EuP Lot 30:
Electric Motors and Drives

Task 2: Economic and Market Analysis

ENER/C3/413-2010

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Anibal de Almeida

Hugh Falkner

João Fong

Keeran Jugdoyal

ISR – University of Coimbra

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Contents

2 Economics and Market

This section gives data on current market figures, stock and market trends, in order to indicate the place of possible eco-design measures on motors and drives. Data that will be used for the calculation of Life Cycle Costs, such as motor prices and electricity rates are also collected here.

2.1 Generic Economic Data

The global stock of electric motors is estimated at 2,23 billion. Small motors, under 750 W, account for 90% of the electric motors population (approximately 2 billion) but use only 9% of the overall electricity consumption. There are around 230 million medium motors, in the 0.75 kW to 375 kW power range, about 9% of the installed motors, which are responsible for 68% of the electricity consumed by motor systems. Large motors, with powers over 375 kW represent the smallest number, with only 0,6 million motors installed globally but, nevertheless, they are responsible for 23% of the energy use [1].

Motor market data, relating to Europe, was primarily sourced from official EU statistics so that it is coherent with official data used in EU industry and trade policy. Prodcom [2] (which stands for Production Communautaire) is the official Eurostat source of statistics on the production of manufactured goods.

Table 2-1 presents the PRODCOM classification for electric motors.

Table 2-1 PRODCOM categorisation for electric motors

27.11.10.30	DC motors and generators of an output > 37.5 W but <= 750 W (excluding starter motors for internal combustion engines)
27.11.10.53	DC motors and generators of an output > 0.75 kW but <= 7.5 kW (excluding starter motors for internal combustion engines)
27.11.10.55	DC motors and generators of an output > 7.5 kW but <= 75 kW (excluding starter motors for internal combustion engines)
27.11.10.70	DC motors and generators of an output > 75 kW but <= 375 kW (excluding starter motors for internal combustion engines)
27.11.10.90	DC motors and generators of an output > 375 kW (excluding starter motors for internal combustion engines)
27.11.21.00	Universal AC/DC motors of an output > 37.5 W
27.11.22.30	Single-phase AC motors of an output <= 750 W
27.11.22.50	Single-phase AC motors of an ouput > 750 W
27.11.23.00	Multi-phase AC motors of an output <= 750 W
27.11.24.03	Multi-phase AC motors of an output > 0.75 kW but <= 7.5 kW
27.11.24.05	Multi-phase AC motors of an output > 7.5 kW but <= 37 kW
27.11.24.07	Multi-phase AC motors of an output > 37 kW but <= 75 kW
27.11.25.40	Multi-phase AC motors of an output > 75 kW but <= 375 kW (excluding traction motors)
27.11.25.60	Multi-phase AC motors of an output > 375 kW but <= 750 kW (excluding traction motors)
27.11.25.90	Multi-phase AC motors of an output > 750 kW (excluding traction motors)

The Prodcom data available is not sufficiently disaggregated for the purpose of this study, particularly regarding DC motors which are grouped with DC generators. Furthermore, the data for DC motors also includes motors produced for applications where only DC power is

available such as forklifts, battery powered tools and for subsystems used in the automotive industry (e.g. powered windows, windscreen wipers), which are outside the scope of this study. This is especially relevant for small motors under 750 W. As an example, in 1999 automotive applications represented 37,1 of fractional power (<1hp or <0,750 kW) DC motors sales by value, in Germany [3], shown in Table 2-2. Since then, the number of automotive applications for small DC motors has increased and with it the respective market share.

Table 2-2 Small DC motor market - Percent of Revenues by Application (Germany, 1999)

Application	**(%)**
Automotive Auxiliaries	37,1
Domestic Appliances	11,2
Industrial Machinery	13,1
Pumps and Compressors	10,2
HVAC	9,3
Portable Tools	4,7
Office Machinery	5,7
Medical Equipment	4,2
Others	4,5
Total	100,0

Note: Others include toys, video recorders, hi-fi stereo systems, photographic equipment, agriculture, defence and aerospace, clocks, garage doors and a growing range of other automated household functions and security systems.

Traditionally, conventional brushed DC motors in the medium power range have been used in industrial applications requiring accurate torque and/or speed control (e.g. servo drives, traction). The developments in power electronics in the last 25 years allowed induction motors to achieve the same torque/speed performance of DC motors in high demand applications, but with much higher reliability leading to a decline in market share of DC motors, in the medium power range.

Table 2-3 presents the number of electric motors sold in the EU-27 in 2010 in the different power ranges by technology used, according to ProdCom data.

Table 2-3 ProdCom data for electric motors and generators sold, in thousands (EU-27, 2010)

	Power range					
	≤ 750 W		**> 0,75 ≤ 375 kW**		**> 375 kW**	
	n. units	%	n. units	%	n. units	%
DC Motors and Generators	128 176	*56*	4417	*21*	1	*5*
AC Single-Phase	67 019	*29*	6379	*30*	n/a	*n/a*
AC Multi-Phase	11 700	*5*	10175	*49*	28	*95*
Universal	23 228	*10*	n/a	*n/a*	n/a	*n/a*
Total	**230123**		**20970**		**30**	

In 2010 over 250 million motors were sold in Europe, 91 % of which were in the small power range, that is, under 750 W. The share of large motors is very small (only 0,01%). The remaining 9% of motors sold are in the medium power range. These values are consistent with the available estimates of global sales of motors.

Table 2-4 shows the revenues of motors sold in each technology, for each of the power ranges under consideration.

