



E-mobility International Workshop 2026: challenges and opportunities
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E-mobility & eDrive : Exemple of the MAXIMA project

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Funded by
the European Union

General context

- ✕ Massive electrification in automotive
 - Vehicle accessible to the majority
 - Manufacturing of low-cost components
- ✕ Sustainable development
 - Low environmental impact of components through all their life
 - High energy efficiency and recyclability including reuse
- ✕ Supply risk of Critical Raw Material (CRM)
 - Limitation of CRM use
 - Development of recyclability process



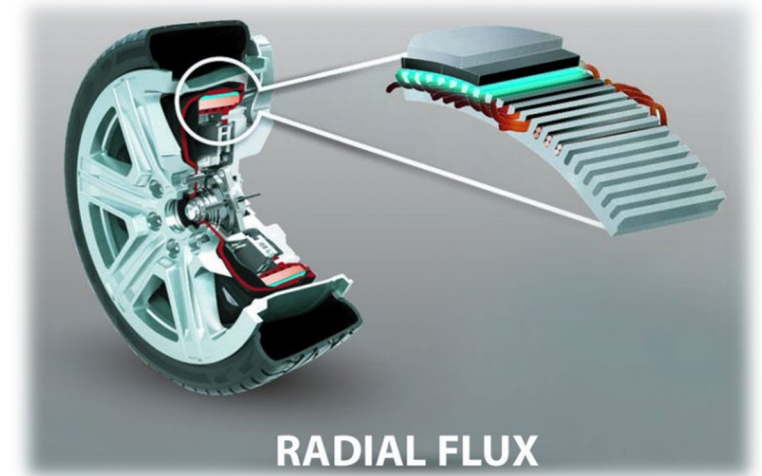
➤ Electrical machines for automotive

Most EM are **RADIAL** flux EM:

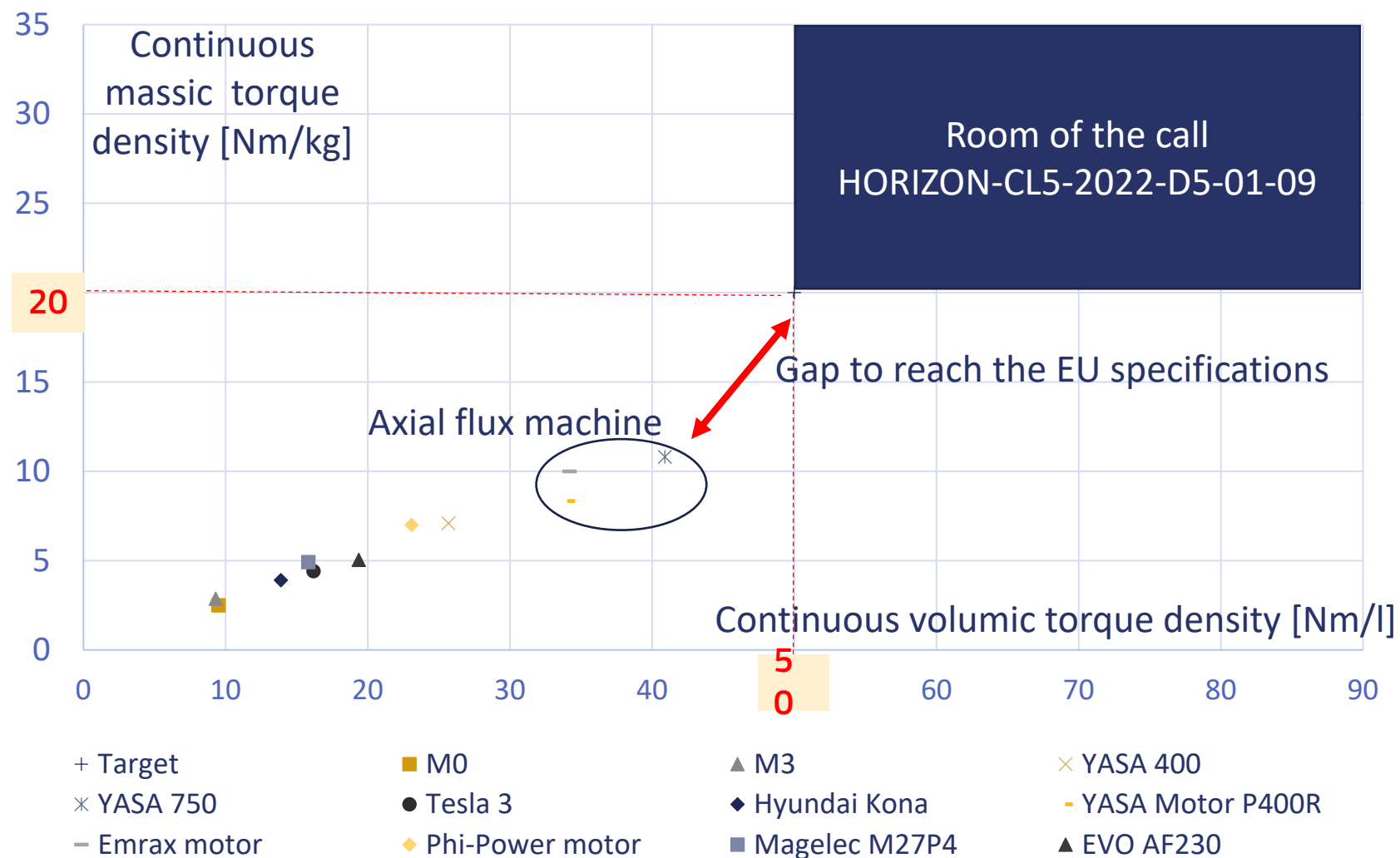
- Very good performances with PM
- Manufacturing well known
- Low cost

