



Accelerating the Global Adoption of ENERGY-EFFICIENT ELECTRIC MOTORS AND MOTOR SYSTEMS

POLICY GUIDE SERIES



Half of all electrical energy is used by **electric motor** systems



With **energy-efficient motors**, countries can **save** the equivalent of the **annual electricity** generated by approximately **60** coal-fired power plants



Global electricity demand by **electric motors** and **motor systems** can be **reduced** by **20 to 30** per cent by 2030



Electricity that powers **electric motors** and **motor systems** will be **wasted** if **robust policies** are not adopted and enforced



The experience of over **40** countries shows that mandatory **minimum energy performance** standards, as the **cornerstone** of an **integrated policy** approach, are the **most effective instrument** to transform markets for electric motors



United for Efficiency helps developing and emerging economies transform their markets with **energy-efficient electric motors** and **motor systems**

BACKGROUND

Motors convert electrical energy into motion. They are found everywhere, from micro motors in computer hard drives and small motors in domestic appliances to medium and large motors in commercial buildings and factories.

General purpose motors and the systems that are driven by these motors are the target of policies recommended in this policy guide. These motors comprise 10 per cent of the global stock but account for 68 per cent of the electrical energy used by motors.



Examples of the motors targeted by this guide

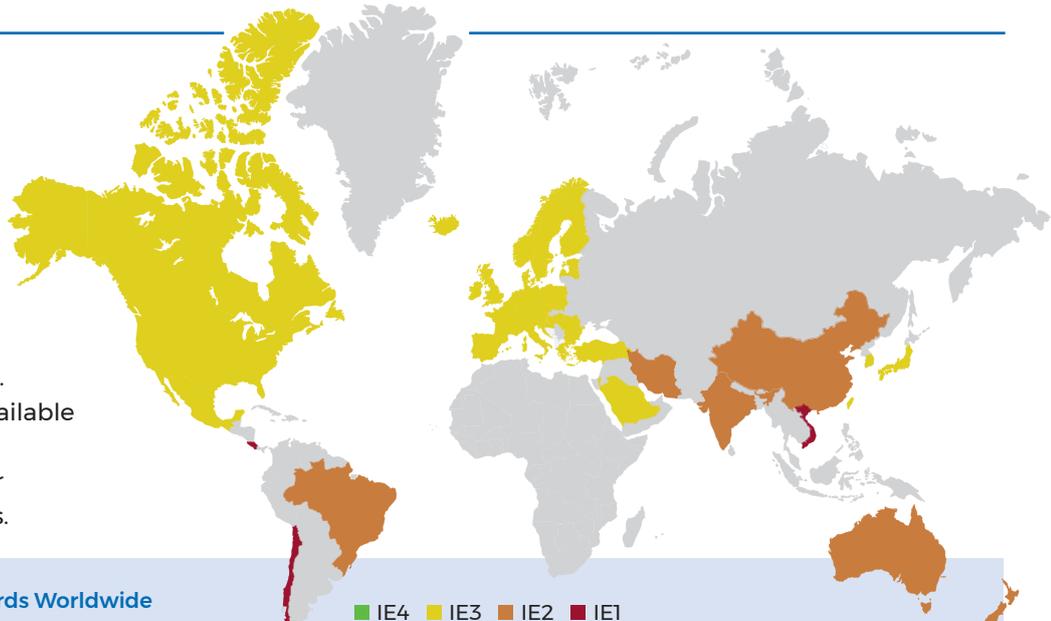
It is estimated that half of all electrical energy, (or more than 10,000 TWh per year), is used by electric motor systems globally.* This share is increasing as more of the transportation sector is electrified, fossil fuel-fired boilers in buildings are replaced with heat pumps, and the number of domestic appliances expands around the world.

Not all of the electrical energy that goes into a motor is converted to usable mechanical energy. Energy is lost as waste heat during the conversion process. Such losses occur at each step in the electric motor system, which compound along the way and can result in significant overall waste.

*IEA World Energy Outlook 2016

WHY LEAPFROG TO ENERGY-EFFICIENT MOTORS?

Over 40 countries representing 80 per cent of global electricity use in motor systems have successfully steered their markets towards higher efficiency equipment. Best practice examples are readily available for replication by others. The risks of inaction are immense, particularly for developing and emerging economies.



