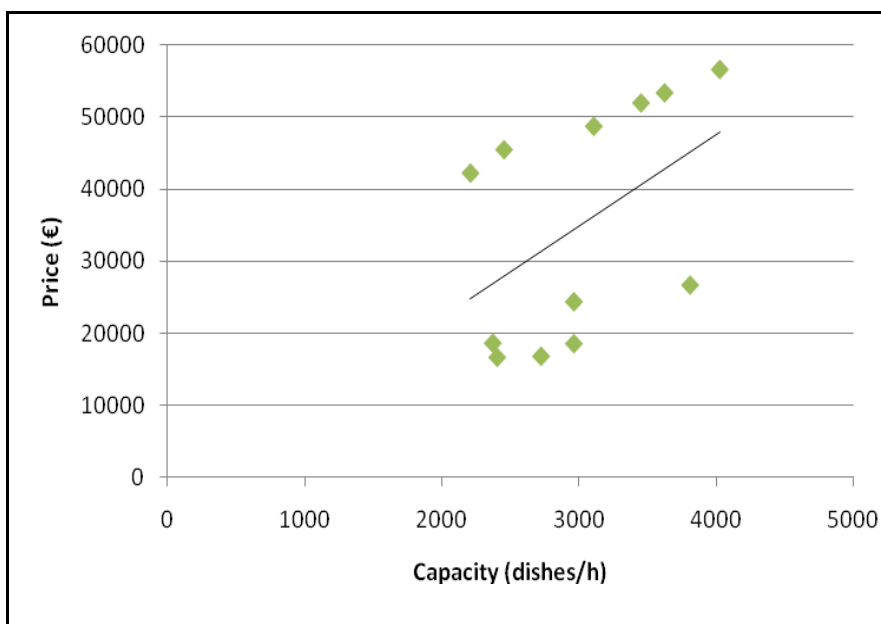


Figure 11 Price and capacity of multi-tank conveyor-type dishwasher equipments (dishes/h), 2009-2010

## 5.2 Running costs

Running costs, understood as costs generated by the use of the appliance, can be split into:

- Energy costs (electricity, gas)
- Consumable costs (water, detergent, rinse, paper filters, etc.)
- Maintenance and repair costs

### 5.2.1 Energy costs

Energy costs are a significant running cost of dishwashers. The latest electricity and gas rates for industrial customers in Member States are presented below, according to the different consumption classes. The EU average will be used in LCC calculations at a later stage of the study (Task 5 and Task 7).

#### Electricity rate

A typical fast food restaurant uses approximately 350-400 MWh of electricity per year<sup>24</sup>. Small restaurants are estimated to use less, while large institutional facilities would use much more (normally including electricity consumption not related to the preparation or washing of catering products). The electricity rate in Europe depends on the consumption and therefore will vary depending on the customer types (which can be attributed to certain product types too). Three consumption bands are presented below for the electricity rate at industrial rates (IA – < 20 MWh, IB – 20-500 MWh, and IC – 500-2 000 MWh) in Table 25.

Table 25 Electricity rates for industrial customers in EU-27<sup>25</sup> average 2007-2009 (taxes excluded)

Member States	Consumption Band Rate (Euro/kWh)		
	Industrial – IA < 20MWh	Industrial – IB 20MWh – 500MWh	Industrial – IC 500MWh – 2 000MWh
<b>Belgium</b>	0.141	0.120	0.097
<b>Bulgaria</b>	0.073	0.069	0.061
<b>Czech Republic</b>	0.161	0.129	0.106
<b>Denmark</b>	0.102	0.086	0.079
<b>Germany</b>	0.156	0.112	0.093
<b>Estonia</b>	0.071	0.059	0.055
<b>Ireland</b>	0.165	0.144	0.127
<b>Greece</b>	0.136	0.108	0.087
<b>Spain</b>	0.148	0.119	0.100
<b>France</b>	0.099	0.075	0.059

<sup>24</sup> McDonald's Switzerland Environmental report 2006, [www.environment.mcdonalds.ch/EN/Achievements/Restaurants](http://www.environment.mcdonalds.ch/EN/Achievements/Restaurants)

<sup>25</sup> Eurostat (2009); Environment and Energy, Data in focus, 48/2009; extracted 12/08/2010



