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COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, XXX

Draft

Explanatory Memorandum accompanying
COMMISSION REGULATION (EC) No .../...
of [...]

implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for electric motors and their drives

EXPLANATORY MEMORANDUM

1. CONTEXT OF THE PROPOSAL

Grounds for and objectives of the proposal

The Ecodesign Framework Directive 2005/32/EC establishes a framework for the setting of ecodesign requirements for energy-using products. It is a key instrument of Community policy for improving the energy and other environmental performances of products in the Internal Market. The Directive lists products identified by the Council and the European Parliament as priorities for the Commission for implementation, including appliances in electric motor systems (Article 16). Motors and drives¹ are an important part of the efficiency of these systems. Consequently, motors and drives used in motor systems are one of the priority product groups considered for implementing measures under the Ecodesign Directive.

The type of induction motors covered by this implementing measure are the most widely used motors using over 90% of the electricity consumed by all motors in this power range. Equipping these motors with drives in variable speed and load applications strongly increases the efficiency of the motor. However, most motors used in Europe are still low efficiency motors and they are often not equipped with appropriate drives in variable speed/load applications. This regulation aims at correcting this market failure.

A technical, environmental and economical analysis ('preparatory study') has shown that (i) motors are placed in large quantities on the internal market, (ii) the environmental impact related to the life cycle, energy consumption and electricity consumption of these appliances is significant, (iii) there is a wide disparity in the environmental impacts of the appliances currently on the market, and (iv) technical cost-effective solutions exist that could lead to significant improvements, including the use of drives in variable speed part load conditions. Under Article 15 of Directive 2005/32/EC, motors and drives should therefore be covered by an ecodesign implementing measure.

General context

As concluded by the preparatory study, the central aspect for improving the environmental performance of motors is life cycle energy consumption. The environmental analysis showed that the use-phase completely dominates over the other life cycle phases in regard to life-cycle impact of electric motors. The preparatory study backed by stakeholders assumes that some 5% of the materials go to landfill, 90% of the plastics are incinerated and 10% are recycled and that 95% of the metals and glass is recycled. Motors are responsible for 70% of the total electricity consumption in the industrial sector and 38 % in the tertiary sector. Impacts from production and distribution are minor compared to use-phase impact. The use-phase electricity consumption of motors can be significantly reduced in a cost-effective way.

Motors are largely an OEM² market. OEM manufacturers tend to base their purchases on motor cost, since they will not pay the motor operating costs. This is also a major reason for

¹ Drives, such as Variable Speed Drives, are used to regulate the speed of a motor.

² An original equipment manufacturer (OEM) is typically a company that uses a part or a component made by a second company in its own product, or sells the product of the second company under its own brand.

the modest use of drives, as they add to the purchase cost of the motor. Little incentive exists for the manufacturers of these appliances to supply energy-efficient products to the user, because motors, in particular if equipped with drives with advanced environmental performance, cost more to purchase. Even if the additional purchase cost brings the life cycle cost down and despite the very short pay back period which can be counted in a few years, the increase in purchase price can nevertheless be important for price-sensitive markets. This is true for motors in particular, as the purchase cost of the motor is often allotted to a different budget than the running costs of the motor. Cost-effective improvement potentials for the end-user are therefore often not realised. The market failure becomes understandable when it is presented in figures. The purchase price of a medium-sized motor goes up from about €500 for a low efficiency motor to about €1500 for a high efficiency motor, which can become a major obstacle to short-sighted end-users. However, in the light of the running cost of the motor, the pay back period can be counted in a few months or years, depending on motor size. For example in the case of the above type of motors, the life-cycle cost is about €80.000 for the low efficiency motor but €10.000 less for the high efficiency motor.

Information from drive and motor manufacturers indicate that there may be substantial efficiency variation between drives on the market but no such information is yet available with sufficient reliability for the purposes of setting minimum requirements on drives. However, there is ample knowledge on the positive environmental potential of the combined motor and drive product in variable speed and load applications, as shown in the preparatory study.