Table 2-4 Prodcom revenue data for electric motors and generators, in millions (EU-27, 2010)

	Power range					
	≤ 750 W		> 0,75 ≤ 375 kW		> 375 kW	
	Value €	%	Value €	%	Value €	%
DC Motors and Generators	1 762	39	515	11	64	5
AC Single-Phase	1 365	30	805	17	n/a	n/a
AC Multi-Phase	805	18	3384	72	1142	95
Universal	576	13	n/a	n/a	n/a	n/a
Total	**4508**	**100**	**4705**	**100**	**1207**	**100**

Data provided by CEMEP for induction motors slightly differs from the ProdCom data presented, as can be seen in Table 2-5.

Table 2-5 Induction motors sold, in thousands, and revenue in million € (EU-27, 2010)
Source: CEMEP

	Power range					
	≤ 750 W		> 0,75 ≤ 375 kW		> 375 kW	
	n. units	Million€	n. units	Million€	n. units	Million€
AC Single-Phase*	800	48				
AC Multi-Phase	7 300	580	8 100	2 700	13-13,5	320-340
Total						

* Only in typical industry applications.

The number of AC Single-Phase motors sold provided by CEMEP only relates to motors used in industrial applications. However, these motors can be found in a number of other applications, such as household appliances. The total number of AC Single-Phase motors sold according to ProdCom is in-line with other market studies [3] and will be used in further calculations.

The number of DC Multi-Phase motors sold in the EU-27, by power range, in 2010 is shown in Table 2-7.

Table 2-6 Prodcom number of DC Multi-Phase motors sold and market share, in thousands (EU-27, 2010)

Power range	n. of units sold	Market Share(%)
≤ 750 W	128176	96,67
> 0.75 kW but ≤ 7.5 kW	3600	2,72
> 7.5 kW but ≤ 37 kW	800	0,60
> 37 kW but ≤ 75 kW	17	0,01
> 75 kW but ≤ 375 kW (excluding traction motors)	1	0,001
Total	**132594**	**100**

The number of AC Multi-Phase motors sold in the EU-27, by power range, in 2010 is shown in Table 2-7.

Table 2-7 ProdCom number of AC Multi-Phase motors sold in thousands, and market share (EU-27, 2010)

Power range	n. of units sold	Market Share(%)
≤ 750 W	11700	53,42
> 0.75 kW but ≤ 7.5 kW	8366	38,20
> 7.5 kW but ≤ 37 kW	1512	6,90
> 37 kW but ≤ 75 kW	202	0,92
> 75 kW but ≤ 375 kW (excluding traction motors)	94	0,43
> 375 kW but ≤ 750 kW (excluding traction motors)	21	0,10
> 750 kW (excluding traction motors)	7	0,03
Total	**21903**	**100%**

CEMEP data relating to AC motors over 375kW gives a significantly lower number of units sold annually, as seen in Table 2-6.

Table 2-8 Number of Large AC Multi-Phase motors sold in thousands (EU-27, 2012)
Source: CEMEP

Power range		n. of units sold
> 375 kW but ≤ 1000 kW	Low Voltage	10
	Medium Voltage	3 – 3,5
Total		**13 -13,5**

The share of electricity demand of motors, by end-use application in the industrial sector is shown in Figure 2-1.

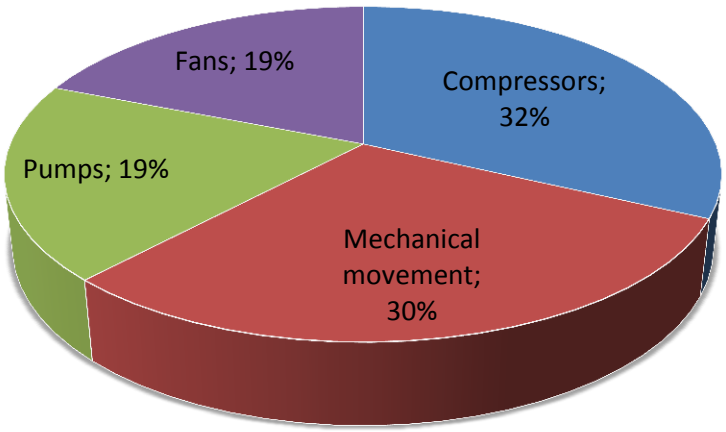

Figure 2-1 Estimated share of global EMDS electricity demand by end-use application

Next table presents the number of inverters sold by power handling capacity, in the EU-27, in 2010.

Table 2-9 Prodcom number of VSDs sold by power handling capacity (EU-27, 2010)

Power handling capacity	**n. of units sold** in thousands	**Value** In million Euros
≤ 7.5 kVA	5837	2400
> 7.5 kVA	2000	3170

The data disaggregation given by ProdCom is not sufficient for the purpose of this study. CEMEP provided VSD market data for the power ranges considered in the study, as shown in table xx.

Table 2-10 Number of VSDs sold and revenues by power range (EU-27, 2012)
Source: CEMEP

	Power range					
	> 120 W ≤ 750 W		**> 0,75 kW ≤ 375 kW**		**> 375 kW ≤ 1000 kW**	
	n. units	Mio €	n. units	Mio €	n. units	Mio €
VSDs	1,13 Mio	200	2,89 Mio	2.500	7.000	260

8,9 million static converters (excluding polycrystalline semiconductors, converters specially designed for welding, without welding equipment, accumulator chargers, rectifiers, inverters), which include soft-starters, were sold representing a sales volume of 1,566 billion euros, according to ProdCom data.

Again, ProdCom data is not sufficiently disaggregated for the purpose of this study. CAPIEL provided market data for Soft-Starters and Electro-Mechanical starters.

