

Policy Guidelines for Motor Driven Units - pumps, fans, compressors

(draft Report Part 2)

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IEA 4E
EMSA - Electric Motor Systems Annex

EMSA Electric Motor Systems Annex



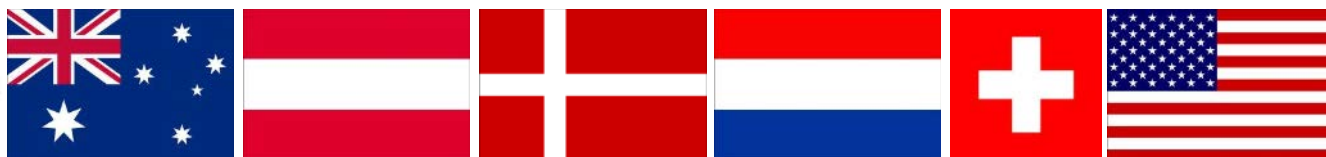
■ 4^E countries 12 (+CA, FR, KR, JP, SW, UK)

■ EMSA countries: 6

■ Time: 2009 – 2019

■ www.motorsystems.org

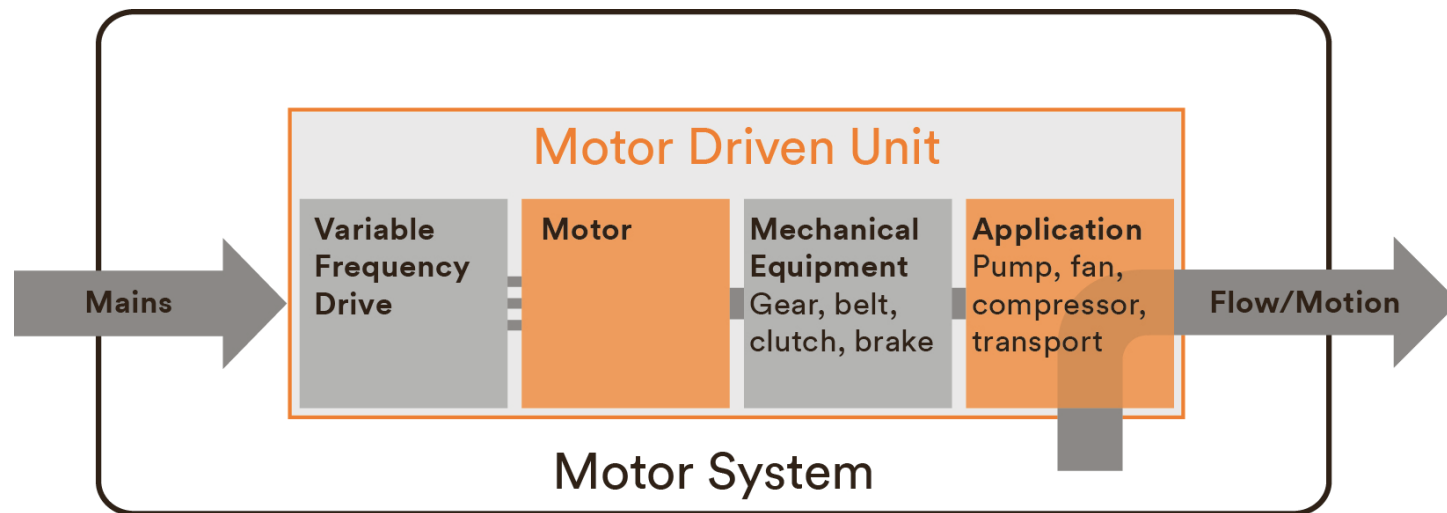
■ Goal: help governments design & implement successful EE policies



Policy Guidelines for Motor Driven Units

Pumps – Fans – Compressors

- Motor systems use 53% of global electricity demand
- ~70% of motor systems electricity consumption by pumps, fans, compressors



Part 1: Analysis of existing standards and regulations (published 2016)