To clarify the potential of environmental performance of drives, a preparatory study will be launched in order to be able to consider possible ecodesign requirements on drives or on drives and motors combined. For the purposes of this Regulation, manufacturers should provide adequate documentation on the essential elements of IE2 motors equipped with variable speed drives, such as on good engineering practices and on any specific precautions that must be taken when they are assembled, installed, maintained or used, including information on how to minimise electrical and magnetic fields from variable speed drives. The objective of the proposed Regulation is to trigger the market transformation needed to realise the improvement potential. Compared to a business-as-usual scenario it is estimated that the proposed Regulation will lead to annual use-phase electricity consumption savings (EU-27) of about 135 TWh by 2020, corresponding to an annual reduction of 63 Mt of CO₂ emissions and savings of € 9 billion. These savings of some 12 Mtoes correspond to the entire annual electricity consumption of Sweden in 2005.

The main reasons for the high savings are the combined impact of a high efficient motor and a drive, which can significantly reduce the energy consumption of a motor in variable speed part load applications representing some two-thirds of all motor applications. For example, reducing the speed of a fan motor from 100% to 50% leads to power consumption drop from 100% to 12,5%³. In other words, when full ventilation is not necessary, it is better to reduce the speed of the motor rather than running the motor in full speed and throttle the air tubes to avoid excessive ventilation.

Additional savings are expected from the fact that the difference in purchase price between a standard efficiency motor (IE2⁴) with a drive and a premium efficiency motor (IE4)

³ Affinity Law.

⁴ IEC 60034-30 standard defines four efficiency classes: low (IE1), standard (IE2), high (IE3) and premium efficiency (IE4). The IE4 efficiency level, for which no numerical values has yet been

technology will strongly decrease. Both of these options lead to major power consumption reduction in variable speed and load applications. In this way, the regulation also acts as an incentive for manufacturers to invest on the development and mass production of premium efficiency motors, which would lead to further savings.

Apart from the savings achieved in the EU, savings are expected in other parts of the world, as the motor market is global in nature and major economies are closely monitoring the development of motor legislation in other jurisdictions, e.g. during the last ten years, the US minimum requirements on motors have triggered the development of similar requirements in several other countries. The proposed Regulation on motors and drives can be expected to lead to many-folded savings world-wide compared to minimum requirements on motors alone.

Some 80% of the motors covered by this Regulation are traded between European countries. The rest is imports from outside Europe. Although the different frequencies used in different parts of the world (e.g. 50 Hz in Europe and in most part of Asia vs. 60 Hz in the US) can be seen as a limitation in the world-wide motor market, industry consolidation has led to a progressive trend towards fewer but larger companies and plants operating globally with production in both frequencies.

The types of induction motors and drives covered by the measure are products/parts applied in a wide range of end-products, some of which are also planned to be regulated under the Ecodesign Directive. In this sense, although the planned measure is a product specific ecodesign implementing measure, it can be considered as having a 'horizontal' aspect. Product, such as pumps, that include a motor covered by this implementing measure, must comply with the measure for affixing the CE mark. If there would be product specific implementing measures on any of the products containing a motor, those products would have to comply with both measures, with the motor and the product specific measure, in the same way as these products must comply with any other relevant EU legislation, such as the Low Voltage Directive, for example. An estimated overlap of around 30% between the motor measure and the forthcoming measures on other energy-using product groups is assumed as a preliminary estimate in terms of energy consumption and energy saving potential. The precise impact will be known when the studies on other product groups have been finalised.

Consistency with other policies and objectives of the Union

Directive 2005/32/EC is an important instrument for achieving the objective of 20% energy savings compared with projections for 2020, and its implementation is one of the priorities in the Commission's Energy Efficiency Action Plan. Furthermore, implementation of the Directive 2005/32/EC will contribute to the EU's target of reducing greenhouse gases by at least 20% by 2020, or 30% if there is an international agreement that commits other developed countries to comparable emissions reductions. The proposed Regulation is a concrete contribution to this process and is in line with the Commission Action Plan on Sustainable Consumption and Production and Sustainable Industrial Policy.

identified in the standard, refers to premium efficiency with new motor technology, such as permanent magnet motor technology, which is already available in the market in some motor sizes but not yet mass produced in the power range considered.