Minimum Energy Performance Standards Worldwide

Mexico, US	0.75-375 kW IE3	Israel	7.5-375 kW IE3
Canada	<150 kW IE3 >150 kW IE2	Australia, Brazil, New Zealand, Iran (Islamic Republic of)	0.75-5.5 kW IE2
Japan, Saudi Arabia	0.75-375 kW IE3	China	<185 kW IE2
EU, Turkey	0.75-375 kW IE3 or IE2+VFD	India	0.75-375 kW IE2
Taiwan	0.75-200 kW IE3	Costa Rica, Chile, Vietnam	0.37-375 kW IE2
Republic of Korea	37-375 kW IE3 0.75-30 kW IE2		IE1

■ IE4 ■ IE3 ■ IE2 ■ IE1

Efficiency Classes: IEC 60034-30-1, 2014

Output Power: 0.12 - 1000 kW; 50 Hz and 60 Hz, line operated; 2-, 4-, 6-, 8-poles

The performance levels are designated by the International Electrotechnical Commission, a non-profit, non-governmental international standards organization that prepares and publishes standards for electrical equipment. See http://www.iec.ch/perspectives/government/sectors/electric_motors.htm for additional information.

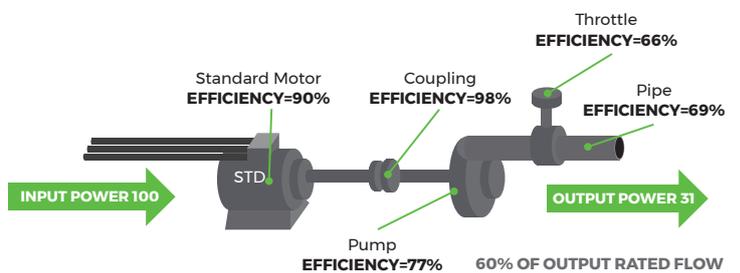
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An absence of well-designed and enforced policies may cause these countries to become the destination for inferior motors that are not acceptable elsewhere. Since motors have long lifetimes, often operating 20 years or more, electricity waste may be locked-in for decades. Outdated motor systems can make factories less competitive and place additional burden on utilities that already struggle to meet growing demand for electricity.

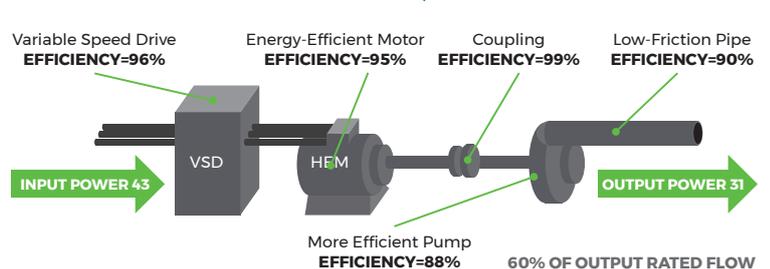
Robust policies can reduce the global electricity demand by electric motors and motor systems by 20 to 30 per cent in 2030.

The higher up-front price of energy-efficient equipment is paid back through savings on utility bills. The payback time varies depending on the efficiency of the equipment, operating hours and electricity costs. Over the lifetime of the equipment, the initial purchase price typically equates to 2 per cent of the cost of ownership while the electricity used over its lifetime is 98 per cent of the cost.

