

# ReFreeDrive

Rare earth free e-drives featuring  
low cost manufacturing

Javier Romo, Fundación CIDAUT





*Foundation CIDAUT is a R&D Centre which promotes scientific investigation, technological development and innovation applicable to industry in general and to the transport and energy sectors in particular.*

**400** Industrial clients

**72** Millions Euros  
R&D facilities and equipments

**17,16** Millions Euros  
2017 Turnover

**3** Headquarters  
Spain, Germany and México

**15** New Technology Based Firms

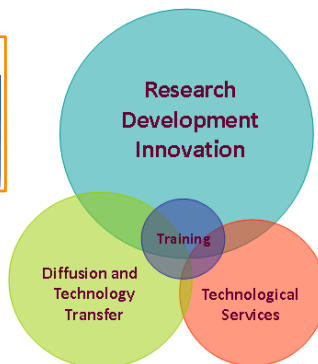
**23.304 m<sup>2</sup>**  
Total surface

**38** Patents

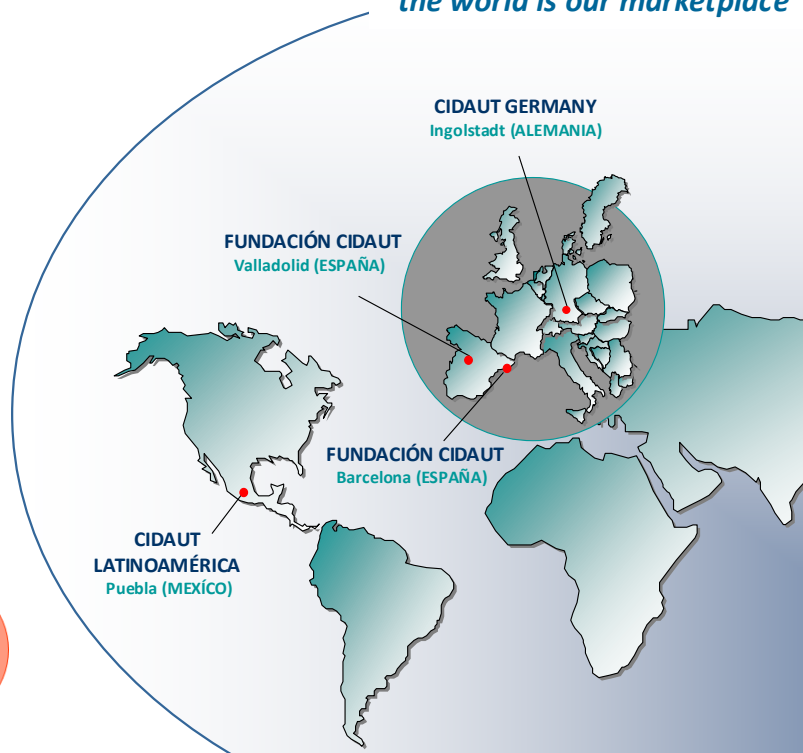
### *Our mission is*

*To increase competitiveness and industrial development of companies operating mainly in the transport and energy sectors*

*Strengthening their industrial fabric by increasing their technological capabilities, allowing the development of new products and processes*

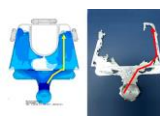


*the world is our marketplace*

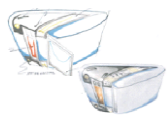


## MATERIALS - PRODUCT - PROCESS

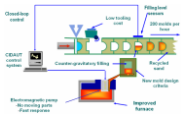
### LIGHT ALLOYS



### PRODUCT DESIGN



### PROCESS DESIGN



### MATERIALS



## ACOUSTICS & VIBRATIONS



## ENERGY AND ENVIRONMENT

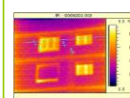
### BIOMASS



### ALTERNATIVE FUELS



### EFFICIENT BUILDING



### HYDROGEN TECHNOLOGIES



### PROPULSION SYSTEMS



### MAINTENANCE & DIAGNOSTIC



## SAFETY ON TRANSPORT

### ACTIVE SAFETY



### PASIVE SAFETY



### ACCIDENTOLOGY



### ROAD INFRASTRUCTURE



### HUMAN FACTOR



### MOTORIST SAFETY



## MOBILITY

### SMART TRANSPORT



### SUSTAINABLE MOBILITY



### MOBILE ENGINEERING



## BIOMEDICAL ENGINEERING



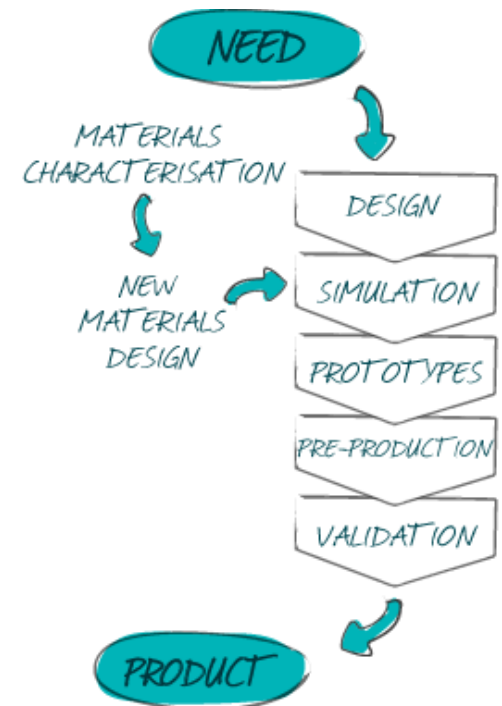
## The keys to our success

CIDAUT carries out each and every stage of product development from the conception of a new idea, selection and analysis of materials, simulation activities, processing, prototype product and tooling design and manufacturing and pre-industrialization tasks, including the final validation of the product.