2. CONSULTATION OF INTERESTED PARTIES AND IMPACT ASSESSMENT

• Consultation of interested parties

Consultation methods, main sectors targeted and general profile of respondents

Stakeholders were consulted as part of the preparatory study (see below for details) as well as within the Ecodesign Consultation Forum.

An Ecodesign Consultation Forum meeting (established under Article 18 of Directive 2005/32/EC) was held on motors on 27 May 2008. Building on the results of the preparatory study, Commission services presented a Commission Staff Working Document (CSWD) suggesting ecodesign requirements for motors. The documents were sent to the members of the Consultation Forum, and to the secretariats of the ENVI (Environment, Public Health and Food Safety) and ITRE (Industry, Research and Energy) Committees of the European Parliament for information. The working documents were published on DG TREN's ecodesign website and placed on the Commission's CIRCA portal alongside the stakeholder comments received in writing before and after the meeting.

The initiative was also discussed at meetings of Commission staff with stakeholders, and with international partners on many occasions, in particular in the Industrial Electric Motor Systems Efficiency Workshop by IEA in Paris on May 2006, International Harmonization Initiative for Energy Efficient Motor Systems (SEEEM) in London on June 2006, Fifth International conference on Energy Efficiency in Motor Driven Systems (EEMODS) in Beijing on May 2007 and in the International Motor Summits in Zurich on April 2007 and in November 2008.

The draft measure will be notified to the WTO/TBT before formal adoption to ensure that no barrier to trade is introduced.

Summary of responses and how they have been taken into account

The positions of the main stakeholders, as expressed before, during and after the Consultation Forum meeting on 27 May 2008 in reaction to the CSWD, can be summarised as follows.

Member States supported ecodesign legislation on motors as defined in the working document and found it unacceptable that there are no minimum requirements in Europe, while these exist in all major economies⁵. The countries having lower minimum requirements will be the markets in which the low-efficient products are sold. Together with environmental NGOs, several Member States requested tougher minimum requirements than proposed by the Commission services, including the inclusion of power range 0.75 – 7,5 kW, as the IE3 efficiency levels have recently been lowered in the revised IEC 60034-30 standard. While the suggested introduction of staged levels was approved in general, they were requested to be introduced faster. All stakeholders requested that drives be covered by the Regulation, if possible.

Industry associations largely supported the general approach to set mandatory requirements under the Ecodesign Directive but requested lower minimum requirements than proposed in the second step requirement and required the inclusion of drives into the measure.

⁵ For example, IE2 requirements exist in China (2007), Brazil (2009), New Zealand and Australia (2006), Mexico (1998), Canada (2001), the US (1997). IE3 requirements will be in force in the US on 2011.

Environmental NGOs welcomed the requirements but found them too low in ambition and requested faster introductory dates, including the inclusion of drives.

- **Collection and use of expertise**

Scientific/expertise domains concerned

External expertise was mainly gathered through the preparatory study providing a technical, environmental and economic analysis, which was carried out by a consortium of external consultants on behalf of the Commission's Directorate General for Energy and Transport (DG TREN). Additionally, a scenario analysis of various policy options was developed for the Impact Assessment by an external consultant. Furthermore, CEMEP and individual motor and drive manufacturers provided data and expertise.

Methodology used

The methodology followed the provisions of the Directive, in particular its Article 15 and Annexes I and II. The technical, environmental and economic analysis followed the structure of the 'Methodology Study Eco-design of Energy-using Products' developed for the Commission's Directorate General for Enterprise and Industry (DG ENTR) and endorsed by stakeholders.

Main organisations/experts consulted

The preparatory study was conducted in an open process, taking into account input from relevant stakeholders including manufacturers and their associations, environmental NGOs, consumer organisations, EU/EEA Member State experts, experts from third countries (e.g. NEMA⁶ in USA, Foundation of Taiwan Industry Services, Japan Business Council Europe (JBCE), Australian Green House Office, Swiss Federal Office of Energy) and international organisations such as the International Energy Agency (IEA).