Part 2: Recommendations for further aligning standards and regulations (April 2018)

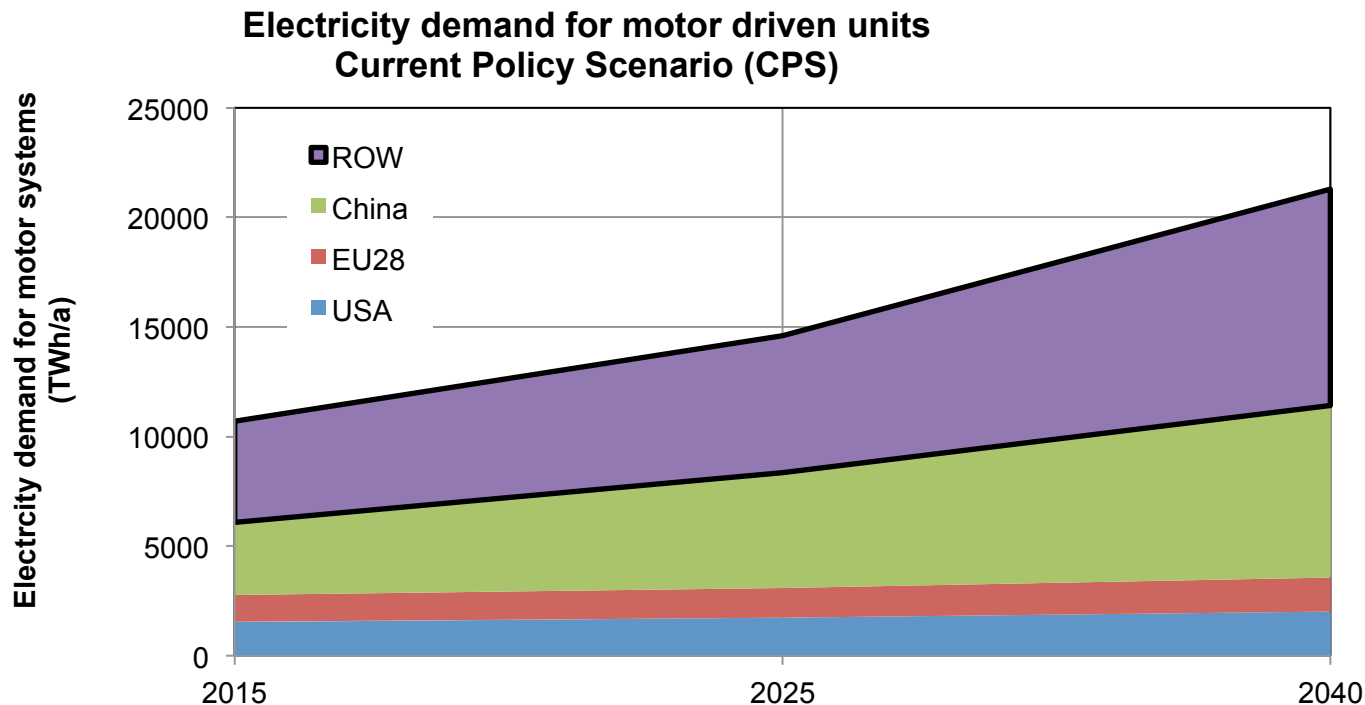
Goal

With this research 4E EMSA wants to:

- Understand the status quo and differences in standards and regulations of MDUs
- Contribute to their future alignment
- Stimulate market development towards efficient motor driven units with *well aligned* international standards and *advanced* national performance requirements.

