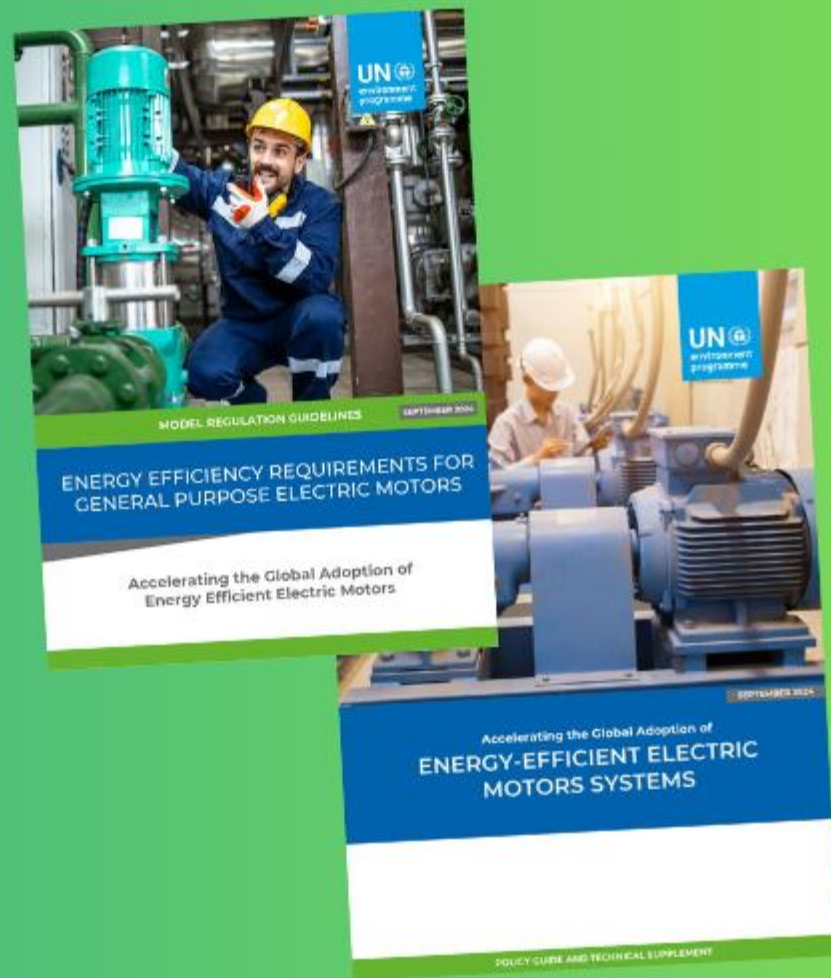


Webinar Electric Motors Systems

- pumps, fans, compressors, motors, VSDs -

23.10.24 | 15:00 - 16:30 (CEST)



Agenda

Duration (90 mins)	Agenda item	Presenter/Moderator
13	Housekeeping and Overview of UNEP U4E	Madeleine Edl
25	Overview of U4E publications <ul style="list-style-type: none"> • Model Regulation Guidelines • Policy Guide 	Ajit Advani, Maarten van Werkhoven
10	Example U4E activities to apply model regulation guidelines	Soledad Garcia
20	Experiences in countries: <ul style="list-style-type: none"> • Chile, Ms. Pamela Castillo Professional from the Efficient Transport and Standards Unit, Ministry of Energy Chile • Türkiye, Ms. Gürsu Sezen Torun Industry and Technology Expert, Ministry of Industry and Technology, Türkiye 	Madeleine Edl
20	Q&A	Ajit Advani, Maarten van Werkhoven
2	Closing Remarks	Madeleine Edl



Overview of U4E publications on electric motor systems

Policy Guide

Model Regulation Guidelines

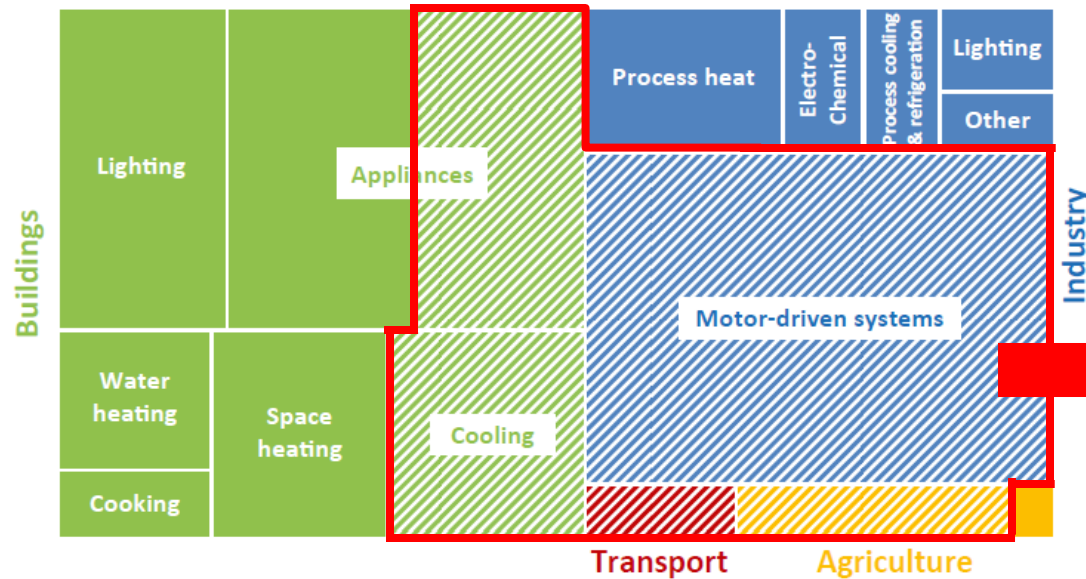
Ajit Advani, ajit.advani@internationalcopper.org

