



JUNE 2023

EU Ecodesign Regulation for motors and drives

For a more sustainable future

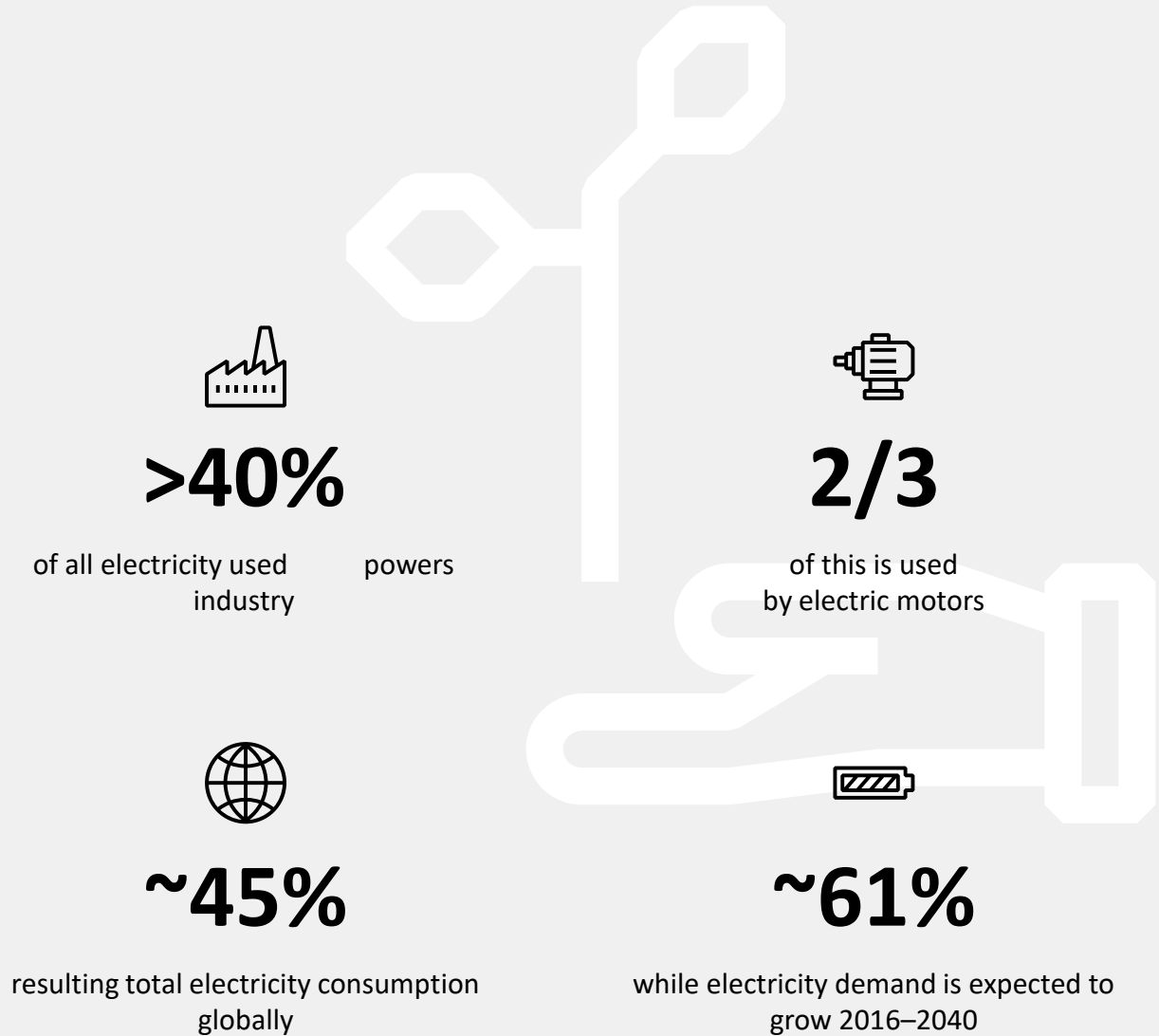
Challenge and opportunity

Pressures to reduce energy consumption and greenhouse emissions come from everywhere

What is climate change and how is it tackled?

