



Policy options to promote energy efficient electric motors and drives in the EU



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ABSTRACT

Motors systems are a major electricity consumer (about 70% of the industrial electricity consumption and about 35% in the non-residential buildings sector). Several studies showed the very large energy saving potential deriving from motor improved efficiency.

After a period of Voluntary Agreement with a somehow limited impact, the EU introduced in 2009 Minimum Efficiency Performance Standards (MEPS) with the Commission Regulation 640/2009, which specifies requirements regarding Ecodesign of electrical motors and the use of electronic speed drives (VSD). The Regulation is based on the findings of the first Energy using Products (EuP) study on motors (Lot 11), which highlighted the importance of introducing Minimum Efficiency Performance Standards (MEPS) relating to these products in the EU.

A new Ecodesign preparatory study (European Commission - Lot 30 on special motors and drives) has since then been carried out to evaluate the possibility of extending the scope of the Regulation to motors outside the current power range and to technologies other than three-phase induction motors.

Six policy options (PO) were identified, as well as their possible implementation timelines, that will lead to the reduction of environmental impacts taking into consideration the Life Cycle Cost and the best available technologies in the market.

1. Introduction

The importance of motors as a major consumer of electricity in industry and service buildings has been recognised for a long time, and almost all the major economies have some kind of voluntary or mandatory regulatory scheme regarding motor efficiency. Most of these economies have mandatory minimum efficiency levels for motors sold in the respective countries and labelling schemes for the promotion of higher efficiency motors [1–4].

A similar route has been followed in the EU, with the introduction of Minimum Energy Performance Standards (MEPS) for electric motors through Commission Regulation 640/2009 [5] under the Ecodesign Directive (2009/125/EC) [6] in 2009. The introduction of MEPS has helped transition the market towards more energy-efficient products. However, despite the positive evolution, the scope of the existing Regulation only covers part of the electric motors placed on the market, which corresponds to around 60% of their total electricity consumption.

In order to evaluate the adequacy of extending the scope of the

regulation to motors not currently covered (e.g. in different power ranges or using different technologies) a new Ecodesign preparatory study - Lot 30: Special motors [7] - was launched in 2012. Besides electric motors, for the first time in the World electronic controllers, such as VSDs and soft-starters were also subject of the study.

The study is based on a methodology for the Ecodesign of Energy-using Products (MEEuP) [8] developed for the European Commission, which is common to all the EuP preparatory studies and identified: a) Existing relevant standards and legislation b) Market characteristics for the products under consideration; c) Relevant environmental aspects of the products and their technical/economical potential for improvement; d) Technical analysis of the Best Available Technologies (BAT) and of the Best Not Available Technologies (BNAT); e) LCC assessment; f) Scenario, policy, impact and sensitivity analysis.

These paper presents the main results of the Lot 30 study, and analyses them in light of the most recent market and technology developments.

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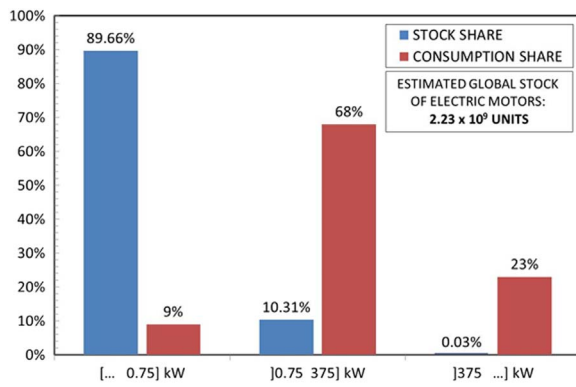


Fig. 1. Global stock and electricity consumption share for electric motors.

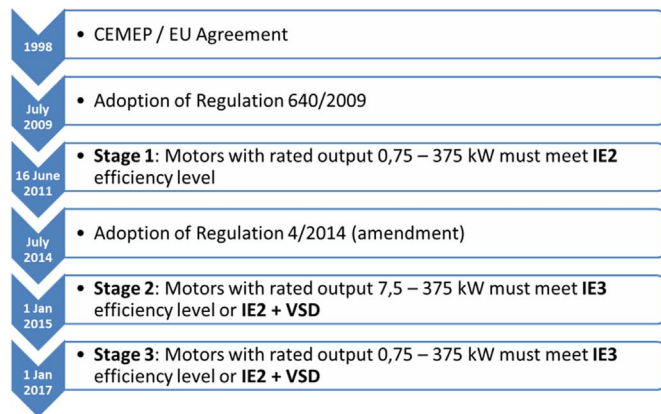


Fig. 2. Timeline of EU motor policies.