Summary of advice received and used

The technical, market and economic analysis carried out for the preparatory study resulted in recommendations for ecodesign requirements on motors. Drives were dealt with in the preparatory study but no ecodesign requirements were suggested on drives, as there are no appropriate test standards or approved efficiency calculation methods available. These recommendations were used, in conjunction with the most recent available data from the industry for suggesting possible ecodesign requirements for motors to the Consultation Forum.

In the Consultation Forum, while approving the proposal in general, main stakeholder requests were to include the power range 0.75 – 7,5 kW for the IE3 efficiency level requirement and to include drives into the coverage of the Regulation. Major input of data and expertise was received from industry after the Consultation Forum on the feasibility of the proposed requirements and on the inclusion of the drives. Motor and drive manufacturers also provided data on the technical feasibility of achieving IE3 levels with motors across the whole power range as well as on the availability of these motors on the market.

⁶ National Electrical Manufacturer Association (NEMA).

As to the IE3 requirement, during the Impact Assessment, Commission services gathered information from individual manufactures on the availability of the IE3 motors in European framesizes in the power range 0,75 - 7,5 kW, including on manufacturers' investment plans and related costs for manufacturers. The inquiry showed that several, although a minority of manufacturers are already producing and planning the production of these motors for the coming years. It was stated that a minimum requirement at IE3 level would further encourage the industry to make these investments. However, for the majority of motor manufacturers the continuation of the standard efficiency IE2 motor production was essential for their survival; a minimum request at IE3 level alone would strongly benefit a minority of motor manufacturers but would seriously damage the operation of the majority of smaller motor manufacturers, in particular in the production of IE3 motors below 7,5 kW, which is technically particularly demanding.

As to the inclusion of the drives into the Regulation, being aware of the technical impossibility of setting ecodesign requirements on drives, on the one hand, and the widely known beneficial impact of drives on the power consumption of motors in variable speed applications, on the second hand (as identified in the preparatory study), the Commission services together with stakeholders developed an approach in setting a requirement to equip standard efficiency motors (IE2) with drives, but in setting minimum efficiency requirements on motors alone. This approach is beneficial for both manufacturers producing standard efficiency motors (IE2) and for those producing high efficiency motors (IE3). It also guarantees the manufacturers the freedom to optimise the efficiency and functioning of the motor and drive combination based on their expertise. First of all, this option leads to far bigger savings than an IE3 requirement alone.

The existence of potentially serious risks with irreversible consequences has not been mentioned by any stakeholder nor were any identified during the preparatory work.

Means used to make the expert advice publicly available

The preparatory study was accompanied by a dedicated website where interim results and further relevant materials were published regularly for timely stakeholder consultation and input. Written inputs from stakeholders are listed in the final report of the preparatory study. The study website was publicised on DG TREN and DG ENTR specific ecodesign websites. An open consultation meeting for directly affected stakeholders was organised at the Commission in Brussels for discussing the preliminary results of the study.

The written input received during the Consultation Forum process is available on the Commission's CIRCA portal. The minutes of the Forum meeting on motors are available on the DG TREN website.

• **Impact assessment**

The outcome of the impact assessment can be summarised as follows.

Several policy options have been considered.

Option 1: No EU action

This option implies that a major part of the improvement potential would not be realised, because the barriers for realizing the potentials to improve the environmental performance of motors and their drives would persist. Furthermore, Member States would most likely want to

take individual, non-harmonised action. This would hamper the functioning of the internal market and lead to high administrative burdens and costs for manufacturers, contrary to the goals of the Ecodesign Directive. In addition, the mandate from the legislator would not be respected.

Option 2: Self-regulation

No initiative for self-regulation on motors and their drives under Annex VIII of the Ecodesign Directive has been brought forward.