Member States	Consumption Band Rate (Euro/kWh)		
	Industrial – IA < 20MWh	Industrial – IB 20MWh – 500MWh	Industrial – IC 500MWh – 2 000MWh
Italy	:	:	:
Cyprus	0.160	0.160	0.144
Latvia	0.110	0.086	0.077
Lithuania	0.107	0.094	0.083
Luxembourg	0.162	0.116	0.100
Hungary	0.128	0.125	0.116
Malta	0.151	0.148	0.137
Netherlands	0.161	0.103	0.088
Austria	0.111	0.104	0.086
Poland	0.136	0.101	0.085
Portugal	0.121	0.093	0.083
Romania	0.109	0.102	0.088
Slovenia	0.145	0.122	0.094
Slovakia	0.185	0.150	0.126
Finland	0.077	0.071	0.062
Sweden	0.108	0.078	0.068
United Kingdom	0.134	0.112	0.102
<b>EU-27</b>	<b>0.138</b>	<b>0.105</b>	<b>0.090</b>

As an assumption for which dishwashing products use which rates, the general assumption can be made that smaller dishwashers tend to be used in smaller establishments and hence have a higher electricity rate as given in the table. Larger dishwashers would be used in facilities with higher electricity consumption and thus lower electricity rates. The resulting electricity rates for appliances for LCC calculations are given in Table 26.

Table 26 Electricity rates for professional dishwashing products in Europe based on typical usage scenario

Type of appliance	Assumed consumption band	Electricity rate (Euro/kWh)
Undercounter (water-change)	IA	0.138
Undercounter (one-tank)	IA	0.138
Hood-type	IB	0.105
Utensil/Pot	IB	0.105
Conveyor-type (one-tank)	IC	0.090
Conveyor-type (multi-tank)	IC	0.090

Natural gas rates

Natural gas rates have to be taken into account for professional dishwashers which use natural gas fuel for heating. Additional investment costs are required for gas-heated dishwashers and national safety regulations for gas appliances are further significant obstacles against this technology.

The evolution of natural gas rates between 2007 and 2009 as well as rates that vary depending on the end users' consumption as reported by Eurostat are presented in Table 27.

Table 27 Natural gas rates for consumers in EU-27<sup>26</sup>, average between 2007 and 2009 (taxes excluded)

Member States	Consumption band rate (Euro/GJ)		
	Industrial – IA < 1 000 GJ	Industrial – IB 1 000–10 000 GJ	Industrial – IC 10 000–100 000 GJ
Belgium	12.4820	10.6260	8.7920
Bulgaria	7.2216	7.0365	6.5722
Czech Republic	10.4181	9.1017	8.4341
Denmark	13.7775	13.0929	7.0364
Germany	12.2960	11.5920	10.6360
Estonia	7.7399	7.2829	6.6899
Ireland	13.4760	10.8900	9.6740
Spain	10.6561	8.7573	7.9959
France	11.7276	10.2872	9.2532
Italy	11.0010	10.6386	9.0520
Latvia	10.2443	9.7811	9.0292
Lithuania	9.3861	9.1367	8.7945
Luxembourg	11.8760	10.5800	10.2420
Hungary	11.4618	10.7835	9.3420
Netherlands	11.8480	10.3720	8.7142
Austria	10.6300	10.4400	:
Poland	10.1192	9.2683	8.2000
Portugal	13.8253	10.7658	8.6272
Romania	5.5257	5.5080	5.6072
Slovenia	13.3580	12.6800	9.8840
Slovakia	11.7883	10.5191	9.9378
Finland	:	:	7.5800
Sweden	14.7633	13.1448	11.2499
United Kingdom	10.8420	8.4012	7.1704
EU-27	11.2115	10.0097	8.7921

<sup>26</sup> Eurostat (2009); Environment and Energy, Data in focus, 49/2009; extracted 12/08/2010

The three consumption bands available for natural gas have been shown here to determine the natural gas rates as they are assumed to be the applicable bands for professional dishwasher customers (as was the case for electricity consumption bands). All dishwasher appliances which use natural gas heating are larger appliances and thus the most applicable bands are the IB and IC bands.