Table 2-11 Number of Soft-Starters and Electro-Mechanical starters sold (in thousands) and revenues (in million €) by power range (EU-27, 2012)
Source: CAPIEL

	Power range					
	> 120 W ≤ 750 W		**> 0,75 kW ≤ 375 kW**		**> 375kW ≤ 1000 kW**	
	n. units	€	n. units	€	n. units	€
Soft Starters	20	1,2	360	74	1	6,5
Contactors	10 300	103	19 200	575	3	4,5

2.2 Motor Stock

For the estimation of the motor installed base a bottom up approach was used starting at the number of motors sold in each category.

The following assumptions were made:

- An average lifetime of 10, 15 and 20 years for motors in each of the power range considered (small, medium and large), which is gives a replacement rate of 10 %; 6,7% and 5% for each of the power ranges, respectively.

- An yearly market growth of 2,1 %, equivalent to the increase of electricity consumption, in the EU-27, in the period 2000-2010.
- European manufacturers often sell motors that are included into equipment that is then exported. It is assumed that these exports account for about 20% of the motors sold and therefore do not contribute to the European stock of motors.

Table 2-12 Estimation of the motor stock in thousands (EU-27, 2010)

	Power range		
	≤ 750 W	**> 0,75 ≤ 375 kW**	**> 375 kW**
	n. units	n. units	n. units
DC Motors and Generators	847444	40304	16
AC Single-Phase	443101	58209	n/a
AC Multi-Phase	77355	92852	n/a
Universal	153575	n/a	317
Total	**1521476**	**191365**	**333**

The evolution of the installed base of three-phase induction motors is estimated here, projecting the sales of these motors according to the existing policy measures (Regulation 640/2009). The results for two scenarios, in the period 1998-2020, are presented here.

1. **No Regulation –** based on the information collected in the EuP Lot 11 study, and the evolution of the electricity consumption in the EU-25. The 1998 (base year) installed stock is conservatively assumed to be divided by efficiency levels according to the sales in that year.

   The motor stock in 1998 was based in previous studies and in the period 1998-2020 the evolution of motor sales in this scenario was made according to the evolution of the electricity consumption in the respective sectors. In the period 1998-2009 the CEMEP sales by efficiency class were considered.

2. **Regulation 640/2009** [4] – Same as **No regulation** until end of 2010. Motors in the power range of 0,75-375 kW manufactured in or imported into the EU after June 2011 must meet or exceed the IE2 efficiency level as defined in the IEC 60034-30 standard until the end of 2014. Motors with a power rating over 7,5 kW (included) manufactured in or imported into the EU after January 1, 2015 must meet or exceed the IE3 efficiency level as defined in the IEC 60034-30 standard [5]. Motors with a power rating over 0,750 kW (included) manufactured in or imported into the EU after January 1, 2017 must meet or exceed the IE3 efficiency level as defined in the IEC 60034-30 standard A residual number of sales (15%) of motors under the IE3 class is maintained to take into account special purpose motors that fall out of the product definition. The option to use IE2 motor+VSD, instead of an IE3 motor was not considered,

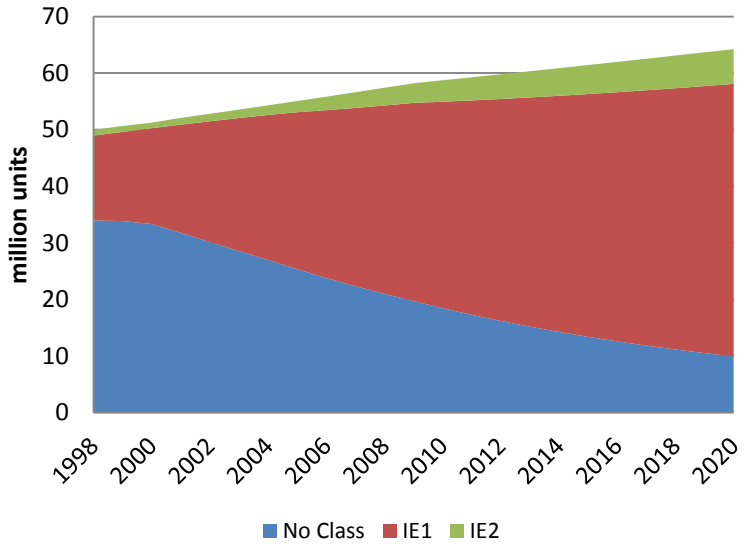

Figure 2-2 Evolution of the motor installed base, by efficiency class, in the industry (No regulation)

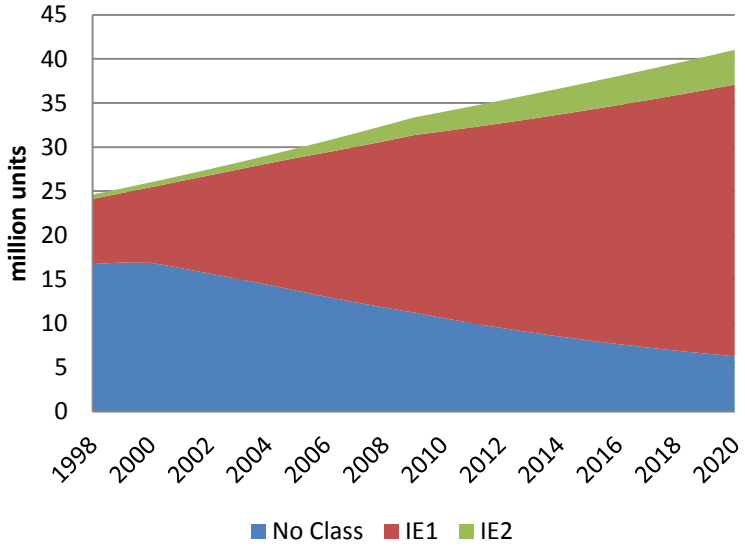

Figure 2-3 Evolution of the motor installed base, by efficiency class, in the tertiary sector (No regulation)