Maarten van Werkhoven, mvanwerkhoven@tpabv.nl

23 October 2024

Electricity use – share by electric motor systems

Global total final electricity consumption by end-uses



▨ Share of motors: 53%

Motors account for more than half of today's electricity consumption

Motors (systems) represent 74% of electricity consumption in industry

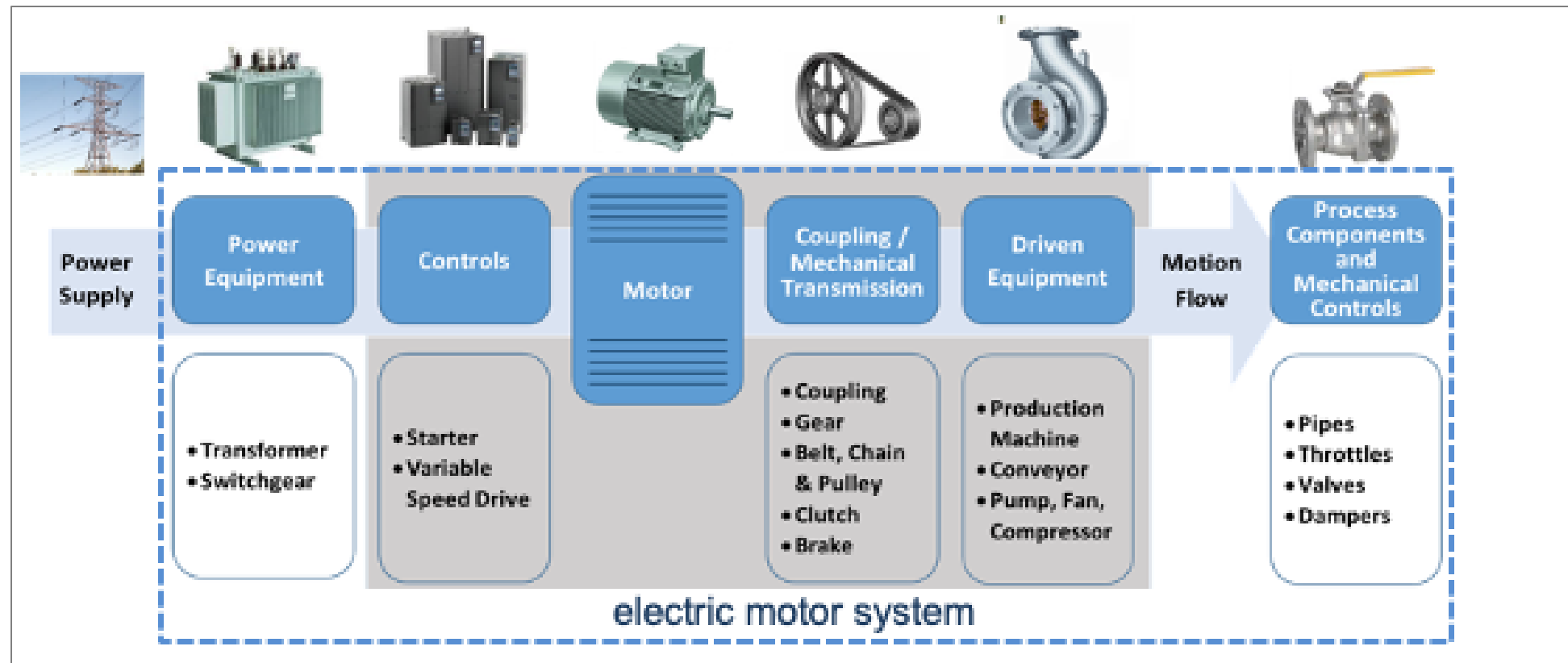
Source: IEA World Energy Outlook, 2019

Motors (systems) are mainly used in industry, large buildings and infrastructure systems. Also transport, agriculture and household appliances include motors.