How does it affect us?

How does it affect industry?



Drivers

Pressures to reduce energy consumption and greenhouse emissions come from everywhere

- Energy Efficiency Directive
- IE energy label
- Emission taxes
- Brand image

- And additional savings in operations and maintenance



>40

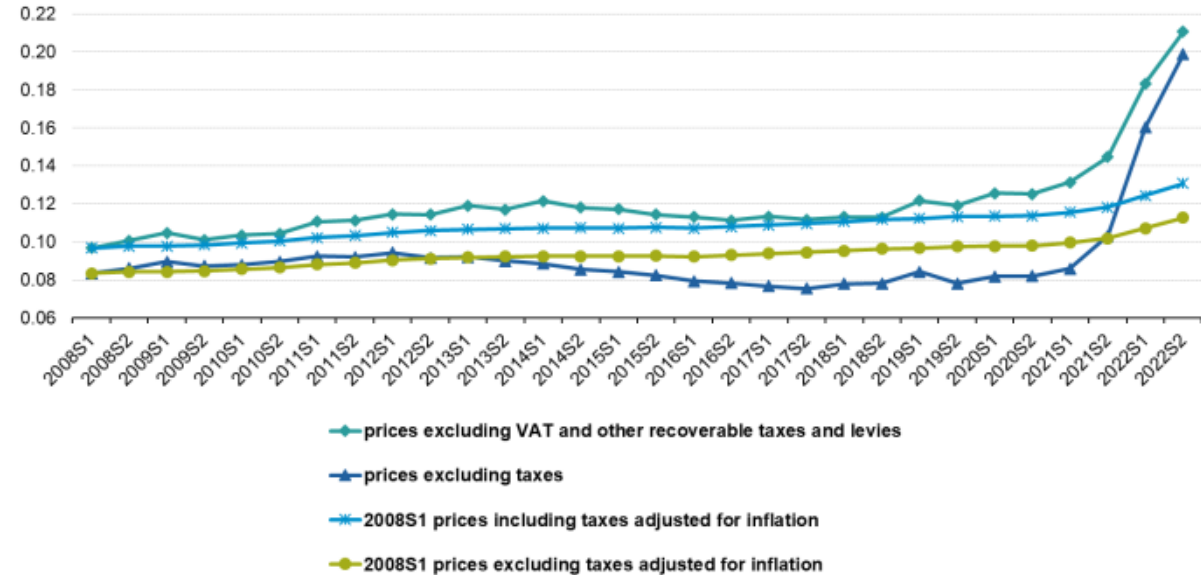
energy intensive industrial sectors have been conducted climate change agreement negotiations



>60%

on an industrial site with an electricity bill per annum, an average, is spent on running motors

Development of electricity prices for non-household consumers, EU, 2008-2022
(€ per kWh)