Option 3: Energy labelling targeting specifically motors and their drives

In principle, it could be possible to label motors and their drives within the revised Energy Labelling Directive 92/75/EEC. However, due to the nature of the markets for these appliances with most motors being sold in the OEM market, such labelling would not be appropriate. It would also be impossible to identify seven efficiency classes to be labelled due to low efficiency differences between motors available on the market, with or without the implementation of the minimum energy efficiency requirements.

Option 4: Ecodesign implementing regulation on motors alone or on motor and their drives

This option aims at improving the environmental impact of motors by setting maximum levels for energy consumption.

Following the principle of proportionality in conducting the analysis, Options 1-3 were assessed qualitatively and discarded for the detailed analysis, and the impact assessment focussed on Option 4. In accordance with Article 15(4) and 15(5) of Directive 2005/32/EC, the impact on the environment, consumers and manufacturers was assessed in several sub-options for setting ecodesign requirements for power consumption levels, including the timing for entry into force.

Conclusion

It has been concluded that ecodesign requirements for motors and their drives should come into force as follows:

- From 16 June 2011, minimum energy consumption requirement at IE2 level for a motor alone for all motors covered and;
- From 1 January 2015, minimum energy consumption requirement at IE3 level for $\geq 7,5$ - 375 kW motors alone, together with a requirement at IE2 level for $\geq 7,5$ - 375 kW motors to be equipped with an appropriate drive;
- From 1 January 2017, minimum energy consumption requirement at IE3 level for $\geq 0,75$ - 375 kW motors alone, together with a requirement at IE2 level for $\geq 0,75$ - 375 kW motors to be equipped with an appropriate drive

This would provide the appropriate balance between an improved environmental impact of these appliances and cost benefits for the user/consumer (due to reduced electricity consumption), on the one hand, and possible additional burdens for manufacturers (in particular due to unplanned re-design) on the other hand. In particular:

1. a clear legal framework which leaves flexibility to achieve the high efficiency IE3 motors' efficiency levels of stages 2 and 3 for motors already earlier (before stages 2 and 3 come into effect);
2. no significant impacts on the competitiveness of industry, and in particular SMEs, due to the costs on product re-design and re-assessment of conformity that are spread over 7 years with higher efficiency requirements imposed only in a second and third stages;
3. no significant impacts on the competitiveness of industry, and in particular SMEs, due to the fact that the sales of standard efficiency IE2 motors can still continue after the second and third requirements provided that the motor is equipped with an appropriate drive;
4. significant incentive for manufacturers willing to invest and produce premium efficiency (IE4) motors due to the reduced price difference between an IE2 motor with a drive and a premium efficiency motor;
5. positive impact on employment in the EU, and no impact on employment in third countries producing motors;
6. considerable reduction of life cycle environmental impact of motors related to both the total energy consumption and the use-phase electricity consumption;
7. removing of barriers for market take up of high-efficient motors and ensure proper functioning of the internal market;
8. no significant administrative burdens for manufacturers or retailers;
9. increase in purchasing cost, which is to be fully compensated by savings during the use-phase of the product with pay back period counted in a few months or years, including the foreseen impact of economies of scale to reduce the purchase price of premium efficiency technologies;
10. increased sales of drives with positive impact on business with associated strongly increased savings in electricity cost and environmental pollution

3. LEGAL ELEMENTS OF THE PROPOSAL

• Summary of the proposed action

1. Definition of the motors and their drives

The scope of the product categories is addressed by the proposed ecodesign regulation on electric motors and their drives. Motors cover electric single speed three-phase induction motors with a power range of 0,75 kW to 375 kW. Drives cover equipment that is continuously adapting the electric power according to the motor load in controlling the rotational speed of an alternating current electric motor by changing the three-phase 50 Hz grid power supply to an variable frequency and voltage supplied to the motor. These definitions are in line with the preparatory study and relevant European harmonised standards and legislation as well as with industry practice.

The definition of drives is based on an agreement with European drives manufacturers recognising that the daily technical terminology often refers to words such as ASD (Adjustable Speed Drive), VSD (Variable Speed Drives) and VFD (Variable Frequency Drive), which basically all means the same in regard to CO2 reduction. The concept 'VSD' is used in this legislation, as it normally refers to drives used with induction motors to alter the frequency and the voltage of the motor.