CONVENTIONAL PUMPING SYSTEM, SYSTEM EFFICIENCY = 31%



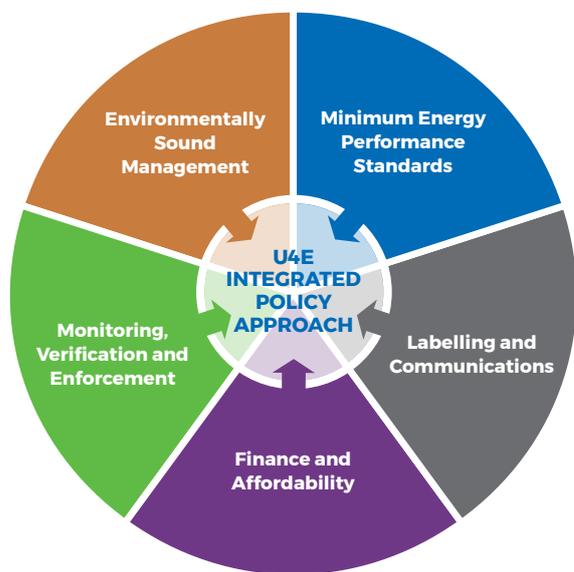
ENERGY-EFFICIENT PUMPING SYSTEM, SYSTEM EFFICIENCY = 72%



Energy Savings potential of a typical motor system

RECOMMENDATIONS FOR POLICYMAKERS

Policymakers are encouraged to follow United for Efficiency's *Integrated Policy Approach* to transform their markets to more efficient motors and motor systems. A National Efficient Motors Strategy should be developed to show how such a transformation is to unfold in the years ahead.



The strategy development process brings key stakeholders together to foster a shared vision for the market and to identify the resources and mechanisms needed to pursue it. Policymakers should collaborate with others in the region to align policies with international best practices, and to share resources (e.g. testing facilities, communications materials), experience and information (market monitoring data).

It is best to start by regulating general purpose, medium-size Induction motors, which can deliver rapid and sustained energy savings. These should be accompanied by policies to encourage voluntary actions to upgrade existing motors and motor systems, and improvements in motor repair practices. Once sufficient experience has been gained, policymakers should expand regulations to cover additional motor sizes and types, and other parts of the motor system (which is more complex but offers considerably larger energy savings potential).

An Integrated Policy Approach includes:



Standards and regulations that define which equipment will be blocked from the market (for failing to meet minimum energy performance standards - MEPS), which equipment may be recognised for meeting higher performance and quality requirements, how to test the equipment, and other aspects. MEPS at IE2 (high efficiency) level, with a timetable for graduating to IE3 (premium efficiency), is recommended for countries that have domestic motor-manufacturing industries that need time to adjust.** MEPS at IE3 level is recommended for countries without a domestic motor manufacturing industry.



Labelling and Communications that ensure the smooth implementation of standards and regulations and achieve broad acceptance. Labels indicate the performance of the equipment and allow for easy comparison between competing products. It is recommended that all motors feature IEC 60034-30-1 conformant nameplates. Communications campaigns should inform, educate and gain the support of key stakeholders. Best practices (e.g. per ANSI/EASA AR100 or the specifications of the Consortium for Energy Efficiency) should be encouraged in shops to yield professional repairs by certified technicians.



Monitoring, verification and enforcement (MVE) that track which equipment is sold in the market, test the equipment to ensure that claims of performance are accurate and to prompt corrections by those that fail to comply. Otherwise, incentives intended for efficient products may reward sub-standard alternatives and non-compliant equipment will enter the market. Aim to implement an MVE regime within the national legal framework in time to coincide with the adoption of MEPS. Ensure accurate and reliable measurement of the energy efficiency of motors as prescribed by IEC Standard 60034-2-1.