To summarise, the following gas rates in Table 28 will be used for professional dishwasher LCC calculations.

Table 28 Summary of the rates used for gas for professional dishwashers

Type of appliance	Assumed consumption band	Gas rate (Euro/GJ)
Undercounter (water-change)	IA	11.21
Undercounter (one-tank)	IA	11.21
Hood-type	IB	10.01
Utensil/Pot	IB	10.01
Conveyor-type (one-tank)	IC	8.79
Conveyor-type (multi-tank)	IC	8.79

Preliminary information suggests that gas may not be relevant for smaller dishwasher types; this will be elaborated in Task 3.

## 5.2.2 Consumables (detergent, water, etc.)

The costs of consumables will be discussed in this section.

### 5.2.2.1 Detergent and rinse aid

There is wide variation in the prices of detergents found in Europe. Example prices for France, the UK and Germany are given for some detergent brands aimed at professional dishwashers in Table 29.

Table 29 Example detergent prices (products on sale on the internet)

Price per litre in Euro
34 € / 20 litres
69 € / 20 litres
20 € / 10 litres
43 € / 20 litres
79 € / 18 litres

For the purposes of this study, a mid-range cost of detergent of **3.0 Euro/litre** will be assumed, based on the range of prices found during internet research and stakeholders comments. In particular, the price can vary depending on the quality of the detergent, and the quantity sold. This will translate into a direct cost for the consumer for each wash cycle in later tasks when the amount of water, concentration of detergent and frequency of use is characterised (Tasks 3 and 4).

Rinsing aid (rinse agent) prices were found to vary as much as detergent prices throughout Europe, depending on location and perceived quality. A cost similar to detergent was found through distributor brochures and advertisements, and therefore, rinse aid costs of **3.0 Euro/litre** will be used in the study for LCC calculations.

Detergents represent a particularly important aspect of the performance and environmental impacts of dishwashers in general. The type of detergent used can affect the temperature and amount of water required as well as the time that each wash cycle must run before the wash ware is clean. This will be further evaluated in Task 3.

### 5.2.2.2 Water

The cost of water to consumers can be difficult to evaluate as it is either based on a variable rate which corresponds to consumption or a fixed rate which is set by local utilities.

An indication of water prices in France is shown in Figure 12, where a breakdown in the cost of water to consumers is given over 15 years.

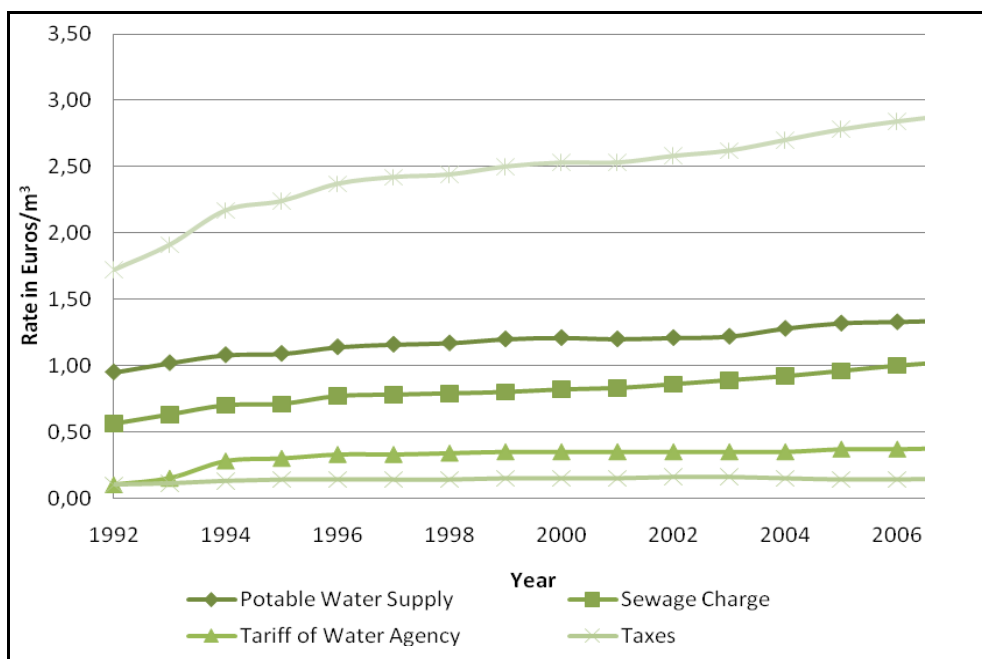


Figure 12 Water cost break down in Rhône region of France for 15 years

A final water tariff to the consumer can be observed at 2.90 Euro/m<sup>3</sup> with an average increase of 0.064 Euro/m<sup>3</sup> per year, suggesting a current water tariff in this region of France of 3.08 Euro/m<sup>3</sup>.