Electric Motor Systems have the largest CO₂ mitigation potential of all appliance groups

- IEA projects that global electricity use in Electric Motor Systems is to rise 25% - 30% by 2030 over 2021.
 - Electricity use in 2021 was 12,400 TWh giving rise to 6.5 Gt of CO₂ emissions
 - 70% - 80% growth will come from *China, India and other emerging markets and developing economies.*
- CLASP modelling shows that policy actions to
 - double the efficiency of new industrial motor systems; and
 - greatly accelerate the replacement of existing industrial motor systems stockcould mitigate 3.4 Gt CO₂ emissions by 2040 and 5.1 Gt by 2050. This is *more than* the combined potential of all other appliance groups

1. Energy savings in Electric Motor Systems will come from improvement of component efficiency + optimisation



The Opportunity and the Challenge for EMDE*

- Market transformation policies exist in 56 countries.
- Global best practices available.
- Rest, largely emerging markets and developing economies need to act
 - Lack of technical capacities, know-how and financial means are a constraint in most cases
- Risks of inaction
 - Ready markets for inefficient products not wanted elsewhere
 - Lock-in of inefficiency (motor lifetime > 20 years)

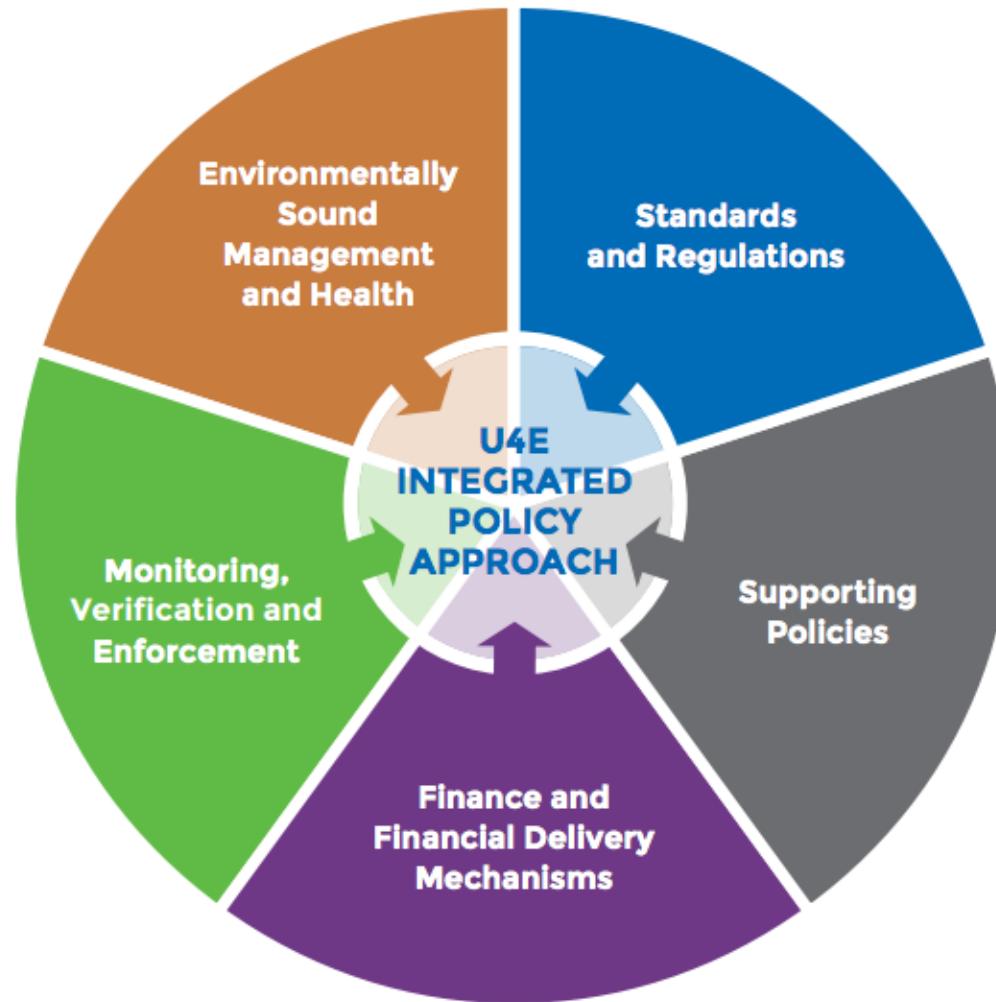
* Emerging Markets and Developing Economies