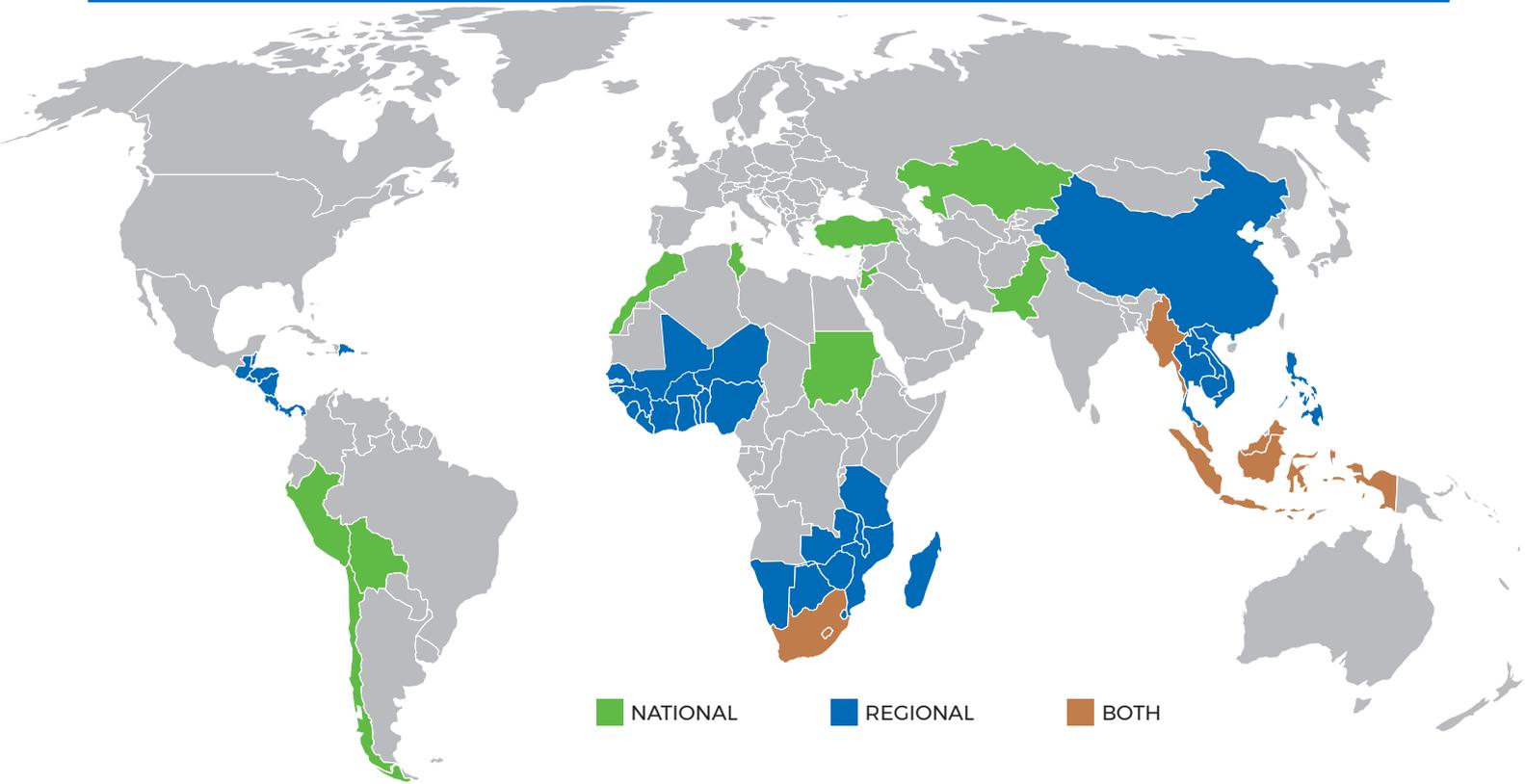
Financial mechanisms help address the barrier of higher upfront costs of efficient equipment through incentives such as grants, rebates and tax-relief, or by extending credit lines, partial risk guarantees, loans, bulk procurement opportunities, equipment leasing through financial intermediaries and services through energy service companies. Assess existing sources of finance and conduct market analysis to understand financial barriers so that applicable delivery mechanisms are in-place to support voluntary actions (e.g. encourage the purchase of motors with higher efficiency than the minimum standards, early-replacements of inefficient motors, upgrading motors systems, etc.).



Environmentally Sound Management and Health considerations, given the hazardous wastes (e.g. lubricating grease) found in motors, the risks for workers during motor manufacturing and repair, the recycling opportunities for many components that can be diverted from landfills and the need to get end-users engaged to facilitate waste collection and processing. Establish collection and recycling mechanisms for motors that have reached the end of their useful life, as the cast iron, steel, aluminium, copper, stainless steel and brass parts that constitute more than 98 percent of the material content are fully recyclable.

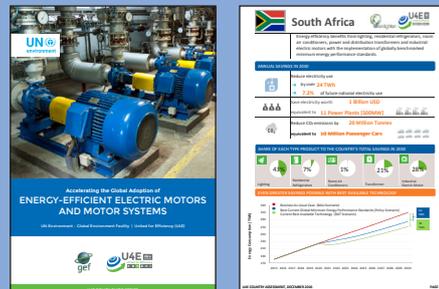


CURRENT UNITED FOR EFFICIENCY NATIONAL PROJECTS AND REGIONAL HARMONISATION ACTIVITIES



ABOUT UNITED FOR EFFICIENCY

United for Efficiency is a global initiative led by UN Environment, funded by the Global Environment Facility, and supported by leading companies, expert organisations and public entities with a shared interest in transforming markets for lighting, appliances and equipment.



Download the full policy guide and review the 150 United for Efficiency Country Savings Assessments at our website.



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