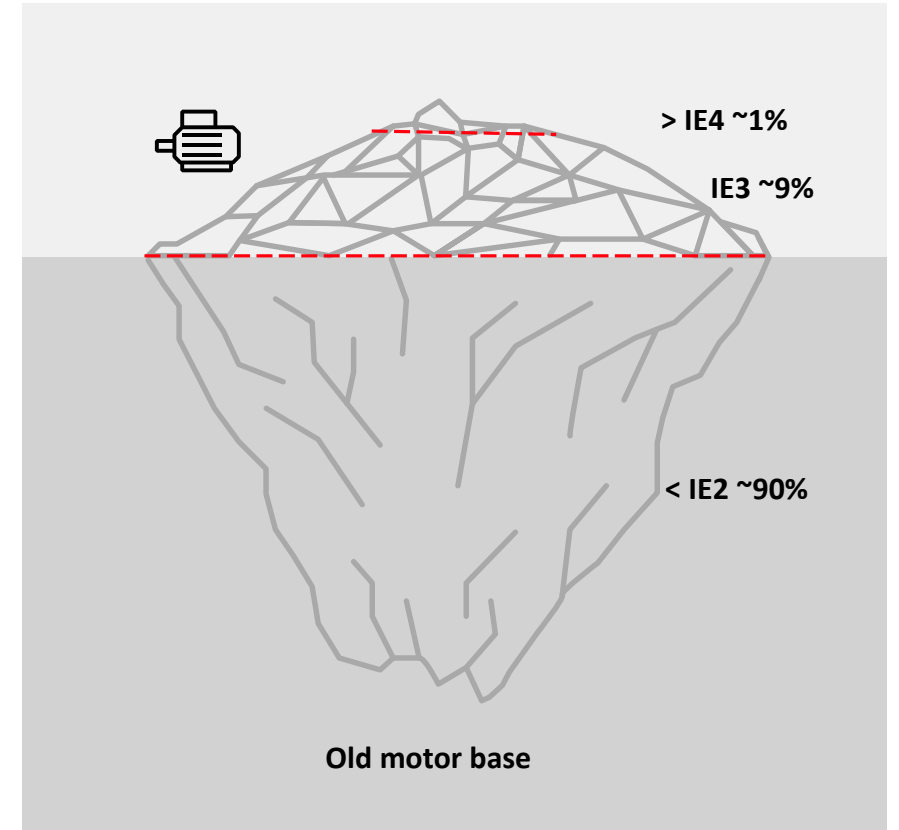
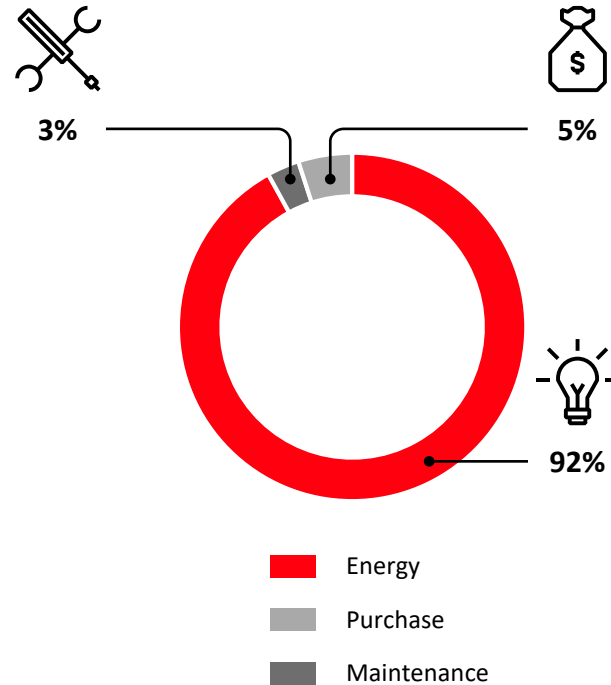


Source: Eurostat (online data codes: nrg_pc_205)

Total Cost of Ownership

Industrial Motors

- Bulk installed base is inefficient (< 90%)¹
- CAPEX is a fraction of OPEX
- Purchase price is only a fraction of its operating cost
- Energy cost set to increase over the next 5 years



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Ecodesign Regulation and timeline

Preparing for Step 2

Ecodesign Regulation for motors and drives

Background

The Ecodesign Regulation sets **energy efficiency** requirements for electric motors and variable speed drives.

ABB Motion's motors and drives play a crucial role in **containing worldwide energy consumption** and **reducing CO₂ emissions**.

Ecodesign Regulation (EU) 2019/1781 came into effect in October 2019. It applies to low voltage induction motors rated at less than 1,000 V alternating current (AC) and to variable speed drives (VSDs). The regulation is implemented in two steps.

Step 1 has been in force since July 1, 2021. We are now getting ready for **Step 2, which extends the scope and increases the requirements for motors. Step 2 is effective from July 1, 2023.**



Ecodesign Regulation for motors and drives

Timeline: preparing for Step 2

1 Step 1: requirements up to June 30, 2023

Motors

The regulation covers 3-phase single speed, 2-8 pole, 50-1,000 V motors, 50 Hz, 60 Hz, or 50/60 Hz for direct-on-line operation with continuous duty defined as S1, S3 \geq 80% and S6 \geq 80%.