MDU* market will grow significantly

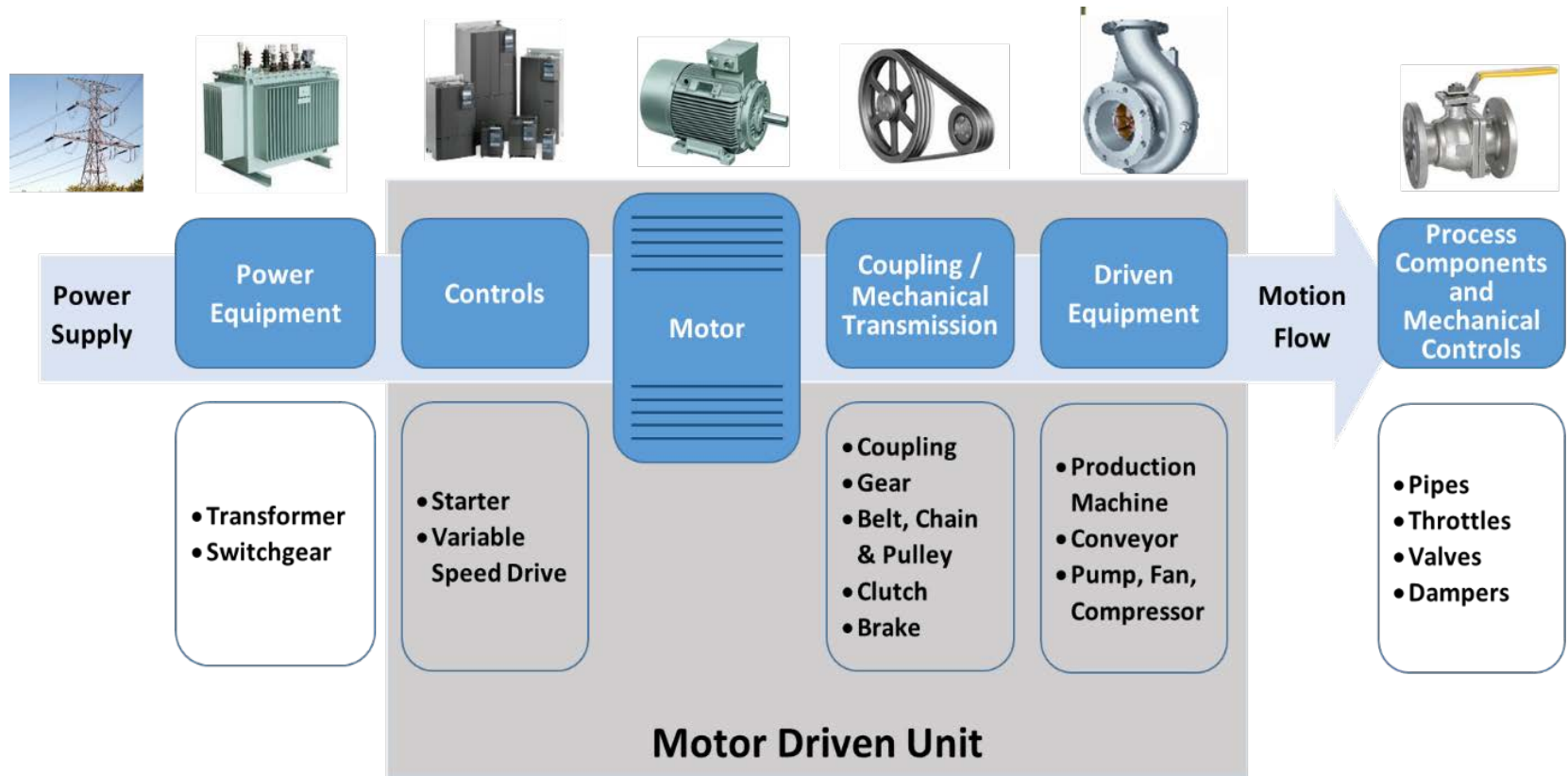
- Energy use will almost double by 2040
 - Largest contribution China & 'ROW' (rest of world)
 - Systems efficiency increases slowly



Source: IEA WEO 2016

*Motor Driven Unit

Motor System & MDU



$$\eta_{\text{system}} = \eta_{\text{power equipment}} \times \eta_{\text{controls}} \times \eta_{\text{motor}} \times \eta_{\text{transmission}} \times \eta_{\text{driven equipment}} \times \eta_{\text{components and controls}}$$