AXIAL flux machine in automotive

- Luxurious cars
- E-Sport



Market



Axial flux machine issues for automotive application

Axial flux machines is a good potential candidate to address the automotive core market (50kW-120kW) but:

- ✘ Performances below EU specifications

- ✘ Costly solution

- ✘ Use of CRM (PM)

Aim of Maxima project

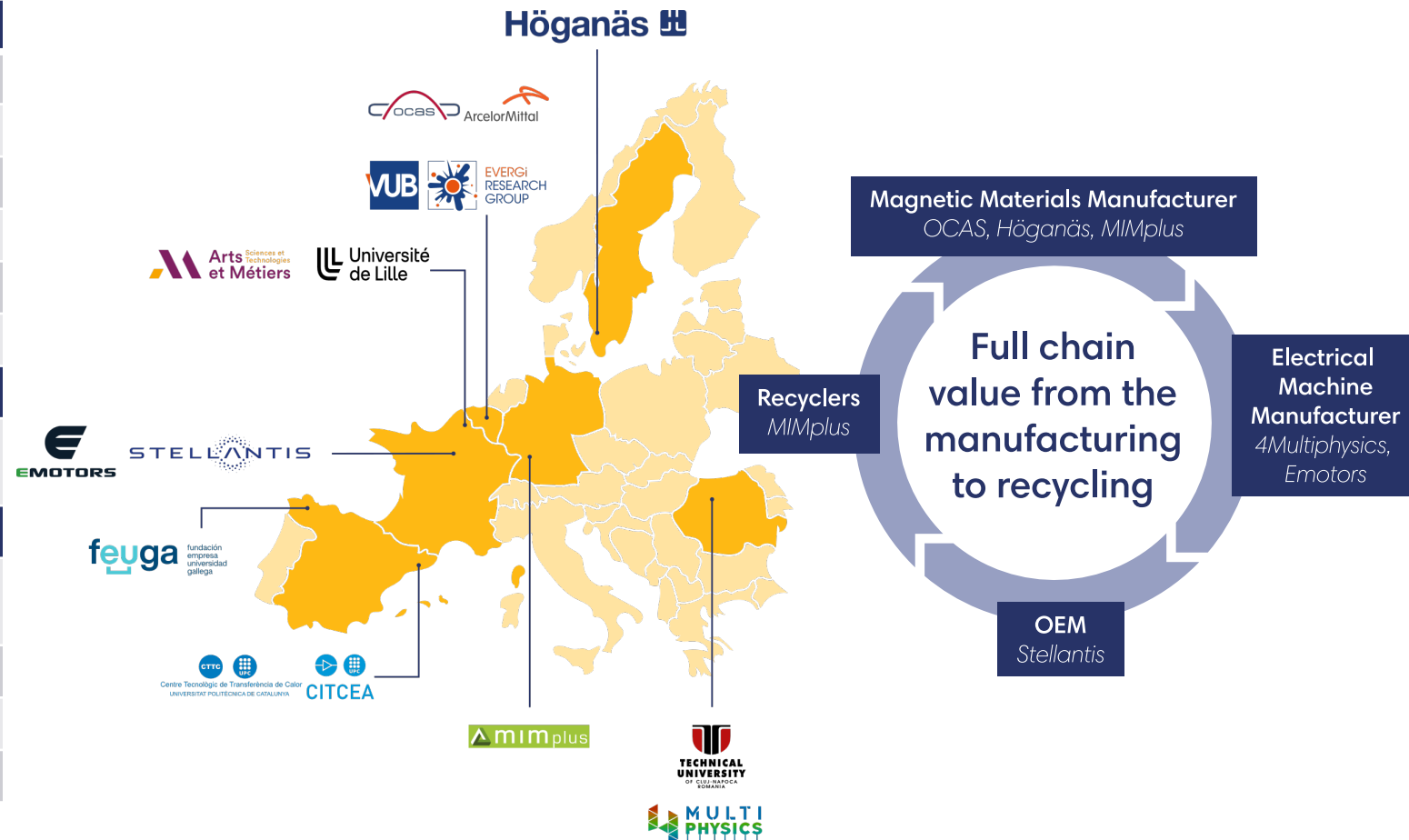
The ambition of MAXIMA is to design and develop a low cost modular PM axial flux EM for the automotive core market :