Note: Option of IE2 + VSD no longer available

- **IE3 efficiency mandatory for:**
 - Rated output from 0.75 to 1,000 kW
 - Motors with protection types Ex ec, Ex d, Ex de, Ex t
 - Motors with IC418 cooling Totally Enclosed Air Over (TEAO)
 - Brake motors with external brake
- **IE2 efficiency mandatory for:**
 - 3-phase motors with rated output from 0.12 to 0.75 kW
 - Variable speed drives
- **IE2 efficiency mandatory for:**
 - 3-phase standard drives (diode rectifier) from 0.12 kW to 1,000 kW

2 Step 2: from July 1, 2023 – additions to Step 1

Motors

In addition to the Step 1 requirements, starting from July 1, 2023:

- **IE4 efficiency mandatory for:**
 - 3-phase motors with rated output from 75 to 200 kW, 2-6 poles (does not apply to brake or Ex motors)
- **IE3 efficiency mandatory for:**
 - Motors included in IE3 minimum requirements in Step 1 but not included in IE4 minimum requirement in Step 2
- **IE2 efficiency mandatory for:**
 - Ex eb increased safety motors from 0.12 to 1,000 kW
 - Single-phase motors from 0.12 to 1,000 kW
- **Variable speed drives**
 - No changes from Step 1 requirements

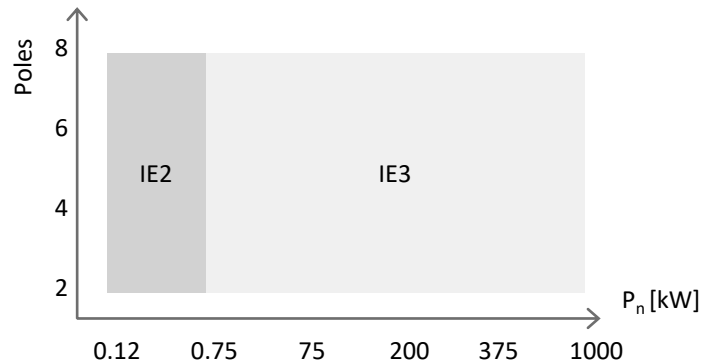
Ecodesign Regulation for motors and drives

Graphic: requirements for low voltage induction motors

Step 1: requirements up to June 30, 2023

Coverage:

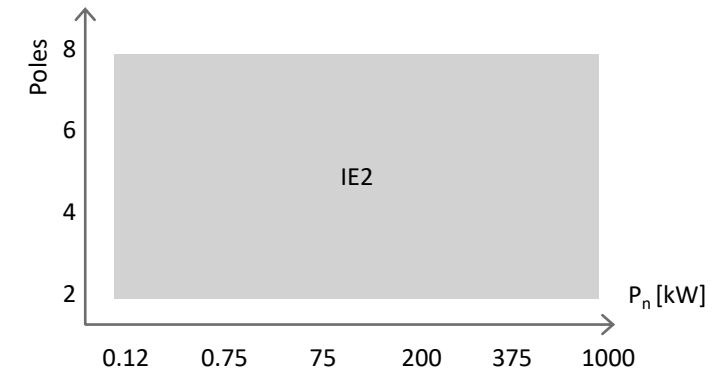
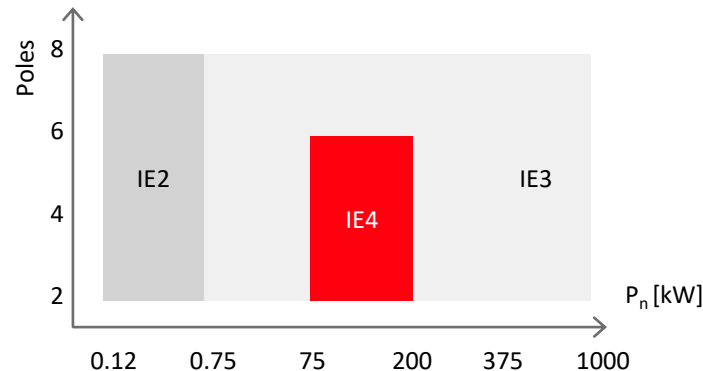
- 3-phase single speed motors 50, 60 and 50/60 Hz
- Ex motors - protection types Ex d, Ex ec and Ex t
- Brake motors with external brake
- IC418 (TEAO) motors