Status of MEPS* for MDU *in China, EU and USA*

Pump MDU characteristics per region (darker colour = more advanced MEPS)				
MDU	Product type	China	EU	USA
Pump	Clean water	Pump only	Pump only	MDU
	MEPS status	In effect	In effect (under revision)	Published, in effect per 2020
Fan	Industrial fans	Fan only	MDU	MDU
	MEPS status	In effect	In effect (under revision)	Under development
Com- pressor	Standard air	Compressor package	Compressor package	Compressor package
	MEPS status	In effect	Under development	Pre-published

Notes: darker colour = more advanced MEPS with a metric at MDU level. The evaluation of the status of MEPS in the different regions is based on the regulations that are currently (2017) in effect. The regulation for fans in the USA and compressors in the EU is in draft stage, therefore not marked with colour in the table.

* MEPS = Minimum Energy Performance Standards

Metrics in regulations

from application only to MDU

MDU type			Metrics in regulations in China, EU and USA			
Pump			Pump only		MDU	
	Metric	acronym	EI	MEI	PEI EEI	
		full name	Efficiency Index	Minimum Efficiency Index	Pump/Energy Efficiency Index	
	Region in use		China	EU (clean water)	USA, EU (circulators)	
	Input		Mechanical	Mechanical	Electrical	
	Output		Hydraulic (fluid)	Hydraulic (fluid)	Hydraulic (fluid)	
	Motor, VFD, transmission incl.		no	no	yes	
	Fan			Fan only		MDU
	Metric	acronym	FEG		FMEG or N	FEP FEI
		full name	Fan Efficiency Grade		Fan Motor Efficiency Grade	Fan electrical power; fan efficiency index
	Region in use		China		EU	(USA under dev.)
	Input		Mechanical		Electric	Electric
	Output		Hydraulic (gas)		Hydraulic (gas)	Hydraulic (gas)
	Motor, VFD, transmission incl.		no		calc. values, if not present	calc. values, if not present
	Compressor					Compressor package
	Metric				Compressor Efficiency Grade	Isentropic Efficiency
	Details				Specific power, iso-thermal efficiency	Actual vs. ideal isentropic compression cycle
	Region in use				China	USA pre-publ. (EU under dev.)
	Input				Electric	Electric
	Output				Flow, pressure	Isentropic
	Motor, (VFD), transmission, ancillary equipment incl.				Yes	Yes

Benefits, energy savings – *example Pumps EU MEPS*

- At least 11 times higher savings: from 3.6 TWh/a to 39–55 TWh/a
- By establishing MEPS for complete MDUs (instead of component level), differentiating between constant and variable load, extending the product coverage and increasing the stringency of MEPS levels

Pump types and regulation	Energy use		Savings at product level		Savings at MDU level	
	TWh/a	%	TWh/a	%	Minimum	Maximum
					TWh/a	TWh/a
Clean water pumps (547/2012)	179	69%	3.6	100%	35.4	47.1
Other pumps (not regulated)	79	31%	1.6	45%	3.7	7.9
Clean water	36		0.7		3.6	5.1
Other use	43		0.9		0.1	2.8
Total	258	100%	5.2	145%	39.1	55.0

Table: Electricity use and estimated savings for EU pump Motor Driven Units at product and MDU level