The preparatory study initially focused on motors in the power range of 0,75-200 kW. However, due to two main recent developments the preparatory study together with stakeholders proposed a broader power range of 0,75- 375 kW for the Regulation. First, this power range is in line with the IEC60034-30 Standard on Rotating Electrical Machines, which provides a framework for motor manufacturers across the world. Second, minimum efficiency requirements are becoming commonplace in world's major economies with coverage similar to this Regulation (e.g. in the USA up to 370 kW and in China up to 315 kW), while there is no such legislation yet in the EU.

Currently no harmonised efficiency test standards or efficiency classification methods exist on drives. International and European standardisation initiatives are underway, including the standardisation of motors and drives together. Also, the European Commission has issued a mandate for the development of test standards and efficiency classification for drives to the European Standardisation Organisations. The mandate also includes the development of test standards for motors designed solely for converter operations, including the definition of IE4 efficiency levels. The Working Group 28 under the Technical Committee 2 of the IEC 60034-2-3 on Rotating Electrical Machines is developing a harmonised standard to determine losses in converter-fed AC machines.

For these reasons, this Regulation does not set minimum requirements on drives. Given the fast evolving drives technology an important benefit from the approach of setting ecodesign requirements on motors and drives based on the motor efficiency alone is that it ensure that manufactures are able to fully exercise their expertise in optimising the motor and drive efficiency while benefiting from the level playing field created by a clear regulatory framework on motors and drives. Also, all energy-using products integrating motors and their drives will have to comply with this regulation.

Benchmark on motors is set at IE3 level, as the efficiency values for the higher IE4 level correspond to a different technology, such as permanent magnet motor technology. Also, efficiency values for IE4 level have not yet been established. After the second and third stages, the IE3 benchmark will apply in particular to motors to which VSDs are attached.

2. Staged implementation of ecodesign requirements

- Energy Efficiency levels

Minimum requirements for maximum allowable energy efficiency levels for electric motors are proposed, to come into force in three stages as follows:

- (1) from 16 June 2011, motors shall meet or exceed the IE2 efficiency level;
- (2) from 1 January 2015:
 - (i) motors of 7,5 – 375 kW shall meet or exceed the IE3 efficiency level;

- (ii) motors that do not meet the IE3 efficiency level but meet the IE2 efficiency level, shall be equipped with a variable speed drive.
- (3) from 1 January 2017:
- (i) motors of 0,75 – 375 kW shall meet or exceed the IE3 efficiency level;
 - (ii) motors that do not meet the IE3 efficiency level but meet the IE2 efficiency level, shall be equipped with a variable speed drive.

These requirements respect the strong stakeholder request to include drives into the Regulation due to their important energy saving impact. However, the impact assessment showed that the majority of individual motor manufacturers have considerable difficulties in adapting to the second and third requirements at IE3 level. This is why up to seven years is given for these manufacturers to adapt to the third step of requirement, recognising however that several manufactures would have preferred an earlier introduction of these requirements. Simultaneously, manufacturers will be able to continue putting on the market IE2 motors when equipped with appropriate drives while the forerunners can put high efficiency IE3 motors on the market already before the introduction of the second and third requirements. Furthermore, the strongly decreased price difference between IE2 motors equipped with a drive and premium efficiency IE4 motors will provide an incentive to invest on new motor technologies, such as permanent magnet motors.

These requirements aim at realising the use-phase energy consumption improvement potential, while fulfilling the criteria for ecodesign implementing measures set out in the Ecodesign Directive. The preparatory study and analysis of the most recent data have shown that these levels can be achieved with current state-of-the-art technology.

The (1) first requirement on 2011 on standard IE2 motors corresponds to the proposed first requirement in the CSWD discussed in the Consultation Forum on 27 May 2008 and to the minimum requirements already in place in many countries such as US, Canada, Australia, Mexico, China etc. In 2006, IE2 motor sales represented 3% of total motor sales in the EU, 85% being low efficiency (IE1) motors and 12% below this efficiency. For example in the US, standard efficiency IE2 motors represent 54% of the total motor sales. Low efficiency IE1 motors can not be sold in the US.