The eco-design preparatory study for Lot 14 (domestic dishwashers and washing machines) proposed a water rate of 3.70 Euro/m<sup>3</sup> for domestic water use in 2008 across Europe. Domestic water prices are not directly applicable to this study as professional dishwashers are not operated in a domestic environment.

Furthermore, BIPE analysed the water rate for eight major European cities in 2006. The relevant information is presented in Table 30.

Table 30 Water consumption and effective rate for eight European cities<sup>27</sup>

City	Water Consumption (m <sup>3</sup> /capita/year)	Average persons per household	Average water bill per household (Euro)	Effective water rate (Euro/m <sup>3</sup> )
Amsterdam	57	2.3	506	3.86
Athens	61	2.7	171	1.04
Berlin	43	1.8	360	4.65
London	54	2.4	312	2.41
Madrid	61	2.9	207	1.17
Paris	52	1.9	229	2.32
Rome	104	2.6	229	0.85
Stockholm	77	2.0	302.5	1.96

Based on the population of the above cities, the weighted average water rate for the eight cities cited by BIPE is 2.38 Euro/m<sup>3</sup>.

Based on the above sources, a water rate extrapolated from the weighted average of the eight largest cities in the EU to the year 2010 based on the change in the water price in France over 15 years gives a water price of **2.64 Euro/m<sup>3</sup>** for the EU-27.

This figure will be used to calculate the LCCs of dishwashers in Task 5 of this study and may impact the LCCs of these appliances when considered on the scale of the entire European dishwashers market. As water consumption is arguably central to dishwasher efficiency, this figure will be used in a sensitivity analysis to determine how variations in this price affect the LCC of professional dishwasher products. This will also help to evaluate the high variability in water prices found in the above analysis.

<sup>27</sup> Consumption, persons per household and average water bill per household taken from: BIPE, Analysis of Drinking Water and Wastewater Services in Eight European Capitals: the Sustainable Development Perspective, 2006

Starting from 2010, the Water Framework Directive<sup>28</sup> requires Member States to improve their water management strategy through setting pricing and policy incentives to preserve the natural water systems of Member States. It can be expected that in years to come, the price of water will become an increasingly important concern for professional dishwasher manufacturers and likewise, professional dishwasher users, as Member States gradually increase the cost of water to reflect environmental and resource use costs more adequately, as defined in the Directive (see also Task 1).

### 5.2.3 Interest and inflation rates

Table 31 shows the latest reliable national inflation and interest rates for the EU-27 as published by Eurostat and the European Central Bank (ECB). Figures from 2007 have been given as more recent data is unavailable.

Table 31 Interest and inflation rates for EU-27, 2007

Member State	Inflation rate (%) <sup>29</sup>	Interest rate (%) <sup>30</sup>
Austria	2.9	4.29
Belgium	2.8	4.33
Bulgaria	10.9	4.54
Cyprus	3.4	4.48
Czech Republic	5.1	4.28
Denmark	2.3	4.29
Estonia	9.3	5.69
Finland	2.5	4.29
France	2.5	4.30
Germany	2.7	4.22
Greece	3.7	4.50
Hungary	7.2	6.74
Ireland	3.1	4.31
Italy	2.7	4.49
Latvia	13.8	5.28
Lithuania	8.6	4.55
Luxembourg	3.5	4.56
Malta	2.3	4.72

<sup>28</sup> Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. Available at: [http://europa.eu/legislation\\_summaries/agriculture/environment/l28002b\\_en.htm](http://europa.eu/legislation_summaries/agriculture/environment/l28002b_en.htm) accessed 01 Feb 2010.