Current component standards

Electric Motors/VFD

► IEC

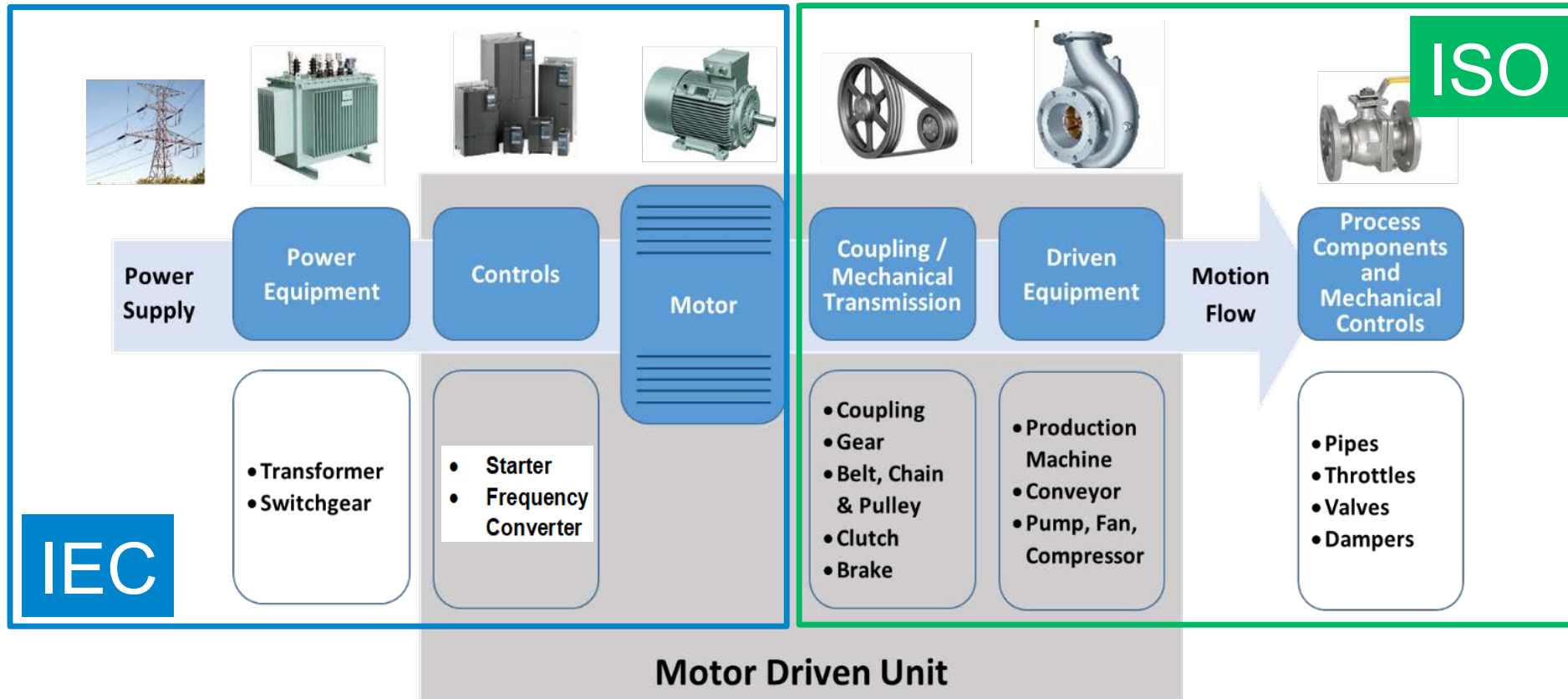
- Motors:
IEC 60034-x
- VFD:
IEC 61800-9-x

Mechanical components ►

ISO

- Pumps:
ISO 9906
- Fans:
ISO 5801/ 13349/ 12759
- Compressors:
ISO 1217 /5389/ 5390/
12942