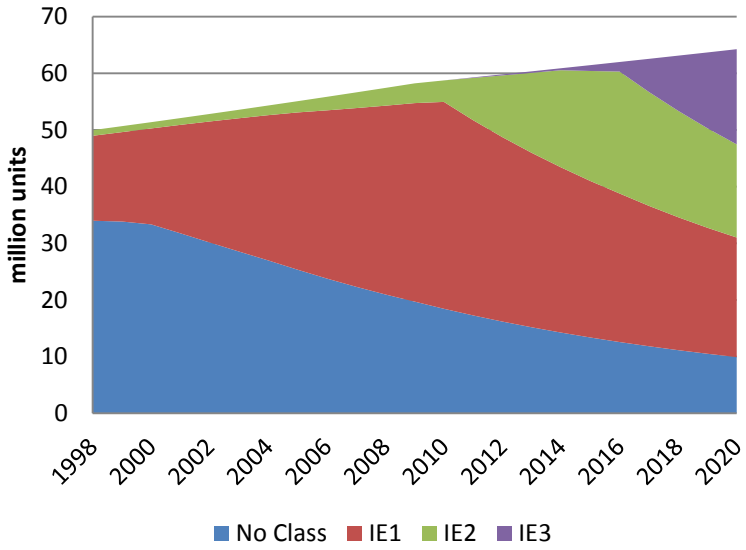

Figure 2-4 Evolution of the motor installed base, by efficiency class, in the industry (Regulation 640/2009)

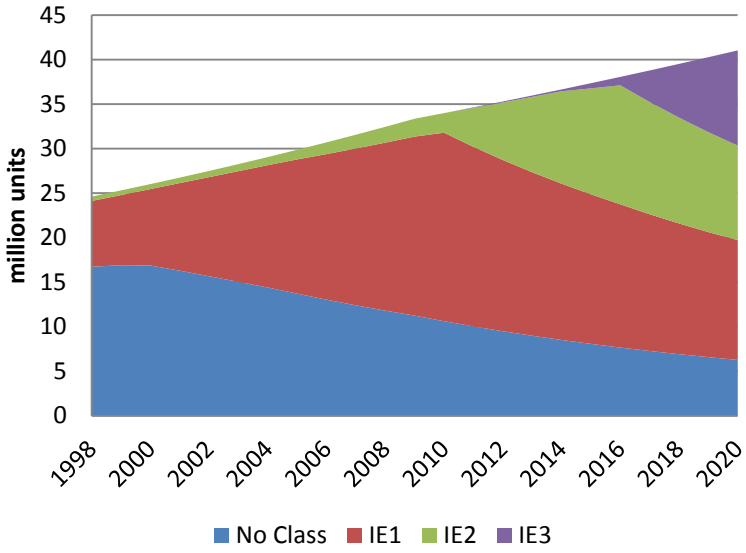

Figure 2-5 Evolution of the motor installed base, by efficiency class, in the tertiary sector (Regulation 640/2009)

2.3 Market Trends

2.3.1 Small motors (150 W to 750 W)

The market of single-phase motors has been slowly declining as they are being replaced by other technologies in HVAC, domestic appliances and some industrial applications.

The falling price of inverters is expected to promote growth in the use of AC polyphase products. As inverters become less expensive, a growing number of industrial motor users are favouring AC polyphase motors over DC motors. Accompanied with an inverter, AC polyphase motors offer good control and lower running costs in the medium and long run because of the absence of brushes.

The falling price of DC brushless motors is encouraging the gradual replacement of existing DC products and of induction motors. While brushless motors remain more expensive than standard DC motors, reduced operating costs because of the absence of brushes and much higher efficiency are increasingly seen as justifying the higher initial cost. The minimum efficiency requirements set to some applications also encourages OEM to include these motors in their products.

The number of units sold, per technology used in this power range, can be seen in the next figure, for the years 2003 to 2010.

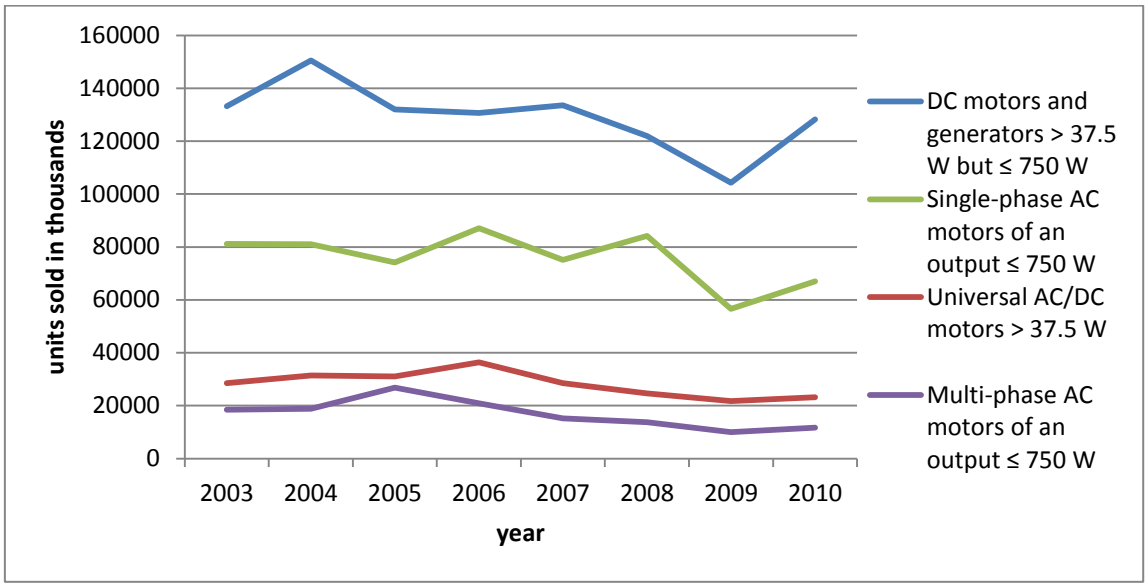

Figure 2-6 Number of small electric motors sold, per technology used (EU-27)