<sup>29</sup> 12 month average rates May 08-07 / May 07-06. Source: Eurostat, <http://europa.eu/rapid/pressReleasesAction.do?reference=STAT/08/85&format=HTML&aged=0&language=EN&guiLanguage=en>

<sup>30</sup> European Central Bank long-term interest rates; 10-year government bond yields, secondary market. Annual average (%), 2007, [http://epp.eurostat.ec.europa.eu/cache/ITY\\_OFFPUB/KS-30-08-410/EN/KS-30-08-410-EN.PDF](http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-30-08-410/EN/KS-30-08-410-EN.PDF)

Member State	Inflation rate (%) <sup>29</sup>	Interest rate (%) <sup>30</sup>
Poland	3.6	5.48
Portugal	2.6	4.42
Romania	6.7	7.15
Slovakia	2.6	4.49
Slovenia	5.3	4.52
Spain	3.7	4.31
Sweden	2.4	4.17
Netherlands	1.7	4.29
UK	n.a.	5.06
<b>EU-27 average</b>	<b>3.0</b>	<b>4.58</b>

The above rates have changed significantly since 2007. For reasons of simplification, the European Commission has recommended a discount rate assumption for this project of **4.0%**.

### 5.3 Maintenance and service costs

Stakeholders have commented that service contracts are usually included as part of the purchase of professional dishwashing products. The exact nature of the contracts can vary and depends on the type of equipment, complexity and capital cost. Normally, more sophisticated and expensive machines have more elaborate and comprehensive service contracts to help ensure a long product lifetime and payback period on capital investments.

For smaller appliances, dealers or wholesalers may provide warranty services to clients on behalf of the manufacturer, or they may also provide the warranty services at their own expense as part of the dealer arrangement between the manufacturers.

For larger more complex products, especially conveyor-type dishwashers, the manufacturer typically services the product as these products are also typically sold directly from the manufacturer themselves.

As a preliminary estimate of the maintenance and service costs of professional dishwashing appliances, an indication can be taken from the size of the new equipment market versus the “spares and service” (spare parts including accessories, repairs and maintenance) market in the UK. In total, the UK spares and service market was 44% of the value of the new food-service equipment market in 2006.<sup>7</sup> This indicates that for the entire lifetime of a foodservice product, the total **maintenance costs are 44% of the initial purchase costs**. This value will be used to estimate the life cycle costs of dishwashing products later in the study (it is therefore assumed that the professional dishwashers have average maintenance and repairs costs, in comparison with other foodservice equipment, including prime cooking and refrigeration equipment). Table 32 presents the resulting maintenance costs that will be assumed for each product type when calculating the life cycle costs of professional

dishwashing products in this study. Stakeholders indicated that for undercounter water-change, maintenance costs represented approximately 37.5% of the product price. This seems to make sense as smaller (and simpler) machines are expected to require less repair services.

Table 32 Lifetime maintenance costs of professional dishwasher products in Lot 24

Type of appliance	Lifetime maintenance costs (Euro)
Undercounter water-change	1 200
Undercounter one-tank	1 540
Hood-type	2 068
Utensil/Pot	4 620
Conveyor-type one-tank	6 600
Conveyor-type multi-tank	19 800

Stakeholders have commented that the most common items for maintenance on professional dishwasher products are water pumps, control panels, heating elements and doors. All of these components in professional dishwashers are easily replaceable and generally justify maintenance rather than replacing the entire dishwasher. According to manufacturers, the most common cause for professional dishwasher breaking is operator misuse or abuse.

#### 5.4 Disposal costs

In general, most professional catering service establishments need a working dishwasher for daily operation. As a result, for all replacement sales, the old dishwasher unit is removed at the same time as the new unit is provided.

Stakeholders have commented that many professional dishwasher units can be refurbished and resold as second-hand products by dealers in a fairly buoyant second-hand market (around 5-10% of the annual sales, according to manufacturers' estimates). These products generally are given new water pumps, control panels and heating elements, as the most common items to fail.

According to stakeholders, dishwashers that are not refurbished are almost always recycled for scrap parts. A large majority of the materials in professional dishwashers is valuable metallic parts (stainless steel) and the value for scraps is high. As a result, most dealers or manufacturers will offer to remove the old dishwashers on purchase and delivery for new dishwashers, and may even provide the customer with a discount for the salvaged product.