Motor System efficiency



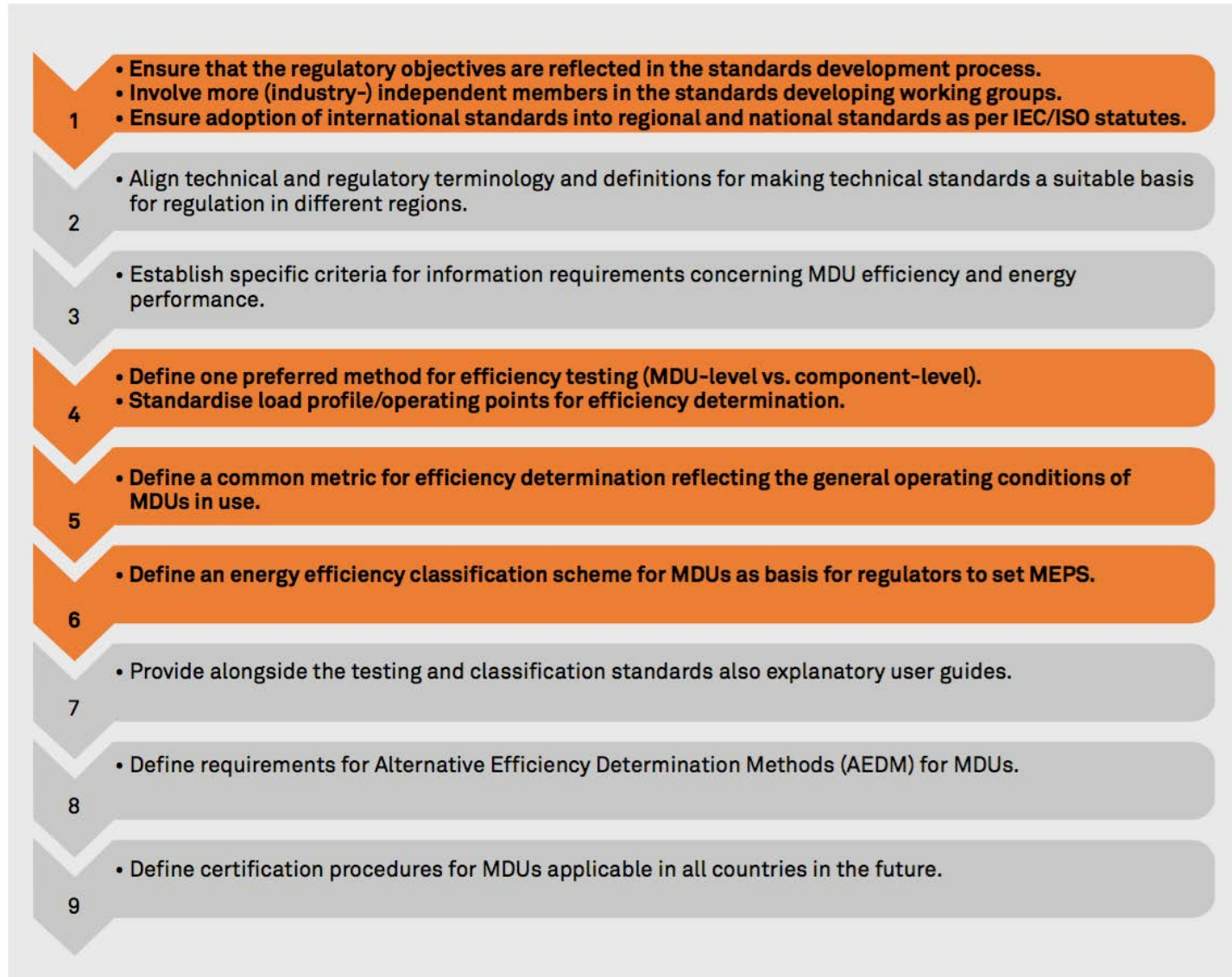
$$\eta_{\text{system}} = \eta_{\text{power equipment}} \times \eta_{\text{controls}} \times \eta_{\text{motor}} \times \eta_{\text{transmission}} \times \eta_{\text{driven equipment}} \times \eta_{\text{components and controls}}$$

MDU: coordination of standards

Motor Driven Units (MDU): Standards for efficiency testing and efficiency classification