The (2) second requirement on 2015 is composed of two parallel requirements; on (2a) high efficiency IE3 motors alone in power range 7,5 – 375 kW and, in the same power range, on (2b) standard efficiency IE2 motors, which have to be equipped with a VSD.

The (3) third requirement on 2017 is composed of two parallel requirements; on (3a) high efficiency IE3 motors alone in power range 0,75 – 375 kW and, in the same power range, on (3b) standard efficiency IE2 motors, which have to be equipped with a VSD.

The (2a) requirement on high efficiency IE3 motors corresponds to the proposed level of second requirements in the CSWD. The level of the requirement corresponds with the minimum requirements coming into force in the US on 2011 for the whole power range, while several other countries consider following the example. As to the delayed introduction of this requirement in the EU in comparison with the US, it has to be noted that the minimum IE2 requirements have been in place in the US for a long time, which has given the industry time to adapt.

The (3a) requirement on high efficiency IE3 motors on the small power range has been added on the basis of the impact assessment, which shows that these motors are appearing on the market. Due to a larger frame size of the US motors it is easier to add more copper into the motor than in European frame sizes. Consequently, currently the IE3 motor market is basically non-existent in Europe and the standard efficiency IE2 motor sales represent only 3% of the total EU motors sales. Thus, the propose regulation foresees a strong market transformation towards high efficiency motors, which justifies the three-step introduction of requirements.

A second (2b) and a third (3b) requirement is introduced on standard efficiency IE2 motors to be equipped with an VSD, ensuring high efficiency in variable speed and load applications (e.g. by far higher than an IE3 motor alone). This will ensure that the majority of manufacturers having difficulties in reaching the IE3 level can still continue producing IE2 motors, which is an explicit request by the industry. Most importantly, this option is environmentally and economically far better in variable speed part load applications than an IE3 motor alone.

In other economies of the world, measures with the structure of this regulation do not yet exist despite of explicit requirements by manufacturers and experts to equip motors with drives in variable speed part load applications. It is expected that third countries consider following the EU example (as has happened after the setting of minimum requirements on motors by the US), which would lead to further savings.

While the first-stage requirements ensure that motors placed on the market during the time between the first and the two subsequent requirements achieve already a certain environmental performance, it also provides time for manufacturers that do not yet produce high-efficient motors to adjust their production accordingly. Of course, manufacturers also can put IE3 motors on the market and equip them with drives already from the first-stage requirement, which will be encouraged by the knowledge of the content of the second and third stage requirements. Finally, the content of these requirements must be linked with the revision of the Regulation in a consistent way. The below summary table on the content of the requirements and the revision illustrates the main application areas and types of manufacturers in question.

Summary table on requirements:

Year of introduction	Content of requirement / revision	Main optimal application area	Type of manufacturer / organisation
2012 First requirement	IE2	Full speed/load	All
Additionally can be placed on the market	IE3	Full speed/load	Technology leaders
	VSDs with IE2/IE3	Variable speed/load	All
2015 Second requirement	IE3	Full speed/load	All
	IE2+VSD	Variable speed/load	All

Additionally can be placed on the market	IE3+VSD can be sold	Variable speed/load	All
	IE4	Full and variable speed/load	Technology leaders
2017 Revision	Ecodesign requirements on motors reconsidered	Variable speed/load	Depends on content of requirements
	Ecodesign requirements on drives considered	Variable speed/load	Depends on content of requirements
Additionally	IE4 efficiency levels to be identified and relevant standards to be developed on motors not covered in this regulation, and on drives		Standardisation Organisations

3. Measurements

- Measurement method

Measurements of the relevant product parameters should be performed taking into account the generally recognised state of the art measurement methods; manufacturers may apply harmonised standards set up in accordance with Article 10 of Directive 2005/32/EC, as soon as they are made available and published for that purpose in the Official Journal of the European Union.