-  with improved performances,
-  integrating CRM less strategies,
-  with a low environmental impact.

> Consortium

Budget: 5,6M€
Duration: 4 years
Starting date: Feb. 2023

Companies	
Stellantis	OEM
Emotors	EM manufacturer
OCAS	Electrical steel supplier
Höganäs	Soft Magnetic Composite supplier
MIMplus	PM Manufacturer and Recycler
4Multiphysics	EM designer
Foundation	
FEUGA	Communication, Dissemination and Exploitation
Universities	
UPC	Thermal modeling and management Digital twin and control of EM
UTCN	EM design
VUB	Life Cycle Analysis
A&M&U.Lille	EM manufacturing, LCA, EM Digital Twin



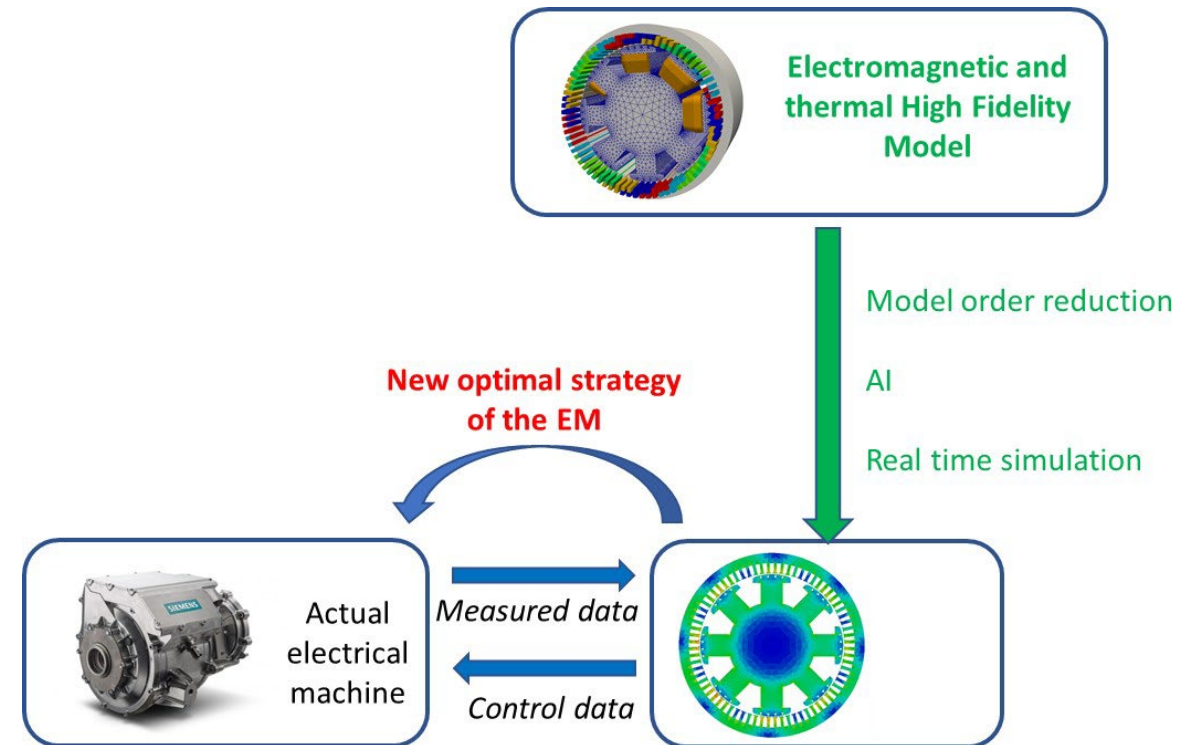
> Improvement pathways

✘ Performances below EU specifications

✘ Costly solution

✘ Use of CRM (PM)

Optimal control with Digital Twin to operate at the limit



> Improvement pathways

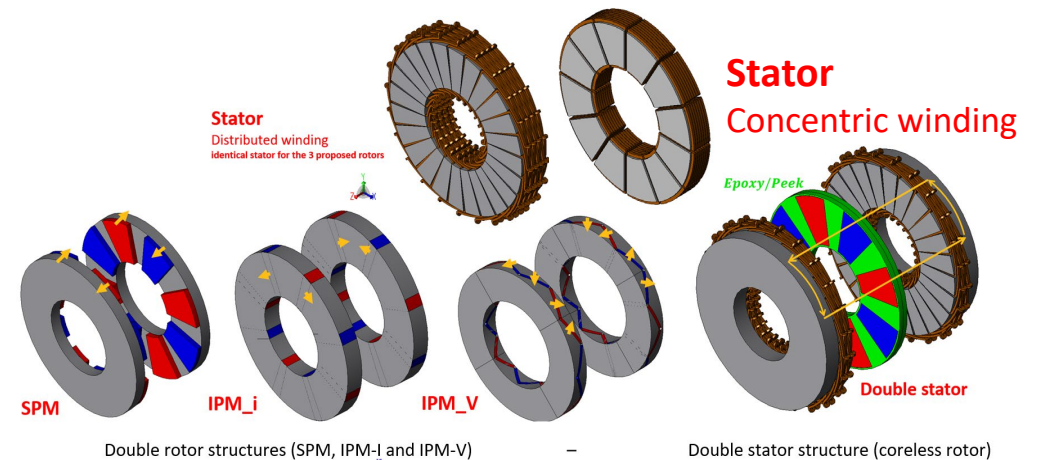
✕ Performances below EU specifications

Optimal control with Digital Twin to operate at the limit

Advanced multiphysics design combined with new concepts for thermal management

✕ Costly solution

✕ Use of CRM (PM)