2.3.2 Medium motors (0,750 to 375 kW)

In the medium power range, conventional Brushed DC motor market is expected to continue to decline as this technology is being replaced by three-phase induction motors which can have a high dynamic performance when fed by VSDs, cost less and require much less maintenance. Permanent Magnet DC Motors are mostly customized products, but they are expected to become widely available commercially, in standard mechanical dimensions (e.g. frame sizes, flanges, shaft heights, etc.) in the near future. Line-start permanent magnet motors, which as the name implies do not need an electronic controller, being able to start by direct connection to the mains supply, have been recently (2010) introduced in the market. These motors are able to achieve IE4 – Super Premium efficiency levels, and are produced in standard frame sizes, allowing the possibility of easy integration in products and allowing retrofitting. Since it does not need an electronic controller in constant speed applications, its application has not the associated cost premium and losses, allowing very high efficiency during synchronous running.

High performance magnets are made from rare earths such as neodymium and dysprosium, which are both imported from China. Because in the last decade China lowered the production prices (like many other products) the production of Rare Earth materials collapsed in other countries. The figure below shows the evolution of market for rare earth materials.

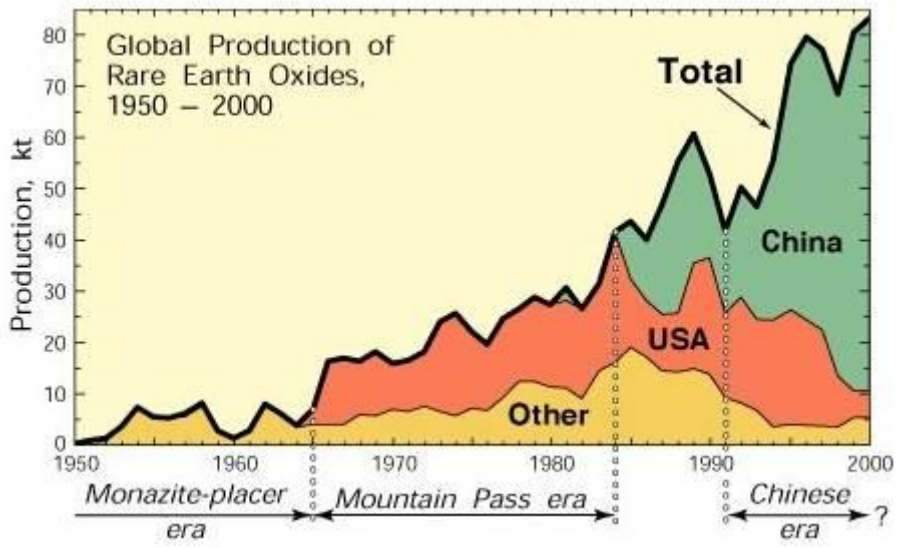

Figure 2-7. Rare Earth Materials Production [6]

It seems critical that 97% of rare earth element production is currently controlled by China, where internal demand is rising.

The increase in demand of rare earth metals has caused an increase in market price in the last few years as can be seen in Figure 2-8.

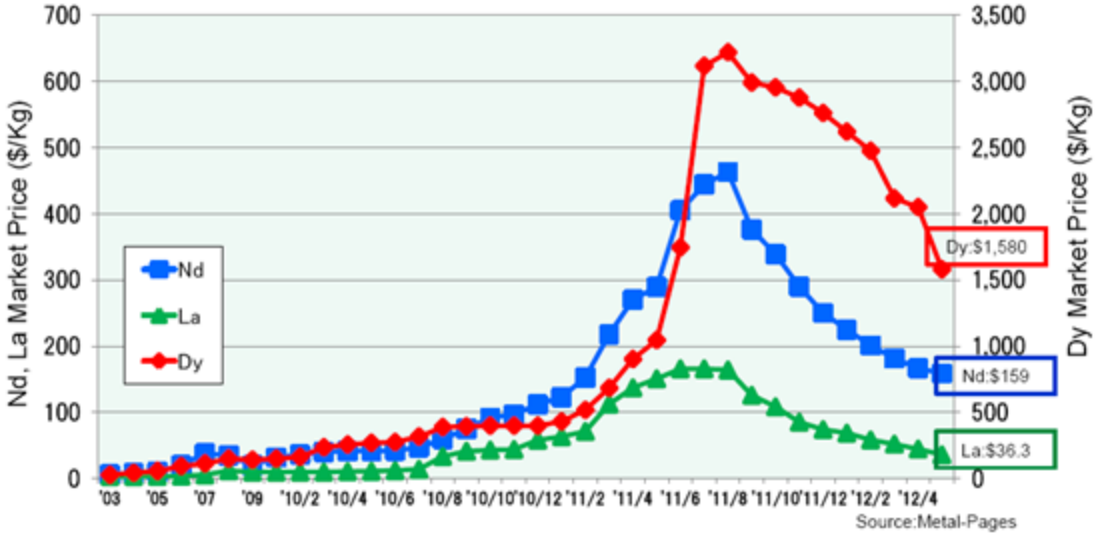

Figure 2-8 Rare Earth Metals Market Price Trends

In applications in which space or weight is not at premium (e.g. appliances and fans) the use of low cost ferrite magnets is already usual. Motor manufacturers have developed motors using ferrite magnets (about one 20th of the price of rare earth magnets which are commonly used in electronics parts.