U4E Policy Guide Electric Motor Systems

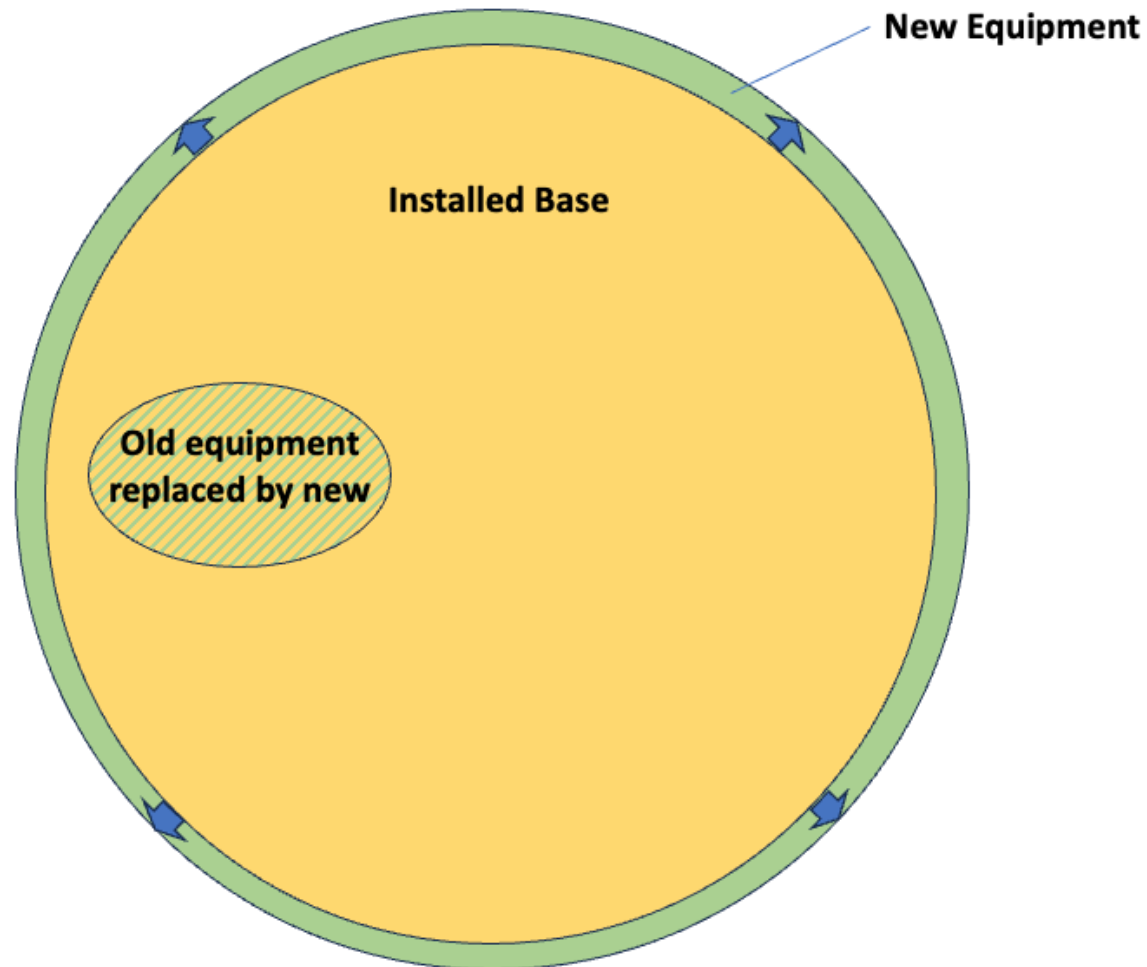
- Single-stop reference source for EMDE* policymakers.
- Scope: LV Motors, VSD's, Fans, Pumps, Compressors + System Optimisation
- U4E Integrated Policy Approach.
- Differentiated Policy Approaches for the New Equipment Market and the Installed Base
- Overview of available resources, tools and best practices globally.
- Technical annex with overview of motor system components, efficiency metrics, terms and concepts.

* Emerging Markets and Developing Economies

U4E Integrated Policy Approach



Differentiated Policy Approaches for the New Equipment Market and the Installed Base



Legend:

Policy Approaches

- MEPS
- Energy Labelling
- Green Public Procurement (HEPS)

- Accelerated Replacement Programs

- Repair Quality
- Energy Audits, Energy Management
- Energy Performance Targets, Incentives and Penalties
- Financing Mechanisms

