4E EMSA Policy Guidelines for Motor Driven Units

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Part 1: Analysis of standards and regulations for pumps, fans and compressors

The 4E EMSA Policy Guidelines for Motor Driven Units (MDUs) investigates policy options for harmonising standards and regulations for MDUs in two parts. Part 1 describes existing standards and regulations. Part 2, to be published in 2017, will provide recommendations for advancing standards and regulations and their harmonisation. This paper gives a short summary of Part 1 of the report [1].

As shown in Figure 1 a Motor Driven Unit converts electrical power into rotational mechanical power and may consist of the following individual components: variable frequency drive, electric motor, mechanical equipment (e.g. gear, belt, clutch, brake, throttle) and a driven application (e.g. pump, fan, compressor, transport).

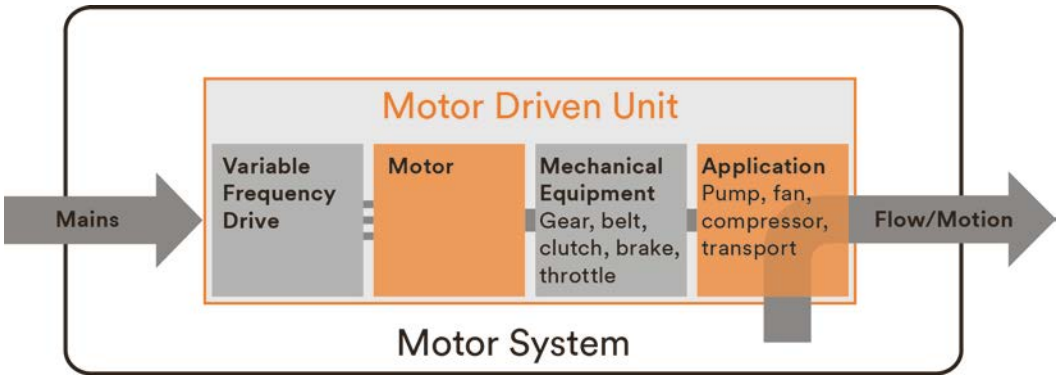

Figure 1: Motor Driven Unit definition. The orange boxes are components that are always part of a MDU

Motor systems are responsible for 47% of global electric energy consumption, or 9,370 TWh per year. Of this, energy use by pumps, fans and compressors account for 70% [2]. This study therefore focuses pumps, fans and compressors.

An optimised MDU with energy efficient individual components matched together to meet the required task and load is able to yield energy savings of 20% to 30%, estimated between 1,900 and 2,800 TWh per year globally [1].

This study covers the following main global economies, accounting for 85% of global electricity use: Australia, Brazil, Canada, China, European Union (EU28 plus Switzerland, Norway and Turkey), India, Japan, Korea, Mexico, New Zealand, Russia, Saudi Arabia, South Africa and USA.

As of 2016 (see Table 1):

- 11 of the 14 countries studied have MEPS for motors. These countries account for 76% of the global electricity use of motor systems.
- 4 countries have MEPS for pumps, covering 60% of the global electricity use of motor systems.
- 3 countries have MEPS for fans, covering 43% of the global electricity use of motor systems.
- 1 country has MEPS for compressors, covering 28% of the global electricity use of motor systems.

Region (ranked by electricity use of motor systems)	MEPS: yes / no *)				Electricity use **)
	Motors	Pumps	Fans	Compressors	
China	y	y	y	y	28.3 %
USA	y	y	(y)	(y)	15.6 %
EU28 ***)	y	y	y	(y)	15.0 %
India	n	n	n	n	5.0 %
Japan	y	n	n	n	4.4 %
Russia	n	n	n	n	4.1 %
Korea	y	n	y+	n	2.7 %
Brazil	y	n	n	n	2.5 %
Canada	y	(y)	n	n	2.3 %
Mexico	y	y	n	n	1.4 %
South Africa	n	n	n	n	1.2 %
Saudi Arabia	y	n	n	n	1.0 %
Australia	y	(y*)	(y)	n	1.0 %
New Zealand	y	n	n	n	0.2 %
Electricity use (%) ****)	76 %	60 %	43 %	28 %	**85 %**

Notes
) (y) = under development; (y) = swimming pool pumps; y+ = domestic small fans;
**) % of global electricity use of motor systems, based on total electricity consumption (IEA 2014) of each country and its 5 major sectors;
***) Including Norway, Switzerland and Turkey
****) % of global electricity use of motor systems in countries with MEPS, April 2016

Table 1: Overview of existing policies for MDUs with MEPS in main economic regions (Source: CLASP's Global S&L Database, April 2016; World Bank 2014; IEA 2014; Appendix II of the report)

Many regulations for MDU-components (like motors, pumps) build on international IEC and ISO standards to define testing methods and performance classifications. In some cases countries adopt these standards without change into national standards, in other cases countries make alterations depending on specific national circumstances. International standards for complete MDUs are not as advanced as for MDU-components and the need for further work in this area is evident.

Major findings

- **Products**: the differences in product definitions and/or categorisation of products within national MEPS regulations hinder analyses and international comparisons of coverage, metrics and efficiency levels.
- **Scope**: in all MEPS the efficiency of the target application (e.g. pump, fan) is within the scope and is required to be measured. The other components, if present and if included in the scope, are in most cases either accounted for by default values and/or calculated values. This does not lead automatically to encouragement of the most efficient MDUs.
- **Metrics** and **methodology**: efficiency may be defined by "input/output" or through "efficiency-indices" relative to a reference MDU. Calculation and test methods show some small and other larger differences, including aspects like specification of load and other parameters.
- **International comparison** of the product efficiency levels within national MEPS of MDUs per country is very difficult, due to the different product parameters used.

Although regulators typically examine existing MEPS from other regions in the preparation of new or revised regulations, there appears no structured way of co-ordinating intelligence or closer alignment between regulators on aspects like product definitions and metrics.

For pumps, fans and compressors above 5 kW, many countries find it easier to define and implement individual component regulations. To develop and implement regulations for a MDU as a system consisting of several components is much more complex, and the enforcement of such regulations is also challenging.

[1] Maarten van Werkhoven, Rita Werle, Conrad U. Brunner: 4E EMSA Policy Guidelines for Motor Driven Units - Part 1: Analysis of standards and regulations for pumps, fans and compressors, October 2016, available at: www.motorsystems.org.
[2] Paul Waide, Conrad U. Brunner et al.: Energy-Efficiency Policy Opportunities for Electric Motor-Driven Systems, International Energy Agency (IEA), Paris France, 2011. Updated global energy consumption data based on IEA statistics for 2014.