Step 2: from July 1, 2023 – additions to Step 1

Coverage:

- **IE4** mandatory for 3-phase motors with rated output from 75 to 200 kW, 2-6 poles (does not apply to brake or Ex motors)
- IE2 mandatory for:
 - 3-phase single speed Ex eb motors
 - Single-phase single speed motors



Ecodesign Regulation for motors and variable speed drives

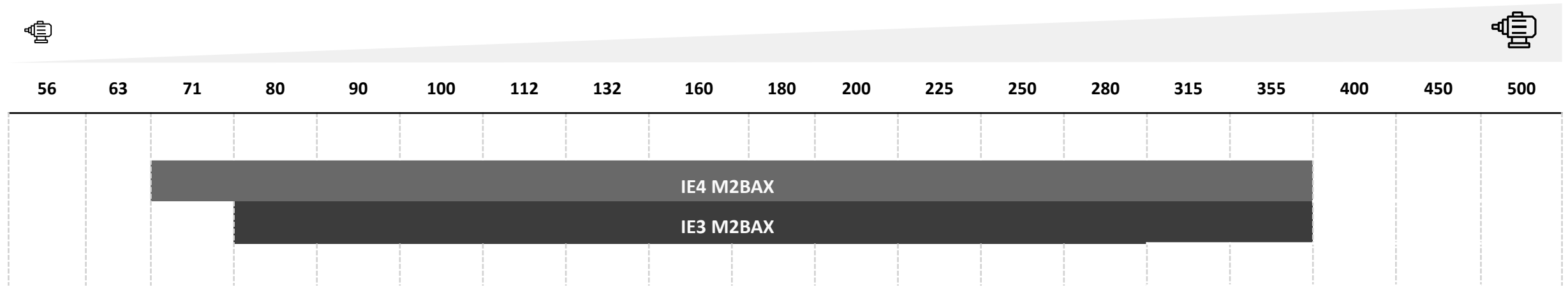
Ecodesign		Minimum efficiency requirements	
Induction motors ≤ 1,000 V		01.07.2021	01.07.2023 onward
≥ 0.12 < 0.75 kW	3-phase, 2/4/6 pole ²⁾	IE2	
	3-phase, 8 pole ²⁾	IE2	
≥ 0.75 < 7.5 kW	3-phase, 2/4/6 pole ²⁾	IE3	
	3-phase, 8 pole ²⁾	IE3	
≥ 7.5 < 75 kW	3-phase, 2/4/6 pole ²⁾	IE3	
	3-phase, 8 pole ²⁾	IE3	
≥ 75 ≤ 200 kW	3-phase, 2/4/6 pole ²⁾	IE3	IE4 ¹⁾
	3-phase, 8 pole ²⁾	IE3	
> 200 ≤ 375 kW	3-phase, 2/4/6 pole ²⁾	IE3	
	3-phase, 8 pole ²⁾	IE3	
> 375 ≤ 1,000 kW	3-phase, 2/4/6 pole ²⁾	IE3	
	3-phase, 8 pole ²⁾	IE3	
≥ 0.12 kW... ≤ 1,000 kW	Ex eb	Excluded	IE2
≥ 0.12 kW... ≤ 1,000 kW	1-phase		IE2
Motors specifically qualified for the safety of nuclear installations		Excluded	Excluded
High Voltage motors and DC motors		Excluded	Excluded
Variable speed drives ≤ 1,000 V		01.07.2021	01.07.2023 onward
0.12...1,000 kW (Diode bridge)		IE2	
Cabinet with already conformity assessed module			
Regenerative drives			
Low-harmonic drives (THD < 10%)			
1-phase drives			
AC drives with multiple AC outputs			
MV drives DC drives			