➔ Growth of the installed base through new equipment placed on the market

U4E Motor Systems Policy Guide Application

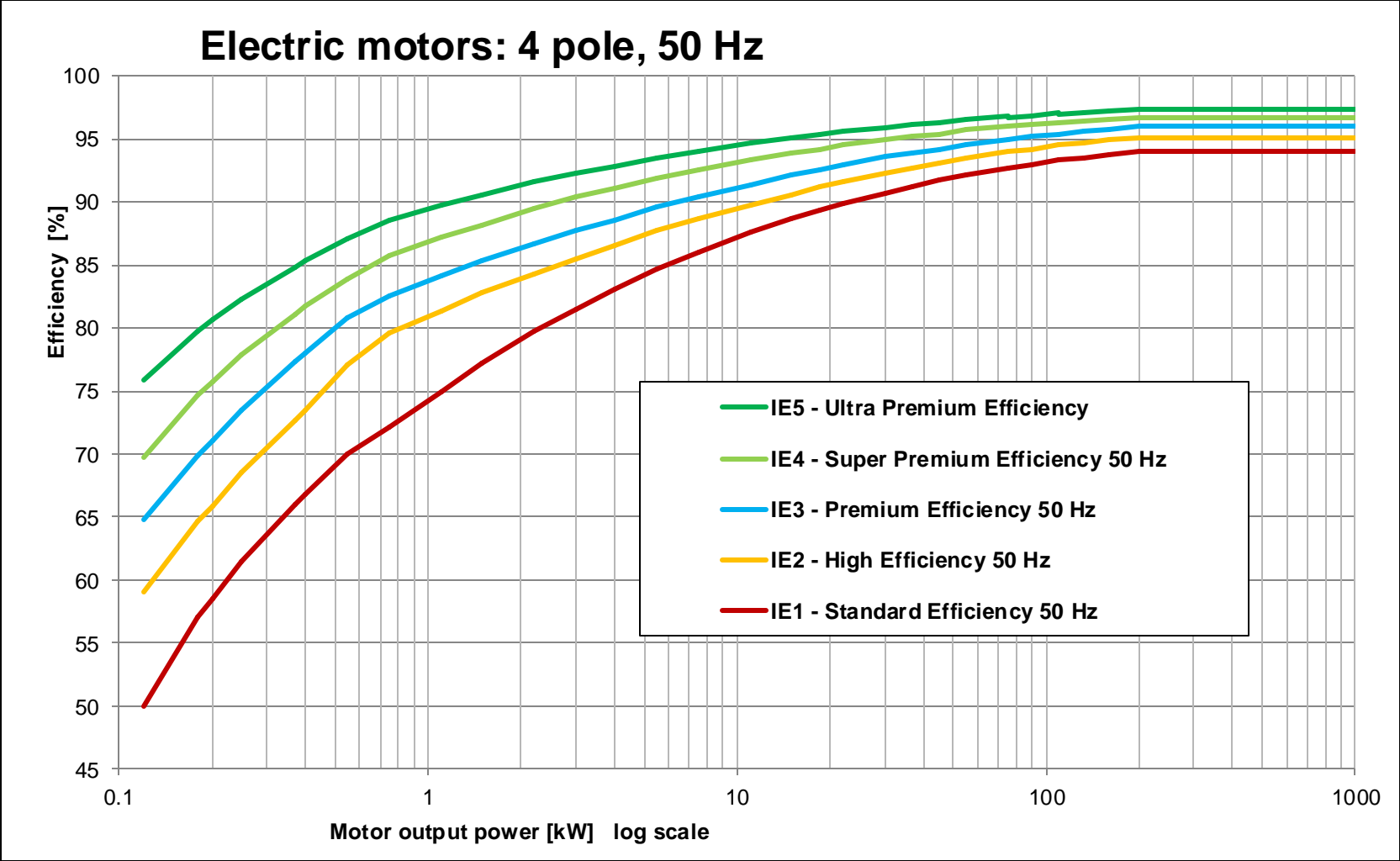
- Facilitate development of vision, policy goals, processes and identify needed resources
- Guidance flexible, not prescriptive
- All components of Integrated Policy Approach described for completeness
- Countries to select based on specific priorities and circumstances

2. U4E Model Regulation Guidelines Electric Motor Systems

- Single-stop reference source for EMDE* regulatory authorities.
- Provides templates for MEPS regulations for
 - Electric Induction Motors
 - Variable Speed Drives
 - Rotodynamic Water pumps and Water pump units
 - Fans driven by Motors
 - Air compressors
- These include definitions, scope, performance requirements, information requirements, applicable test methods and compliance criteria.
- Structured as building blocks that may be combined based on the market structure and practices in each individual country or region.