2. Background

In the EU, the recognition of motors as a major electricity consumer has led to a series of successful studies [9,10] showing the energy saving potential for these products. (Fig. 1 and 2)

Following this recognition, and with the intention of capturing the identified savings potential, a voluntary agreement supported by the European Committee of Manufacturers of Electrical Machines and Power Electronics (CEMEP) and the European Commission was established in 1998 and signed by 36 motor manufacturers, representing 80% of the European production of standard motors. The agreement defined three motor efficiency levels:

1. EFF1 (similar to IE2 in the new IEC 60034-30-1 Standard)
2. EFF2 (similar to IE1 in the new IEC 60034-30-1 Standard)
3. EFF3 (below standard)

Manufacturers agreed to reduce their joint share of EFF3-motors by 50%. Furthermore, this classification system enabled manufacturers to label motors with efficiency logos and increase efficiency awareness.

Although, the CEMEP/EU agreement was important in promoting motor efficiency classification and labeling, and essentially removing low efficiency motors from the EU motor market, which was a positive development, the penetration of high and premium efficiency motors in 2009 – the end of the agreement – was still very modest.

The 2008 Lot 11 EuP study on motors [11] highlighted the importance of introducing Minimum Efficiency Performance Standards (MEPS) relating to these products in Europe, under the Ecodesign Directive (2009/125/EC). The Ecodesign Directive is the European Union (EU) legal instrument establishing the framework which defines the rules for setting product-specific requirements /

legislation on energy efficiency and other parameters.

After the study, on July 2009, Commission Regulation 640/2009 was adopted, which specifies requirements regarding ecodesign of electrical motors and the use of electronic speed control (VSD). More recently the 640/2009 regulation was amended by Commission regulation 4/2014 [12], to avoid loopholes created by the definition of operating conditions.

Minimum efficiency requirements were set, as follows:

1. From 16 June 2011, motors shall not be less efficient than the IE2 efficiency level.
2. From 1 January 2015, motors with a rated output of 7.5–375 kW shall not be less efficient than the IE3 efficiency level, or meet the IE2 efficiency level and be equipped with a variable speed drive.
3. From 1 January 2017, all motors with a rated output of 0.75–375 kW shall not be less efficient than the IE3 efficiency level, or meet the IE2 efficiency level and be equipped with a variable speed drive.

The efficiency levels were taken from the international standard IEC 60034-30:2008 [13].

The requirements set, apply to 2-, 4- and 6-pole, single speed, three-phase, induction motors in the above mentioned power ranges, rated up to 1000 V and on the basis of continuous duty operation. The following types of motor are excluded:

- Motors designed to operate wholly immersed in a liquid;
- Motors completely integrated into a product (e.g. pump or fan) where the motor’s energy performance cannot be tested independently from the product;
- Motors specifically designed to operate:
 - At altitudes exceeding 4000 meters
 - Where ambient air temperatures exceed 60 °C;
 - In maximum operating temperatures above 400 °C;

- Where ambient air temperatures are less than – 30 °C for any motor or less than 0 °C for a motor with water cooling;
- Where the water coolant temperature at the inlet to a product is less than 0 °C or exceeds 32 °C;
- In potentially explosive atmospheres as defined in Directive 94/9/EC;
- Brake motors.

The requirements set out in the regulation also apply when these devices are integrated into other products (e.g. machines).

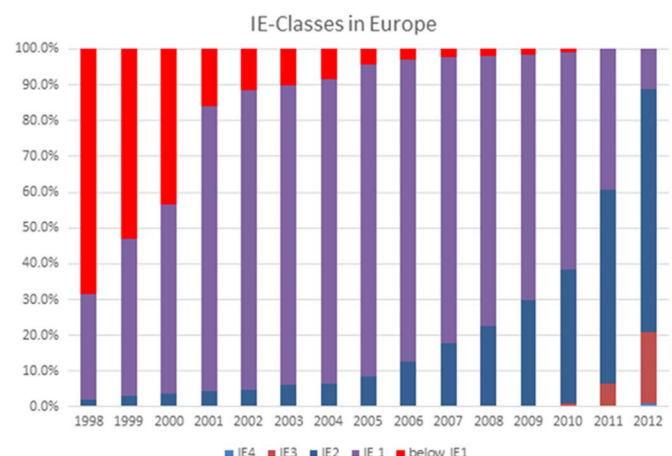


Fig. 3. Evolution of the EU motor market in terms of efficiency (0.75 kW-375 kW), in the period 1998–2012 (CEMEP).

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