1) Exception: Brake motors with internal integrated brake, explosion protected motors 2) Exception: Ex eb, but including Ex t, Ex c, Ex d and Ex de

* Exception: Explosion protected motors specifically designed and certified for mining

General performance

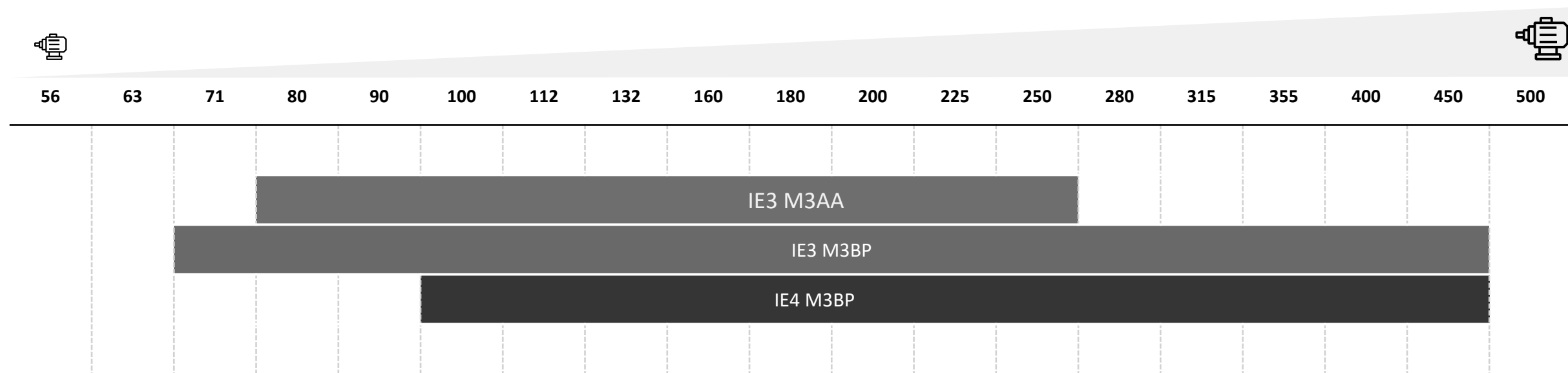
Product line M2BAX



● IE3 ● IE4

Process performance

Product line M3BP & M3AA



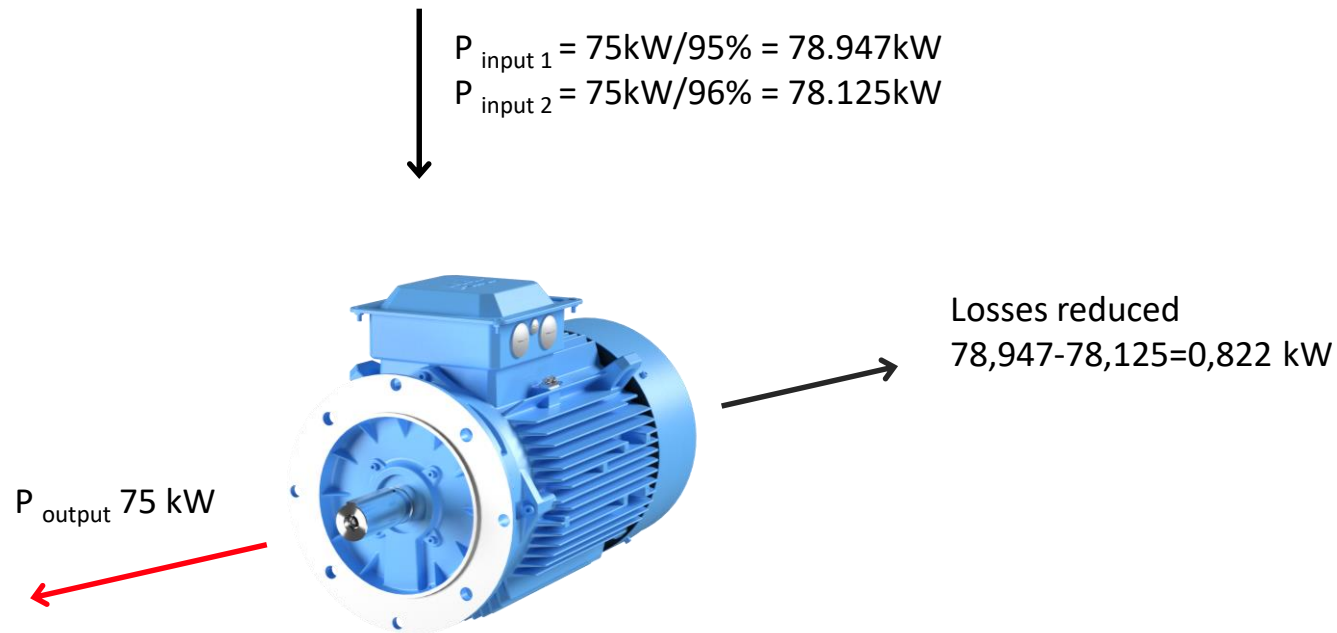
● IE3

● IE4

High efficiency brings more than just economic benefits

IE4 vs. IE3 - 75 kW 4-pole motor

1% efficiency increase and 20% reduction in losses



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75 kW motor in paper mill application



Energy cost £0.10/ kWh



Annual operating time, about of 8000 h

Annual energy savings:

0.822 kW x 8,000 hrs = 6576 kWh

Annual electricity saving:

6576 kWh * =£0.10/kWh = £658.00

Payback period:

about 14 months