* Emerging Markets and Developing Economies

Efficient electric motors → IE-classification

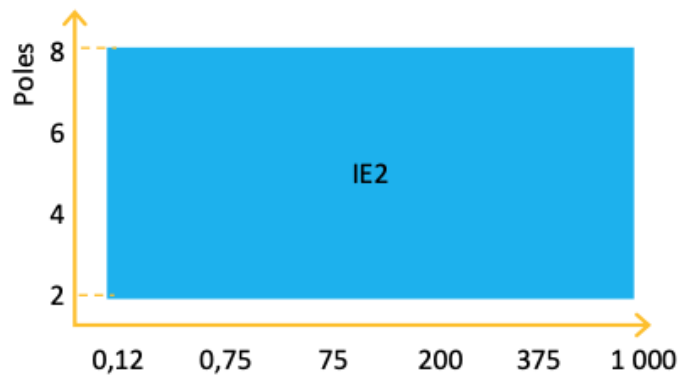


Electric Motors and VSDs – Model Regulation Guidelines



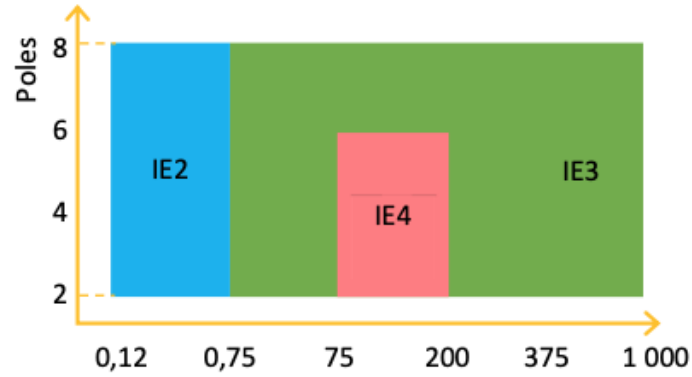
Advanced Level (A), broadest coverage

In line with current international best practice regulations. This is suitable for countries that either do not have a significant domestic motor manufacturing industry, or already have MEPS for motors covering a narrower scope and/or at a lower efficiency level and are ready to adopt the advanced level



Motors rated for operation on 50 Hz, 60 Hz or 50/60 Hz supplies:

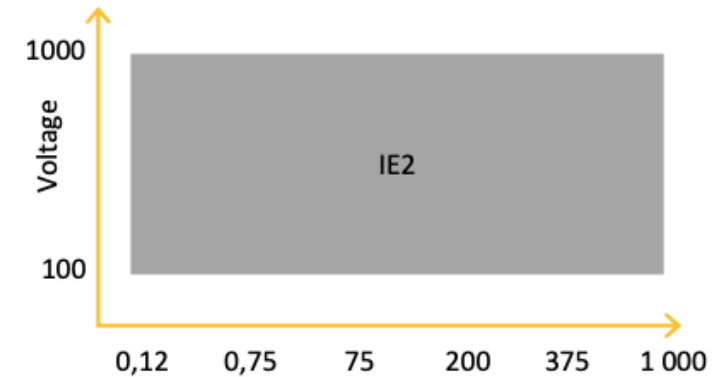
- 1-phase motors
- Ex eb motors for explosive atmospheres



3-phase induction motors

- 2-, 4-, 6-, 8-poles
- 50, 60 Hz or 50/60 Hz
- Rated for continuous duty
- motors for explosive atmospheres Ex ec, Ex tb, Ex tc, Ex db, Ex db eb, Ex dc
- brake motors, incl. Totally Enclosed Air Over (TEAO) motors

Note: IE4 mandatory for 2-, 4- and 6-poles single speed motors which are not brake motors, Ex eb motors for explosive atmospheres or other explosion-protected motors



3-phase variable speed drives from 0,12 kW ≤ P_n ≤ 1 000 kW

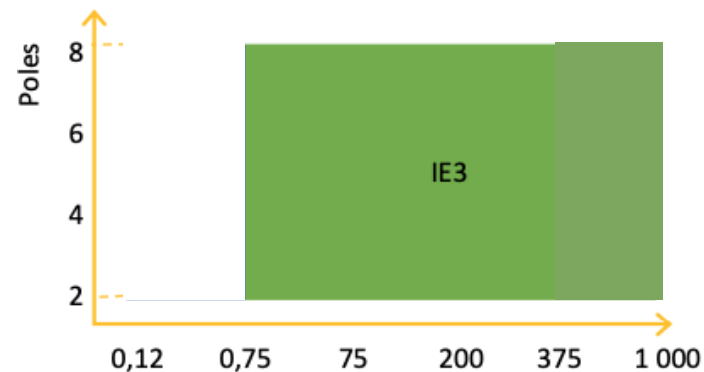
Major exemptions:

- Regenerative drives (active front end, AFE)
- Low-harmonic drives (THD < 10%)
- Multiple AC-output drives
- 1-phase drives

Electric Motors and VSDs – Model Regulation Guidelines

Bridging Starting Level (B), at IE3-level

Countries that do have a significant domestic motor manufacturing industry can choose to start at IE3-level “premium energy-efficiency” for a basic range of 0.75 – 1,000 kW for three-phase motors.