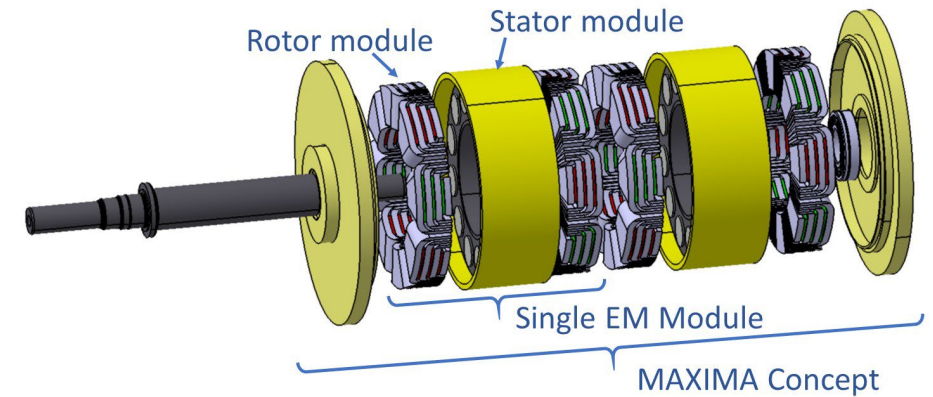


> Improvement pathways

✘ Performances below EU specifications

✘ Costly solution

✘ Use of CRM (PM)



Modular design

> Improvement pathways

✘ Performances below EU specifications

✘ Costly solution

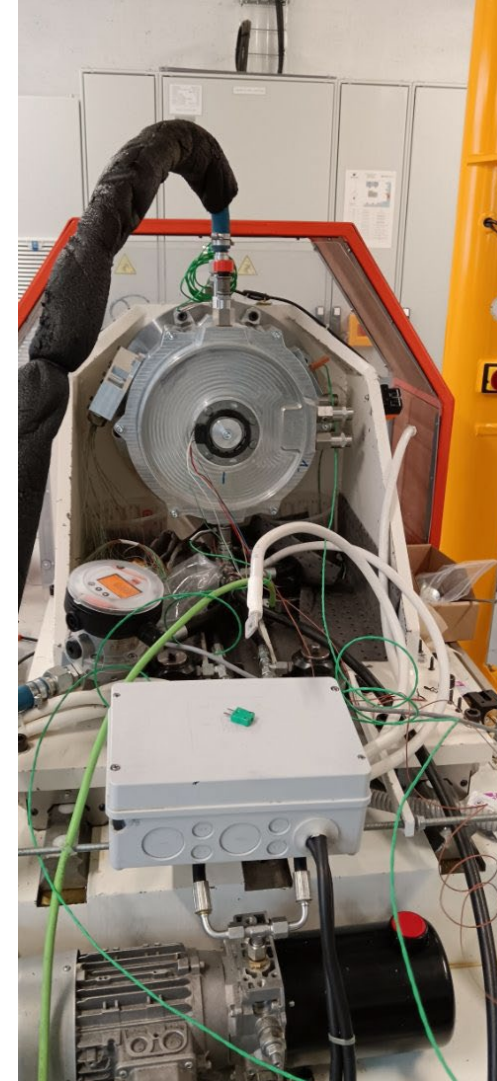


Modular design



Mass production oriented and innovative manufacturing

✘ Use of CRM (PM)