The decrease in demand of single-phase integral motors is expected to persist due to the increased use of electronic speed controls. These controls allow a single-phase supply to feed a cheaper and comparatively more efficient 3-phase motor.

The number of units sold in the EU, per technology used in this power range, can be seen in the next figure, for the years 2003 to 2010.

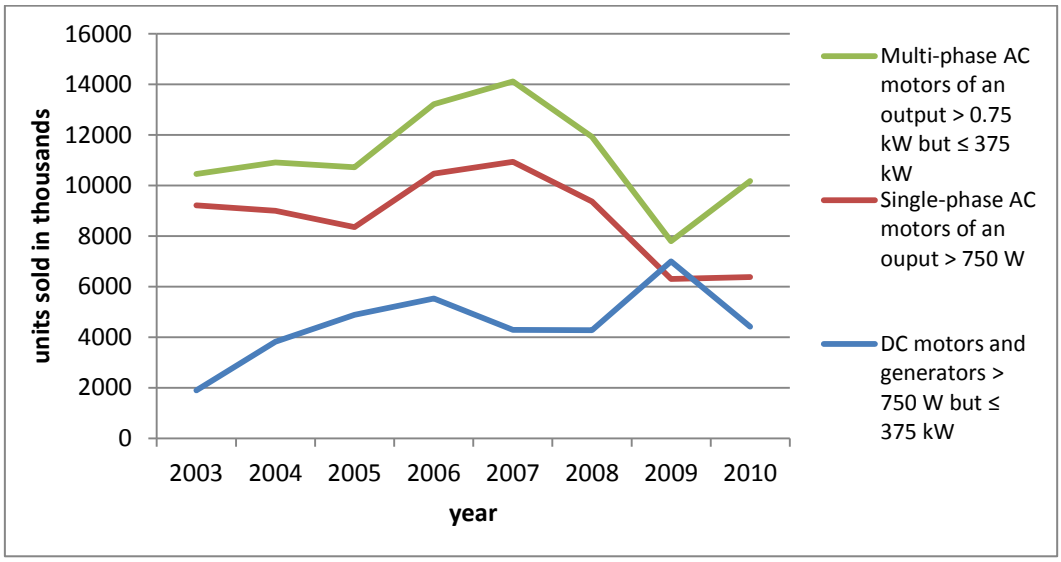

Figure 2-9 Number of medium electric motors sold, per technology used (Prodcom EU-27)

The market in this power range is expected to continue to be largely dominated by three-phase induction motors, in the next years. As mentioned in the previous chapter, the introduction of mandatory and voluntary schemes to promote the penetration of energy efficient motor in the market has proven successful, particularly in countries where mandatory regulation is enforced. For example, the share of IE3/NEMA Premium Class in the United States has reached 20%, but it has failed to penetrate in the European Union.

Recently, IE4 induction motors have been introduced in the market by some manufacturers.

2.3.3 Large Motors (over 375 kW)

The large motor market is a very specialized market, with custom motors designed for specific applications. Since more time and money are spent in the specification of this high cost products, there is a tendency to address high efficiency performance during the process. Therefore, the market structure is not expected to experience major changes.

2.3.4 VSDs and Controllers Market

The VSDs market, in 1998, for powers above 0,75 kW, was dominated by low power drives in the range of 0.75 to 4 kW, representing about 76% of the total units sold in the EU-15 [7].

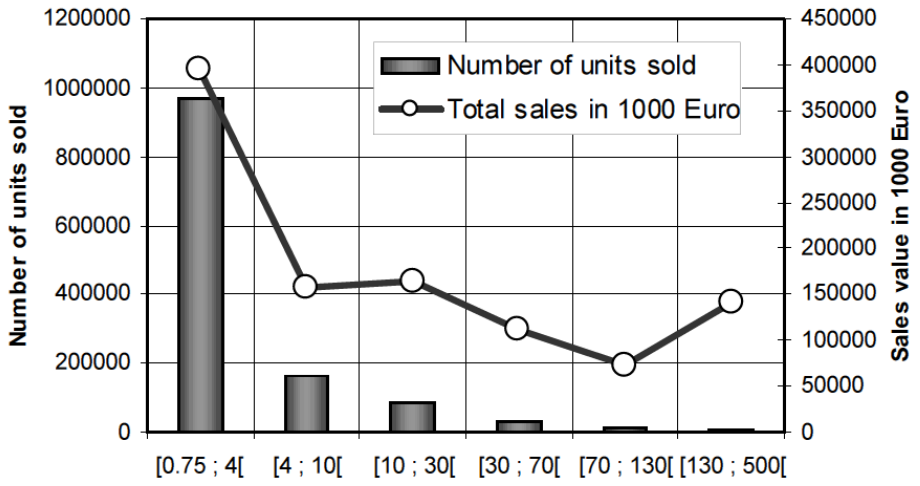

Figure 2-10 Number of units sold in the EU-15 and sales value per power range, in 1998

The market share by power range has not significantly changed for medium and large size applications (over 0,750 kW). The number of units sold with power handling capabilities below 7,5 kVA has risen considerably driven by developments in power electronics and by a price decrease.

The market for VSDs sold integrated into small pumps and fans, particularly in HVAC high-efficiency applications, has also been increasing significantly.

The number of units sold, per power range, can be seen in the next figure, for the years 2003 to 2010.