	Converter		Motor			Pump	
			fed from converter	direct online			
	IS	TC / WG	IS	IS	TC / WG	IS	TC / WG
Test	IEC 61800-9-2	IEC TC22 SC22G WG18	IEC 60034-2-3	IEC 60034-2-1	IEC TC2 WG28	ISO 9906	ISO TC 115 SC2
Classification	IEC 61800-9-2	IEC TC22 SC22G WG18	IEC 60034-30-2	IEC 60034-30-1	IEC TC2 WG31	-	ISO TC 115 WG7
	Converter		Motor			Fan	
			fed from converter	direct online			
	IS	TC / WG	IS	IS	TC / WG	IS	TC / WG
Test	IEC 61800-9-2	IEC TC22 SC22G WG18	IEC 60034-2-3	IEC 60034-2-1	IEC TC2 WG28	ISO 5801	ISO TC 117 WG7
Classification	IEC 61800-9-2	IEC TC22 SC22G WG18	IEC 60034-30-2	IEC 60034-30-1	IEC TC2 WG31	ISO 12759, amendment 1	ISO TC 117 WG11
	Converter		Motor			Compressor	
			fed from converter	direct online			
	IS	TC / WG	IS	IS	TC / WG	IS	TC / WG
Test	IEC 61800-9-2	IEC TC22 SC22G WG18	IEC 60034-2-3	IEC 60034-2-1	IEC TC2 WG28	ISO 1217 ISO 5389:2005	ISO TC 118
Classification	IEC 61800-9-2	IEC TC22 SC22G WG18	IEC 60034-30-2	IEC 60034-30-1	IEC TC2 WG31	-	ISO TC 118

Recommendations for the process and steps of MDUs to be included in IEC/ISO standards



General recommendations for policy makers for further alignment of standards and regulations for pump, fan and compressors

General recommendations for policy makers		To be addressed at IEC/ISO level	Additional energy savings
International standards	Bring the policy perspective into the standards development process by involving more (industry-)independent members.	X	
	Align terminology and definitions used in technical standards and in regulations.	X	
Product definition	Include the main components of the MDU in the product definition, i.e. the motor, the driven application and if applicable a VFD and a transmission.		
Scope	Include in the scope the most commonly used MDUs.		
	Include other categories in the regulation as suited to regional markets.		
Test procedure	Ensure that the international test standards are adopted into local regulations without adding restrictions and/or deviations.	X	
Metric	Use one common metric for the MDU efficiency that includes all components of the MDU and is suitable for a classification scheme.	X	
Setting MEPS	Establish mandatory information requirements for manufacturers to declare the efficiency and performance parameters of the product/MDU.	X	
	Apply minimum requirements for the MDU when it is included in another product.		
	Establish MEPS tiers based on the international efficiency classification standard.	X	