As a result, this study will assume the **disposal costs for professional dishwashers are 0 Euro per product.**



## 5.5 Summary of end-user expenditure

Table 33 summarises the end-user expenditure data presented in the previous sections. This data will be useful in later tasks (Task 5) for estimating life cycle properties of these products.

Table 33 User expenditure base data

Category	Cost items	Units	Value
Purchase	Purchase price	€/product	3 200–45 000
Use	Electricity rate	€/kWh	0.090–0.138
Use	Gas	€/GJ	8.79–11.21
Use	Water rates	€/m <sup>3</sup>	2.64
Use	Detergent	€/L	3.0
Use	Rinse	€/L	3.0
Use	Interest-inflation rate	%	4.0
Maintenance	Servicing and repair	€/product	1 200–19 800
Disposal	Removal and disposal / recycling	€/product	0

## 6 Conclusions

In conclusion, Task 2 presents the professional dishwasher market sector with generic economic data extracted from the Eurostat database, completed by information obtained directly from the main manufacturers.

The main manufacturing Member States identified are Germany, Italy and Spain. Under-counter one-tank dishwashers are the most sold product type by far, followed by hood-type machines and undercounter water-change machines. Conveyor-type dishwashers have low sales as these machines are reserved for heavy duty installations. Their environmental impacts should not be neglected, however, due to the intensity of use and the large capacities of these machines.

The task also contains the consumer expenditure data that will serve as a basis for the economic analysis of the base cases (Task 5) and the improvement options (Task 7). Purchase prices of professional dishwashers are comprised between 3 200 and 45 000 Euro. As a general remark, customers show an interest in more energy-efficient products, provided that these products result in cost savings in the long term.



## 7 Annex

### 7.1 Questionnaire “Task 2” for stakeholders

This paper is provided separately (EuP\_Lot24\_Dish\_T2\_Annex\_Questionnaire.pdf).

### 7.2 Stakeholder feedback to draft versions of Task 2

Please note that the feedback refers to prior versions of draft Task 2 report; thus the indicated numerations of chapters, tables, figures or pages might have been changed.

Feedback		Comment
<b>Hobart</b>		
2.2.4, p. 20	<p><b>Table 2-12</b></p> <p>The average product life time should read: 12, 8, 8, 8, 12, and 17 (top –down) as per outcome of the discussion during the interim stakeholder meeting.</p> <p>Nevertheless we have reviewed the average lifetime for multi-tank conveyor dishwashers and came to the conclusion that it should be reduced to 12 years.</p>	The figure that was commonly agreed during the stakeholder meeting (17 years) will be kept in the final version of the report. No similar comments have been received from other stakeholders justifying an update of this parameter.
2.3.2, p. 29	<p><b>Employment</b></p> <p>Hobart Germany has approx. 900 employees</p>	Thank you for this input.
2.3.4, p. 31	<p><b>Changes on the demand side (last paragraph)</b></p> <p>Governmental institutions have the obligation to consider more than just investment cost. The first decision criterion has to be the LCC.</p> <p>This rule is quite often not followed today.</p> <p>This study might be an opportunity to exert influence on the actual practice</p>	Included in the text.
2.3.4, p. 33	<p><b>Optimised rinse system</b></p> <p>The text refers to rack conveyor and flight type dishwashers while Fig 2-11 is related to undercounter and hood type dishwashers</p>	Modified in the text.
2.3.4, p. 34	<p><b>Heat pumps</b></p> <p>Energy saving of 25 to 35 kW/h seems to be unrealistic high.</p>	The detailed description has been removed from Task 2. A thorough analysis and the savings potential of improvement options is provided in Task 6.
2.3.4, p. 34	<p><b>Rinse with steam</b></p> <p>The rinsing system uses steam in addition to water, not instead. The advantage is savings of water, detergent and rinse aid, not energy savings.</p> <p>The cited Hobart brochure reads: VAPO RINSE ECO</p> <p>The primary task of rinsing is to remove detergent from the wash item. The switchable steam rinse cycle VAPO RINSE</p>	The detailed description has been removed from Task 2. A thorough analysis and the savings potential of improvement options is provided in Task 6.