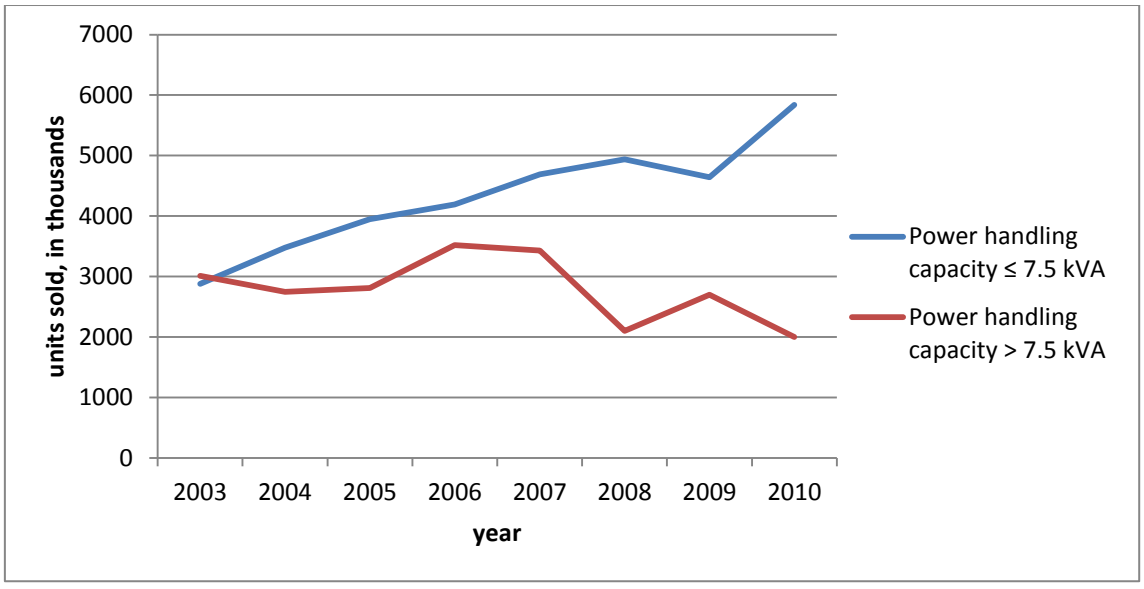

Figure 2-11 Number of VSD units sold for different power ranges (Prodcom EU-27)

The number of motor systems which include VSDs is, nevertheless, still small particularly when compared with countries, such as Japan, which began selling VSDs in de 1980's and where sales have been encouraged by tax incentives since later in the same decade. VSD sales, by the mid-1990s, accounted for about 75% of the sales volume of electric motors, which

implies that a high proportion of applications were using inverters. Prices of inverters dropped by 60% from 1990 to 2002 [8].

As the European VSD market evolves prices tend to decrease, mainly in the lower power ranges, increasing the number of VSDs installed.

2.4 Motor and VSD Prices

Motor prices present a very large variation according to technology used and size. They can vary from a few euros for a very small DC motor to millions for a custom made large synchronous motor.

The next tables present the unit value (value/volume) and the ratio of this unit value to the median unit value. The median is calculated from the available unit values for all countries over the last two years. Although these values are of limited usefulness they give a rough indication of the average product price according to power range.

Table 2-13 Prodcom DC Motor Prices in Euros (2010)

Power range	Median (€)	Unit value (€)	ratio
≤ 750 W	28,79	13,75	2,09
> 0,75 kW but ≤ 7,5 kW	258,19	83,33	3,10
> 7,5 kW but ≤ 37 kW	2785,88	200,00	13,93
> 37 kW but ≤ 75 kW	14740,15	3298,40	4,47
> 75 kW but ≤ 375 kW	29949,07	44542,65	1,49

Table 2-14 Prodcom AC Single-Phase Motor Prices (2010)

Power range	Median (€)	Unit value (€)	ratio
≤ 750 W	31,47	20,37	1,55
> 750 W	91,06	26,98	3,38

Table 2-15 Prodcom Universal Motor Prices (2010)

Power range	Median (€)	Unit value (€)	ratio
> 37,5 W	26,17	24,79	1,06

Table 2-16 Prodcom AC Multi-Phase Motor Prices (2010)

Power range	Median (€)	Unit value (€)	ratio
≤ 750 W	89,43	68,82	1,30
> 0.75 kW but ≤ 7.5 kW	177,82	222,70	1,25
> 7.5 kW but ≤ 37 kW	834,77	521,73	1,60
> 37 kW but ≤ 75 kW	1896,66	1474,01	1,29
> 75 kW but ≤ 375 kW	7717,18	4611,22	1,67
> 375 kW but ≤ 750 kW	28367,41	17573,67	1,61
> 750 kW	78718,09	106001,50	1,35

The Prodcom VSD prices are presented in Table 2-17

Table 2-17 Prodcom VSD Prices (2010)

Power handling capacity	Median (€)	Unit value (€)	ratio
≤ 7.5 kVA	463,86	411,15	1,13
> 7.5 kVA	3207,71	1585,02	2,02

As there are large uncertainties present in ProdCom data, CEMEP provided average prices and installation costs for motors under consideration in the study, which are presented in Table 2-18.

Table 2-18 Motor Average Prices (2012)
Source: CEMEP

Description	Power range (kW)	Unit Price (€)	Installation Costs (€)
AC Single-Phase Motor (IE1)	0.12 -0.75	60	
AC Multi-Phase Motor (IE1)	0.12 – 0.75	80	
AC Multi-Phase Motor (IE2)	0.75 - 2.1	150	
	7.5 – 45	600	
	76 - 110	6 000	
	(LV) 375 - 1000	25 000	1 000
	(MV) 375 - 1000	40 000	3 000

In the medium power range motor prices can vary from around 150 € for an AC three-phase IE2 motor to around 50000 € for a 1000 kW MV motor. In general, the market is very competitive with large discounts (over 40%) offered to OEMs, although there are lesser pressures at higher power ratings as the degree of competition is not considered as fierce.

