Energy Efficient End-use Equipment
International Energy Agency

ENERGY EFFICIENCY POLICY BRIEF

Electric motor systems: why are they important?

EMSA9

Statement of platform objectives and scope of policy brief

The IEA 4E Electric Motor Systems Platform (EMSA) promotes the opportunities for energy efficiency in electric motor systems by disseminating best practice information worldwide. It supports the development of internationally aligned test standards and policies to improve the energy performance of new and existing electric motors and motor systems. Electric motors are used in a wide range of industrial applications, but also in many types of applications in the commercial, residential, agricultural and transportation sectors. They typically operate as part of a motor system, converting electrical energy into mechanical power, driving applications like pumps, fans, compressors and machines.

This Policy Brief highlights the importance of electric motor systems in global electricity consumption.

Observations for Policy Makers

- **Strong growth in electricity demand:** from 2015 to 2023, global electricity demand rose by **24%** (average annual growth of 2.7%). In 2024, growth accelerated to 4.3%, with the IEA expecting it to stay close to 4% per year through to 2027.
- **Even faster growth in electric motor system consumption:** over the same period, electricity consumption due to electric motor systems grew by **26%**. This above-average increase is driven mainly by growth in industry and transportation. This increase – amounting to **2 756 TWh** – is roughly equivalent to the **annual electricity consumption of the European Union** (EU27), underscoring the significant role electric motor systems play in the global energy system.
- **More than half of global electricity consumption is attributed to electric motor systems:** by 2023, electric motor systems were responsible for **53%** of global electricity consumption - **13 462 TWh** – a share that has remained stable in recent years.
- **The share of electric motor systems in electricity consumption varies widely across sectors:** 72% in industry, 36% in buildings, 87% in agriculture and 86% in the transportation sector, see Figure 1.
- **Electricity growth due to increasing number of electric motor systems across sectors:**
  - Industry: electrification of, among others, heating and specific processes with e.g. heat pumps, compressors, pumps and transport;
  - Buildings: rising use of electric heating and cooling (heat pumps, air conditioners);
  - Transport: rapid increase in electric vehicles.
- **A growing challenge – and opportunity:** although the number of motors and motor systems, as well as their electricity consumption continues to rise steadily, their high efficiencies and efficient use offer significant energy savings potential, making them a key element on the way to global net zero by 2050.
- **Policies need to address both newly sold equipment and the existing installed base. Minimum Energy Performance Standards** (MEPS) for electric motors are in place in many economies. Policy efforts focus on introducing MEPS where they do not yet exist, revising stringency and extending scope, including Variable Speed Drives, pumps, fans, compressors. Policy measures for replacing old, inefficient motors and optimising motor systems through **audits, incentives, and energy monitoring and management programmes** can unlock significant savings and need to be accelerated.
- **An integrated policy approach combining regulation, information and incentives is essential,** along the lines of the International Energy Agency's policy toolkit.

MORE INFORMATION

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Further information is available by contacting **emsa@iea-4e.org**.

Key Findings

Electric motor systems: key application of global electricity use in industry

Electric motor systems account for 72% of electricity consumption in the industrial sector, the highest share among all sectors. These motors are integrated in a wide range of equipment, including pumps, fans, compressors, conveyors, and various material handling and processing machines—making them the true workhorses of industrial production.

Their presence extends far beyond industry. In buildings, electric motors drive heating and cooling systems such as heat pumps and air conditioners, as well as everyday appliances like refrigerators and ceiling fans. In transportation, they power electric vehicles, while in agriculture, they operate irrigation pumps, ventilation and cooling equipment.

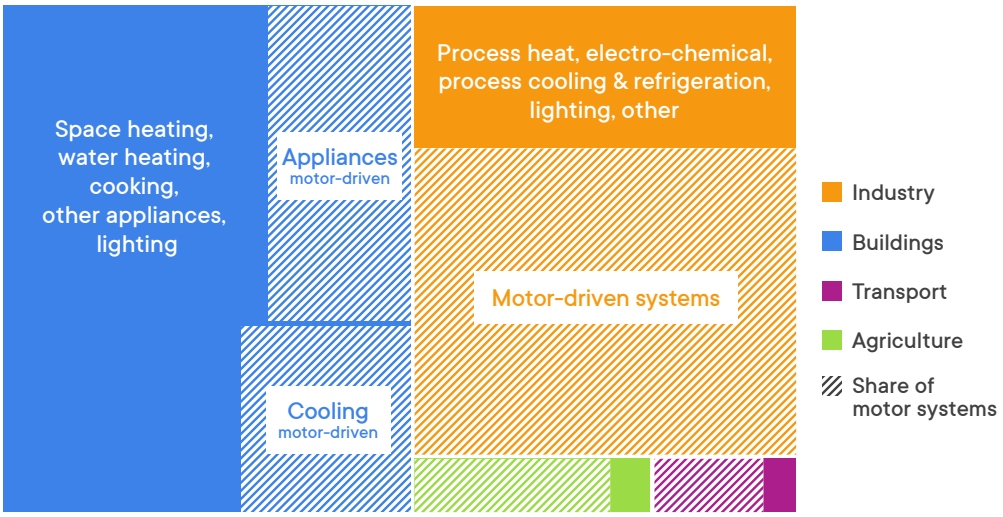

Figure 1: Global total final electricity consumption by end-uses, 2023.

Source: EMSA, based on World Energy Outlook 2016, 2019, 2024 and other sources (see Table 1).

Electric motor systems account for over half of global electricity use

Electric motor systems consume 53% of all electricity worldwide — a striking share that highlights their critical role in both energy efficiency and the path to global net zero by 2050. Unlocking their savings potential requires a dual approach: setting minimum efficiency standards for newly sold motors and components; and implementing supportive policies and programmes - such as financing schemes, energy audits, and capacity-building initiatives - to improve the overall efficiency of motor-driven systems and accelerate the replacement of old, inefficient equipment.

Table 1: Share of electric motor systems within global electricity consumption and each sector.

Electricity, global demand and use by electric motor systems per sector	2015			2023			Increase, 2015/2023	
	Electricity use TWh	Sector share %	Global share %	Electricity use TWh	Sector share %	Global share %	Global electricity use %	TWh
Global electricity demand (all sectors)	20 375		100%	25 188		100%	24%	4 813
Industry	8 507		42%	10 750		43%	26%	2 243
Industrial motor systems	6 125	72%		7 740	72%			
Buildings	10 399		51%	12 891		51%	24%	2 492
Heating, cooling, appliances	3 708	36%		4 597	36%			
Transport	381		2%	492		2%	29%	110
Electric transport means								
Traction, cooling	305	80%		423	86%			
Agriculture	653		3%	807		3%	24%	178
Irrigation, pumps, fans, etc.	568	87%		702	87%			
Total electricity use electric motor systems	10 706		53%	13 462		53%	26%	2 756

Source: EMSA, based on World Energy Outlook 2016, 2019, 2024; U.S. Industrial and Commercial Motor System Market Assessment Report 2021, EU MORE European Electric Motor Market Assessment 2024, Lei Zeng and Hu Bo: Improvement of China's Energy Efficiency Standards for Electric Motors and Its Impact on Carbon Emissions 2024.