3-phase induction motors

- single speed
- 2-, 4-, 6-, 8-poles
- 50, 60 Hz or 50/60 Hz
- Rated for continuous duty

Major exemptions:

- motors for explosive atmospheres Ex ec, Ex tb, Ex tc, Ex db, Ex db eb, Ex dc, nor Ex eb
- brake motors, incl. Totally Enclosed Air Over (TEAO) motors

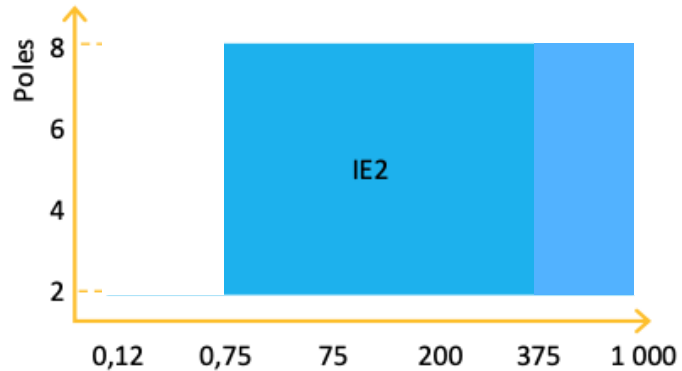
Electric Motors and VSDs – Model Regulation Guidelines

Bridging Starting Level (C), with limited time at IE2-level and transitioning to IE3-level

Alternative for countries with a significant domestic motor manufacturing industry;

A more gradual transition by starting at IE2-level “high energy-efficiency”;

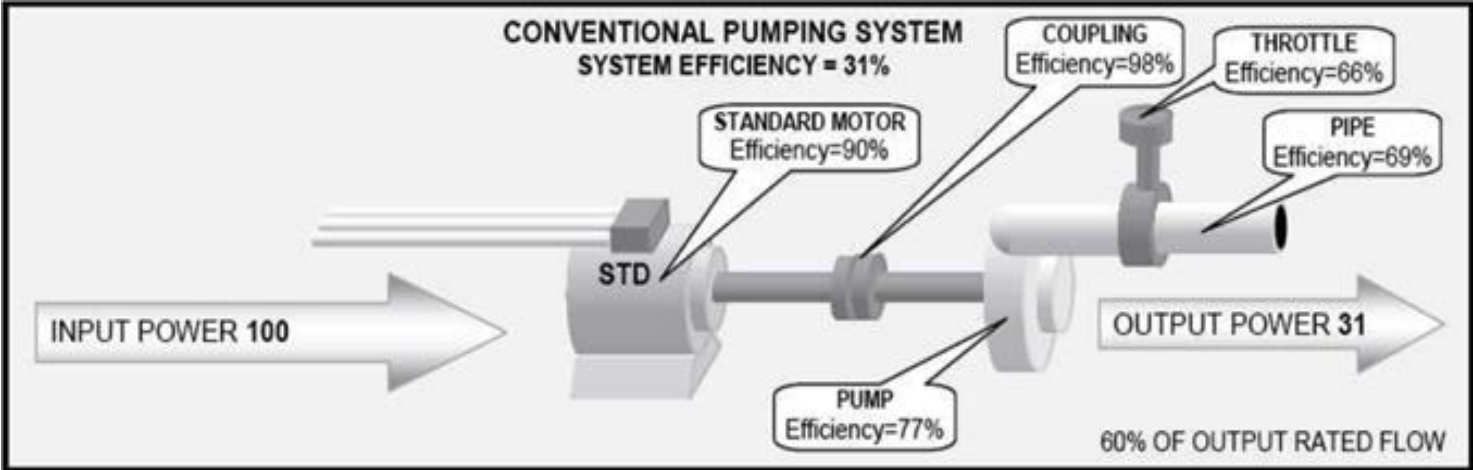
Provides a (limited) transitory time for upgrading technology; with the objective of transitioning in steps to Level B and Level A eventually.