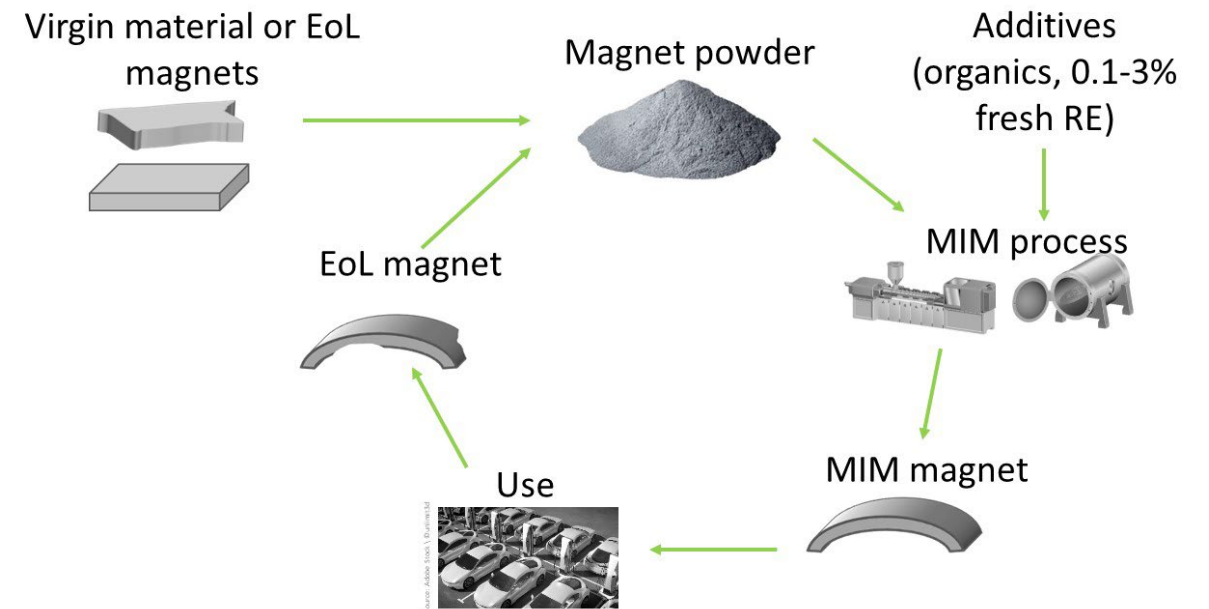


> Improvement pathways

✘ Performances below EU specifications

✘ Costly solution

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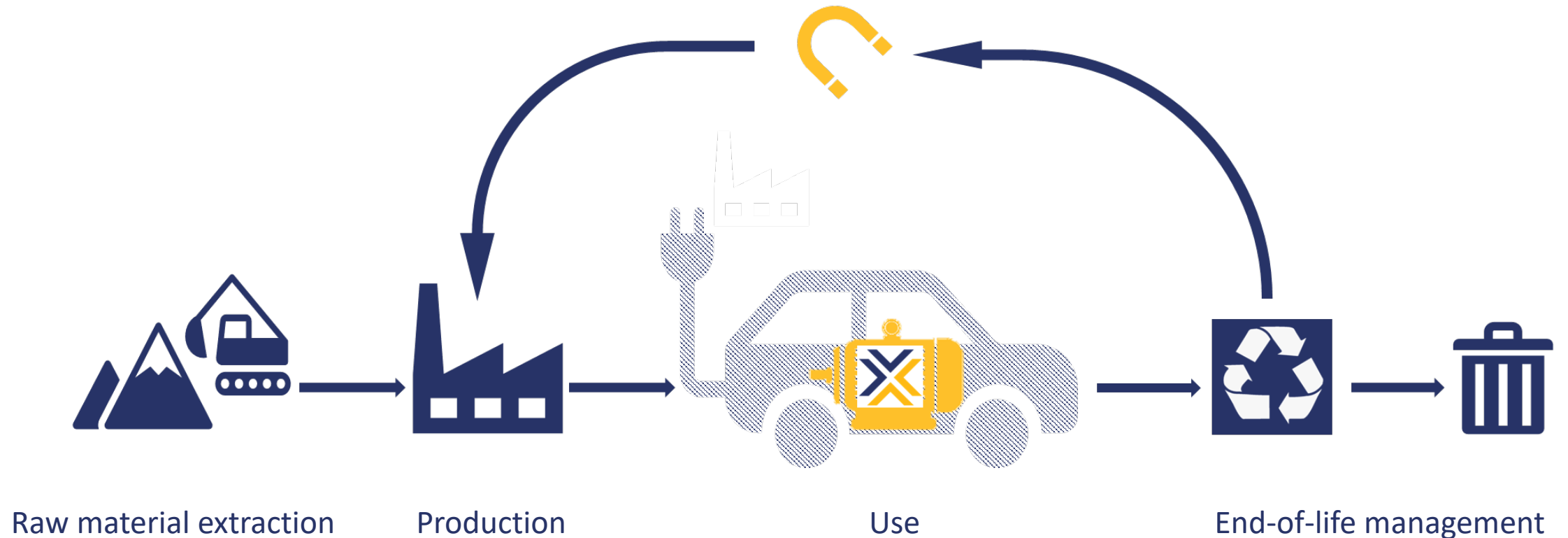