CEMEP and CAPIEL provided average prices and installation costs for VSDs, soft-starters and electro-mechanical starters, which are presented in

Table 2-19. The installation costs can vary depending on several factors, including wiring, filters, environment, location and conditions of the application. The installation costs are estimated as a percentage of the unit price, which is a general estimate, accepting that there will be large variations in either side of these ranges.

Table 2-19 Average prices for VSDs, soft-starters and electro-mechanical starters (2012)
Source: CEMEP and CAPIEL

Description	Power (kW)	Unit Price (€)	Installation Costs (€)
VSD	0.12 – 0.75	200	50-300%
	0.75 – 2.1	280	50-250%
	7.5 - 45	1 130	50-200%
	76 - 110	5 320	50-175%
	375 - 1000	41 790	50-150%
Soft Starter	1,1	60	30
	11	100	70
	110	800	100
Contactors	1,1	12	20
	11	30	30
	110	140	40

2.5 Electricity Prices

Electricity prices vary significantly in the EU, and even in each country the prices are strongly influenced by the consumption level.

The electricity prices for industry in the EU-27, for the first semester of 2011, are shown in the next table [9].

Table 2-20 Electricity prices for the EU-27 countries (€/kWh), 1st semester 2011
Industrial Sector 500 MWh < Consumption < 2 000 MWh

European Union average (27 countries)	0.0935
Euro area average (EA11-2000, EA12-2006, EA13-2007, EA15-2008, EA16-2010, EA17)	0.0940
Belgium	0.1014
Bulgaria	0.0657
Czech Republic	0.1071
Denmark	0.0810
Germany (including former GDR from 1991)	0.0899
Estonia	0.0649
Ireland	0.1260
Greece	0.0982
Spain	0.1100
France	0.0667
Italy	0.1212
Cyprus	0.2041
Latvia	0.1101
Lithuania	0.1034
Luxembourg	0.0957
Hungary	0.0934
Malta	0.1800
Netherlands	0.0829
Austria	:
Poland	0.0895
Portugal	0.0895
Romania	0.0803
Slovenia	0.0889
Slovakia	0.1218
Finland	0.0680
Sweden	0.0823
United Kingdom	0.0998
Norway	0.0764
Croatia	0.0886
Turkey	0.0730
Bosnia and Herzegovina	0.0644

2.6 Repair and Maintenance Costs

Small motors are normally not repaired and are replaced upon failure.

Medium power induction motors above 11 kW are normally repaired at least 2 times during its lifetime but this can occur up to 4 times.

Figure 2-12 allows the comparison between repair prices and new motor prices by power. It shows that for smaller motors the repair price exceeds the new motor price.

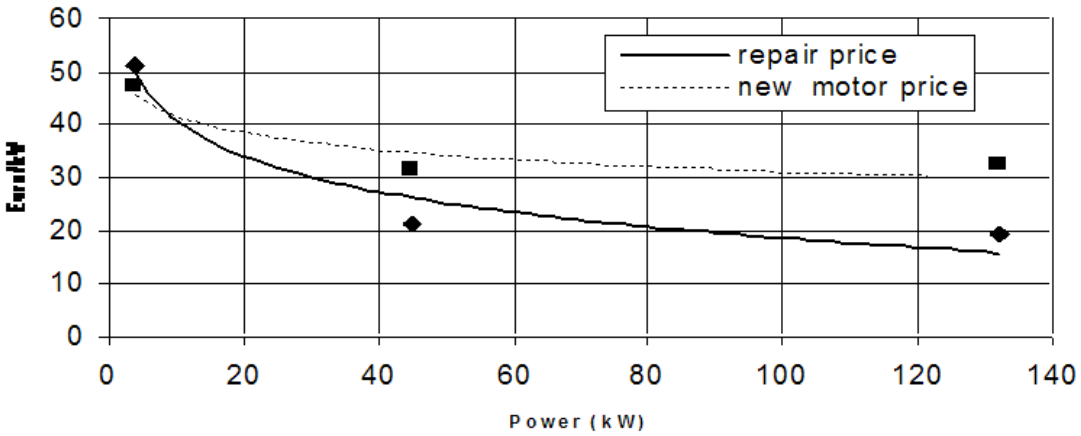

Figure 2-12 Comparison between repair prices and new motor prices [10]

2.7 Summary

In 2010 over 250 million motors were sold in Europe, 91 % of which were in the small power range, under 750 W. The share of large motors is very small (only 0,01%). The remaining 9% of motors sold are in the medium power range, where most of the consumption is concentrated.

In the small power range (< 750 W), DC motors account for 56% of the number of units sold but more than 37% of this motors are used in automotive applications which are out of the outside the scope of this study.

The decreasing price of electronic controllers is expected to lead to the further decline in AC single-phase motor sales, and the increase in AC multi-phase motors and in DC brushless motors.

In the medium power range (0,750 to 375 kW), AC multi-phase motors are responsible for 50% of sold units (72% in value). The conventional Brushed DC motor market in this power range is expected to continue to decline as this technology is being replaced by three-phase induction motors. Very high efficient technologies (e.g. PM motors, LSPM motors), which until recently were considered customized products, are becoming available in the market in standard dimensions, as commodity products.

Because of the recently introduced energy efficiency regulation on three-phase electric motors, the market share of motors in the IE2 and IE3 efficiency levels will increase substantially in the upcoming years.

The number of VSD units sold with power handling capabilities below 7,5 kVA has risen considerably in the last decade driven by developments in power electronics and by a decrease in prices. The market for VSDs sold integrated into small pumps and fans, particularly in HVAC high-efficiency applications, has also been increasing significantly.

2.8 References

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