Feedback		Comment
	ECO works in two phases. In the first phase, the detergent is rinsed off with water. The following VAPO RINSE ECO fills the wash chamber completely with steam which forms a microscopically thin film on the wash items and removes residual alkalinity. The self-drying effect of the wash items is additionally enhanced by the increased temperature penetration into the wash items. The steam rinse cycle VAPO RINSE ECO reduces the consumption of fresh water to 1.5 litres per cycle. Compared to standard machines, this represents a saving of up to 55 % in water and detergent as well as up to 70 % in rinse aid.	
2.3.4, p. 35	<b>Table 2-20</b> Are these really stakeholders assumptions? They seem to be unrealistic. We are unable to prophesy future market shares of the listed technologies.	This table has been removed from Task 2 and the current market shares of the technologies will be assessed in Task 6.
2.3.4, p. 37	<b>Table 2-21</b> "90 litres" is not a capacity for Universal / Pot washers capacity should be given in "cycles per hour" or "sprayed horizontal plane of utensil carrier (rack) per hour" with respect to the non standardized rack sizes.	Has been changed in the new version.
2.3.4, p. 37	<b>First paragraph</b> The price of conveyor dishwashers is mainly influenced by its configuration. i. e. number of washing zones, number of drying zones, heat recovery system, usable width, usable height, etc. The machine configuration depends very much on the intended capacity (plates per hour) and on the specified application. The most expensive models can include: one or more pre-washing zones, two or more washing zones, two or more rinsing stages, drying zone(s), heat recovery/heat pump, etc.	Included in the text
2.4.2, p. 44	<b>Gas heating</b> It should be mentioned that additional investment costs are required for gas heated dishwashers. Country-specific safety regulations for gas appliances are further significant obstacles against this technology.	Included in the text.
Miele		Comment
Table 2-4, p. 9	<b>List of professional dishwasher manufacturers</b> Please add Miele as a manufacturer of Professional dishwashers. Our current product offering includes water-change models, undercounter models and hood type models (categories 1, 2 and 3). Among all those categories Miele has a significant market share.	It is already included (row 8 of the table, first column)
2.2.3, p. 17	<b>Industry stakeholders have identified [...] 'water-change operation' are not true a true commercial dishwashing product [...]</b> As quoted in Draft 1 and as stated in the machinery directive, the intended use determines if a dishwasher is considered commercial or residential appliances. In case of Miele's product offering of water-change models the manufacturer clearly states "commercial applications" as the	Corrected in the text.

Feedback		Comment
	<p>intended use. All models are compliant with the machinery directive. As a matter of fact they are primarily used in those target groups stated in Task 1 table 2 (Office, Pensions, restaurants, B&amp;Bs, Nursing homes, etc.).</p> <p>The fact that Miele has a unique position with its water-change machine and that most manufacturers offer Tank systems doesn't make water-change models less commercial.</p>	
Winterhalter		Comment
2.3.4, p. 33	<p><b>Figure 2-11</b></p> <p>The text above the schedule mentions saving with rack-conveyor and flight-type machines – the Winterhalter schedule shown covers undercounter and pass-through machines, so the text does not fit to the schedule</p>	Text corrected.
2.3.4, p. 35	<p><b>Table 2-20</b></p> <p>From our opinion and our experience neither the functionality, nor the ecological and economical sense of the mentioned technology "rinse with steam" is proved. So we cannot see any rationale for a future market-share.</p>	<p>This table will be removed from Task 2 and the current market shares of the technologies will be assessed in Task 6.</p> <p>However, this option will be kept as a potential BAT and investigated further.</p>
Danish Technological Institute		Comment
2.2.2, p. 9	<p><b>Manufacturers in Denmark</b></p> <p>JEROS A/S Nyborgvej 8, DK-5750 Ringe - Phone +45 63 62 39 13 - email: jeros@jeros.dk , www.jeros.com</p> <p>KEN A/S Bøgebjergvej 60, DK-5672 Broby, Phone: +45 62 63 10 91, Fax: +45 62 63 16 07, e-mail: ken@ken.dk, www.ken.dk</p>	Included in the text.