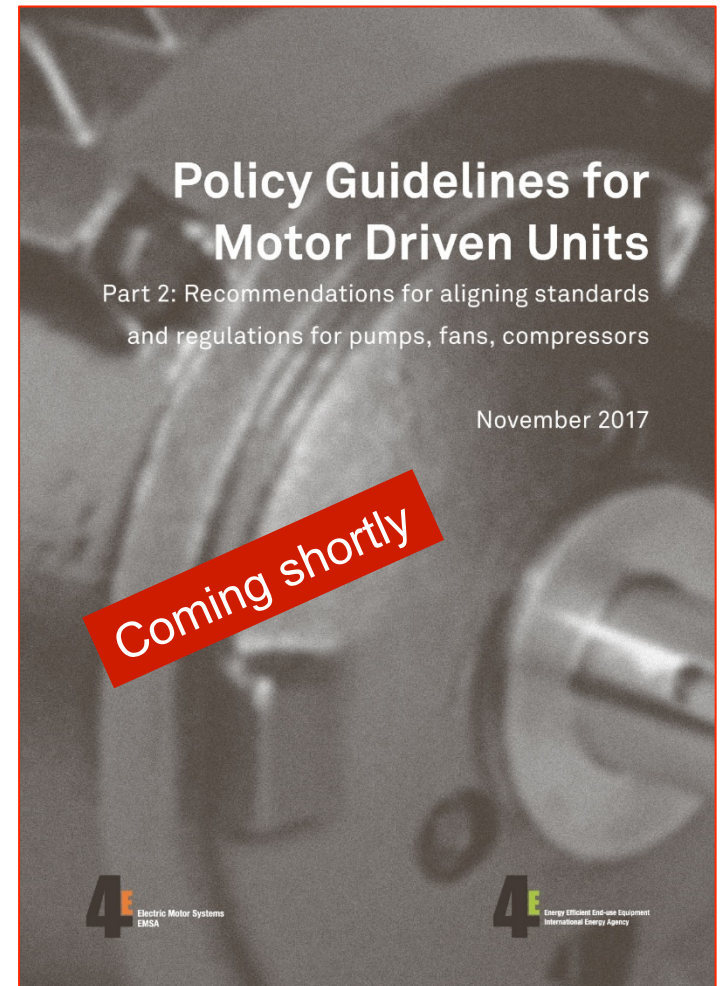
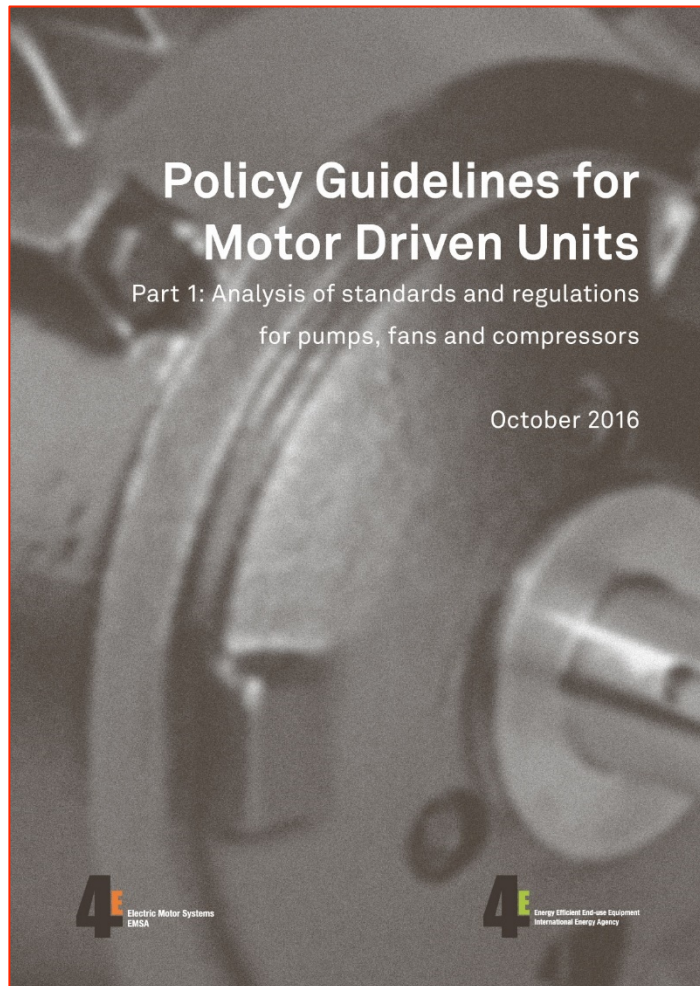
Added complexity for MEPS

- For regulators
 - check every component (or only the entire MDU)
 - different components meet at the end-user
 - accept physical tests only (or AEDM: calculation)
- For standard makers
 - within IEC (or ISO):
several TCs: joint working groups
 - collaboration IEC / ISO:
different tradition, culture, procedures
- Global harmonization beneficial for all stakeholders

Proposed Action(s)

- Closer cooperation IEC/ISO
 - Engagement in ISO and IEC - TCs & WGs:
 - ISO TC 115, 117, 118 and IEC TC 2, TC 22, SC22G
 - 1s steps through IEC ACEE – guides 118, 119
- Engage policy makers, standard developers and industry representatives in a dialogue on the opportunities and steps for aligned standards and regulations for MDUs

4E EMSA: Policy Guidelines MOTOR DRIVEN UNITS (MDU)



Download:
www.motorsystems.org

Thank you



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