Annual CO₂ reduction:

6576 * 0.709 = 4662 kg

- 1) The electricity cost is calculated according to method of the three stages of peak and valley.
- 2) Greenhouse gas emission is calculated based on U.S. Environmental Protection Agency data

Lifecycle of an electric motor – Environmental impact

CO₂ emissions during the lifecycle¹



Raw material extraction/ processing

Extraction of raw material and production of intermediate components

~0,03%



Design

Design of the motor



Manufacturing

Transportation and manufacturing at ABB site

~0,003%



Use

Transportation to customer and use of product at customer site

~99,96%



End-of-life

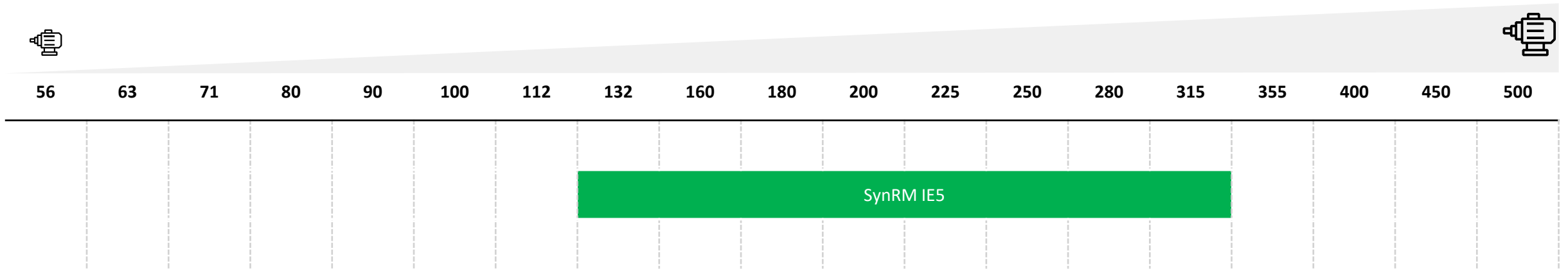
Disposal of the product and transportation to end-of-life management company

~0,0003%

1. Numbers based on LCA for 90 kW SynRM motor.

Process performance Motors

Product line M3BL



● IE5

ABB