Disassembling and recycling of PM

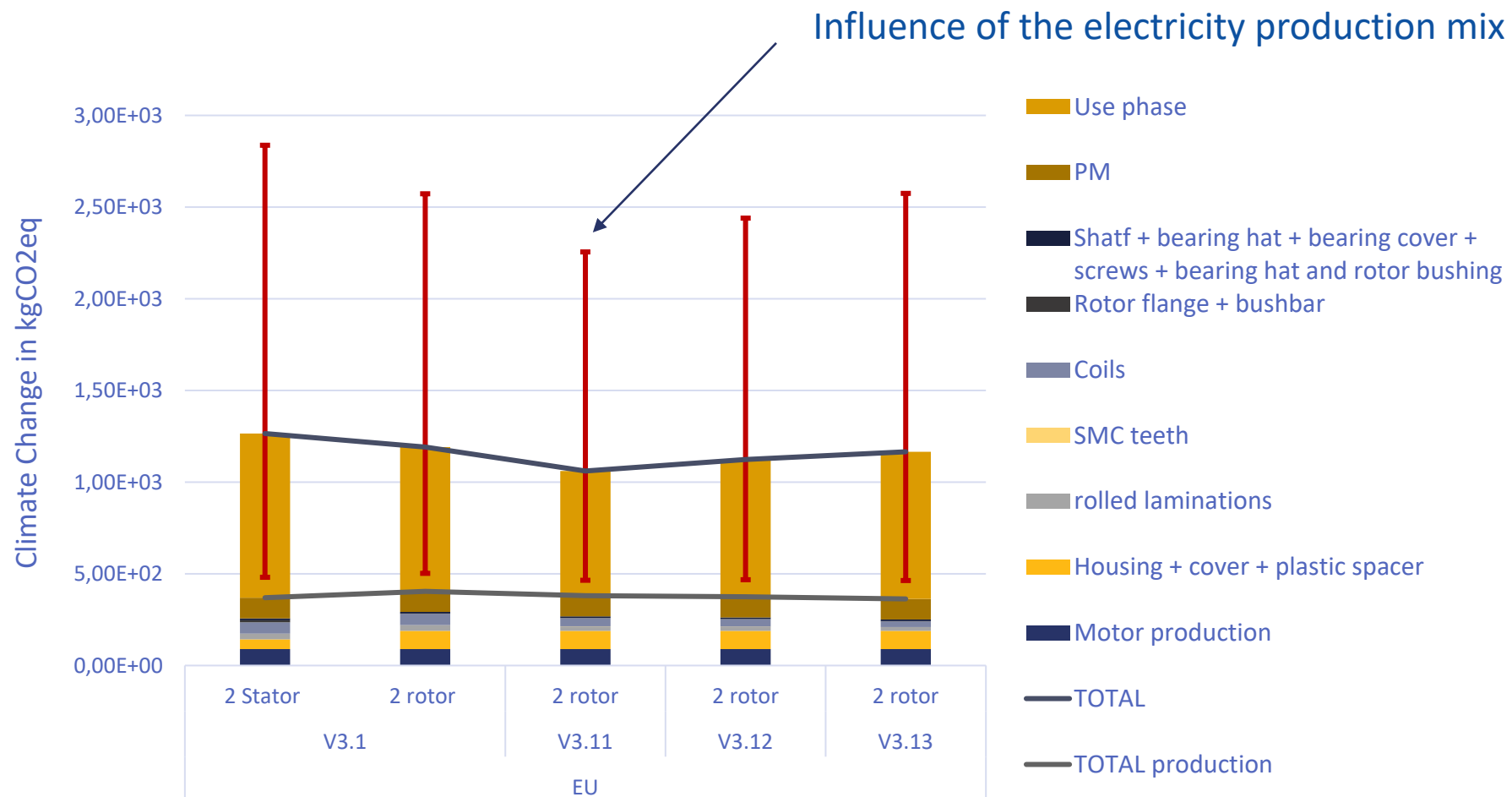
> LCA of an EM

✕ Main goal of LCA in MAXIMA:

- ❑ Providing information on critical sources of environmental impacts and supply risks of EM.
- ❑ Impacts on **climate change** and **mineral resource scarcity** are considered.
- ❑ Help to eco-design the machine considering environmental aspects



> LCA of an EM



THANKS

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