3-phase induction motors

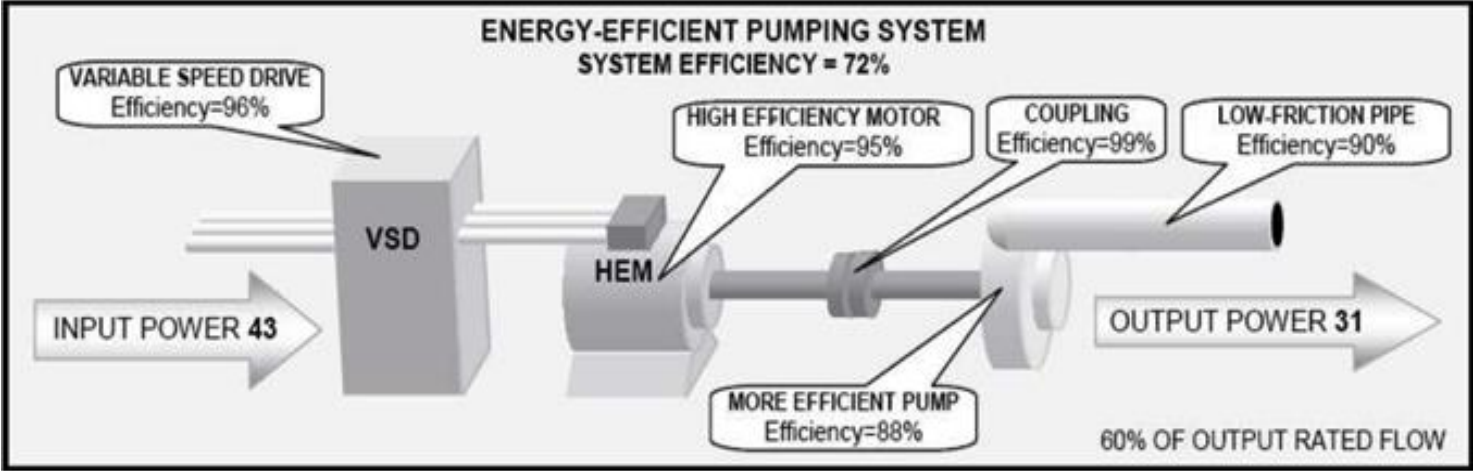
- single speed
- 2-, 4-, 6-, 8-poles
- 50, 60 Hz or 50/60 Hz
- Rated for continuous duty

Efficient water pumps → efficient components



Doubling system efficiency

-> 31%



-> 72%

Pumps – Model Regulation Guidelines



Rotodynamic pumps for clean water

- End suction own bearing (ESOB), End suction close coupled (ESCC), End suction close coupled inline (ESCCi)
- Vertical multistage (MS-V), Horizontal multistage (MS-H), Submersible multistage (MSS) and
- Booster sets (BS)

Advanced Level (A)

- Start directly at the current international best practice level. The efficiency levels include
 - for **water pumps** a Minimum Efficiency Index of 0.4 (MEI), and
 - for **water pump units** - for ESOB, ESCC and ESCCi end suction units up to 45 kW shaft power an Energy Efficiency Index of not more than 0.62 (EEI), and for booster sets an Energy Efficiency Index of not more than 0.5 (EEI).

Bridging starting level (B)

- Optional bridging level: a lower Minimum Efficiency Index for **pumps only** (the hydraulic efficiency) of MEI = 0.1 providing domestic manufacturers a (limited) transitory time for upgrading technology. These exclude the booster sets.

Fans – Model Regulation Guidelines



Five different fan types i.e., axial fans, centrifugal fans, cross flow fans, mixed flow fans and jet fans, with an electric input power between 125 W and 500 kW, at one of the following levels:

Advanced Level (A)

- Offers a regulatory framework designed to leapfrog directly to the best practice advanced level in line with current international best practice regulations.
- Minimum fan energy efficiencies are defined by an *efficiency grade N* specific for each fan type. The efficiency grades N are at ‘premium level’, ranging from N50 to N67 and include *information requirements on partial load*.

Bridging Starting Level (B)

- The bridging level includes lower efficiency grades providing domestic manufacturers a (limited) transitory time for upgrading technology. The efficiency grades N range from N45 to N65.

5. Key recommendations (1/2)



Develop and implement a **national strategy** for efficient electric motor systems

- where an **economic and environmental impact analysis** will provide the principal basis for determining the scope and level of electric motor systems regulations
- **starting with motors** and **extending** in an appropriate timeline to efficient pumps, fans, compressors and variable speed drives.

Leapfrog directly to the Advanced Level options

or choose to start at **Bridging Levels** to accommodate domestic manufacturers with a transitory period

Collaborate with other countries in the region

to **harmonise standards** according to **international best practices** and to share resources and lessons learned

Aim to implement a MVE (monitoring, verification and enforcement) regime

- within the **national legal framework** in time
- to coincide with the adoption of MEPS and
 - to ensure accurate and reliable measurement of the energy efficiency of motor system components

5. Key recommendations (1/2)



Use voluntary **supporting policies** e.g.

- communication campaigns to educate, inform and build capacities;
- to improve **energy management practices** at the government, company, and industry level;
- to pull the market for new equipment above MEPS e.g. through **Labelling and Green Public Procurement**;
- to accelerate the renovation of inefficient motor systems in the installed base;
- to **improve repair practices** and to adopt best practices in shops to yield professional repairs so motors meet their original performance;
- Conduct targeted **outreach and training** to inform, educate, and gain the support of key stakeholders.

Conduct **market analysis**

to understand **financial barriers**; bring **financial delivery schemes** in place to support voluntary actions

Include the subject of circularity

into relevant policies, aiming to **minimise the impact** on human health and the environment, and **reducing waste and environmental impacts**, and - ultimately - eliminated through the principles of durability, reparability, reuse, remanufacturing, and recycling.



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