Verification procedure for market surveillance purposes

Member State authorities shall test a randomly selected motor.

The motor shall be considered to comply with the provisions set out in Annex I, as applicable, of this Regulation, if in the results of the motor efficiency (η), the losses ($1-\eta$) do not vary from the limit values set out in Annex I by more than 15% on power range 0,75 - 150 kW and 10% on power range 150 – 375kW.

Otherwise, the motor shall be considered not to comply.

If the manufacturer still after the failure in the first verification wants to require the CE marking on the product, it must supply three randomly selected motors of the same model to the Member State market surveillance authority in question on its own cost.

The motor shall be considered to comply with the provisions set out in Annex II, as applicable, of this Regulation, if in the average efficiency of the three motors (η), the losses ($1-\eta$) do not vary from the limit values set out in Annex I by more than 15% on power range 0,75 - 150 kW and 10% on power range 150 – 375kW.

For the purposes of checking conformity with the requirements, the authorities of the Member States shall use accurate and reliable state-of-the-art measurement methods which deliver

reproducible results, including where available, harmonised standards the reference numbers of which have been published for that purpose in the Official Journal of the European Union in accordance with Articles 9 and 10 of Directive 2005/32/EC.

4. Information to be provided by the manufacturers

In order to facilitate compliance checks, manufacturers are requested to provide information in the technical documentation referred to in Annexes IV and V of Directive 2005/32/EC on the level of the efficiency of the motor.

The benchmark for best product in terms of energy efficiency must meet or exceed the IE3 efficiency level as defined in Annex I.

5. Conformity assessment procedures

As required in Article 8 of Directive 2005/32/EC the internal design control set out in Annex IV of that Directive and the management system for assessing conformity set out in Annex V of the same Directive are specified as the applicable procedures for carrying out conformity assessment under this Regulation.

6. Based on the currently available technologies, high energy efficiency benchmarks are provided in order to ensure easy access to information on best performing products.

7. Date for evaluation and possible revision

The main issues for a possible revision of the proposed Regulation are:

- the appropriateness of the energy efficiency levels for motors and drives;
- the appropriateness of the benchmark(s);
- the appropriateness of the product scope
- other environmental aspects such as resource efficiency and end of life treatment.

The third stage is proposed to become effective seven years after entry into force of the Regulation. Taking into account the time necessary to collect, analyse and complement the data in order to properly assess the technological progress on both motors and drives, a review can be presented to the Consultation Forum seven years after entry into force of the Regulation.

• **Legal basis**

The proposed Regulation is an implementing measure pursuant to Directive 2005/32/EC, in particular its Article 15(1). The Directive is based on Article 95 of the Treaty.

• **Subsidiarity principle**

The adoption of ecodesign measure for motors by individual Member States' legislation would lead to obstacles to the free movement of goods within the Community. Such measures must therefore have the same content throughout the Community. In line with the principle of subsidiarity, it is thus appropriate for the measure in question to be adopted at Community level.

- **Proportionality principle**

In accordance with the principle of proportionality, this measure does not go beyond what is necessary in order to achieve the objective. It offers a combination of requirements which act as an enabler for the majority of manufacturers to continue standard efficiency motor production when equipped with drives and as an incentive for technology leaders to invest on both high and premium efficiency motor technology. It also leads to higher savings than any other conceivable option with minimum administrative costs.

- **Choice of instruments**

Proposed instruments: regulation.

Other means would not be adequate for the following reason(s).

The proposed form of action is a Commission Regulation (implementing Directive 2005/32/EC), because the objectives of the action can be achieved most efficiently by fully harmonised requirements throughout the EU (including the date for entry into force), thus ensuring the free movement of complying equipment. No costs arise for national administrations for transposition into national legislation.

4. BUDGETARY IMPLICATION

The proposal has no implications for the Community budget.

5. ADDITIONAL INFORMATION

- **Review/revision/sunset clause**

The proposal includes a review clause.

- **European Economic Area**

The proposed act concerns an EEA matter and should therefore extend to the European Economic Area.