CIDAUT generates the necessary knowledge and manages its transference to the customers, so they can achieve their own goals and a greater competitiveness in the market.

More than 400 industrial customers are enough assurance to validate that our methodology is working

- ✗ Exclusivity
- ✗ Confidentiality
- ✗ Knowledge transfer



Complete product development cycle

Our work methodology is guarantee for success



# ReFreeDrive Project Overview

## General Figures

**Title:** Rare earth free e-Drives featuring low cost manufacturing

**Acronym:** ReFreeDrive

**Grant Agreement No:** 770143

**Topic:** GV-04-2017

**Project Total Costs:** 5,999,131.25€

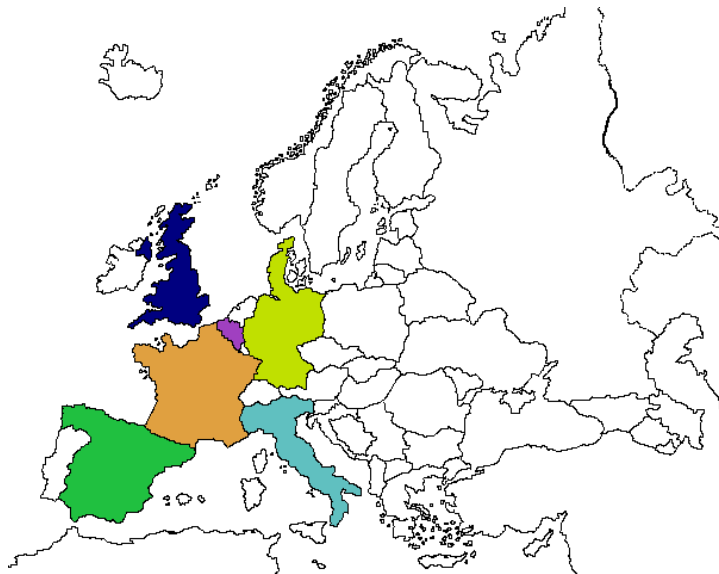
**Total EU Contribution:** 5,999,131.25€



# ReFreeDrive Project Overview

## Project Partners and Locations

ReFreeDrive Consortium is composed of 13 partners in six European countries



3

### UNITED KINGDOM

European Copper Institute  
Motor Design Limited  
Jaguar Land Rover

1

### BELGIUM

Aurubis

1

### FRANCE

IFP Energies Nouvelles

6

### ITALY

Università degli studi dell'Aquila  
Rina - Centro Sviluppo Materiali  
Tecnomatic  
Mavel  
R13 Technology  
Privé

1

### SPAIN

Fundación Cidaut

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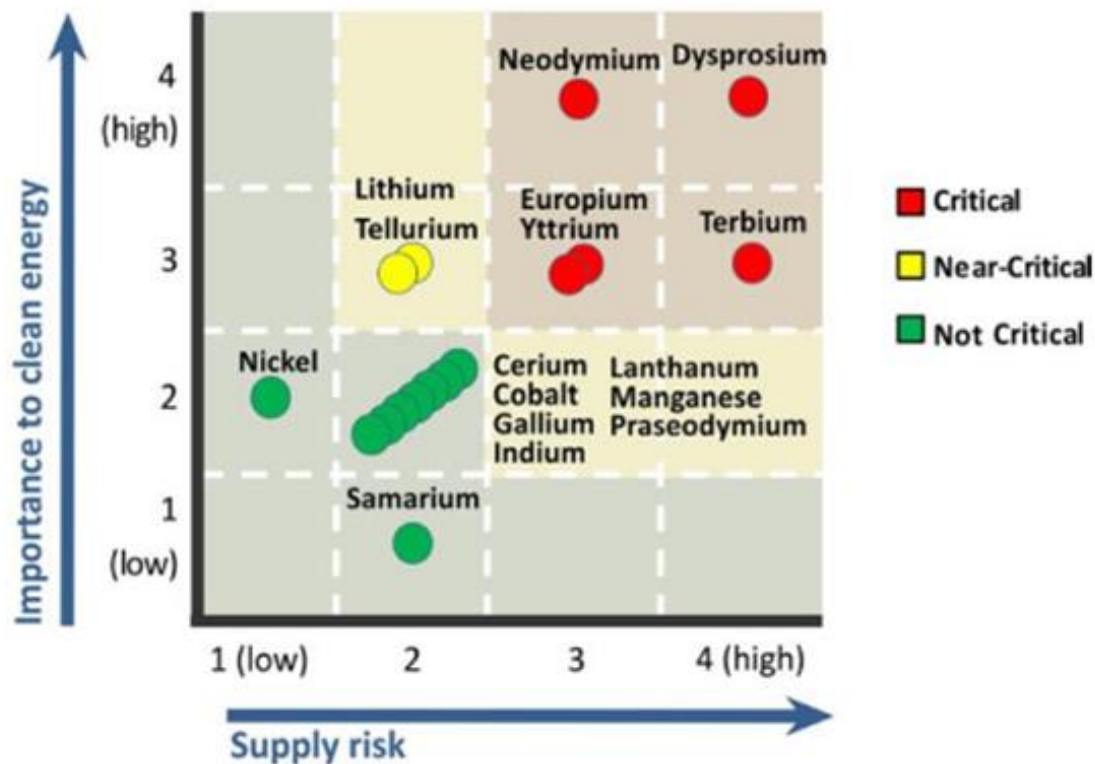
### GERMANY

MetallGiesserei  
Breuckman



# ReFreeDrive Project Overview

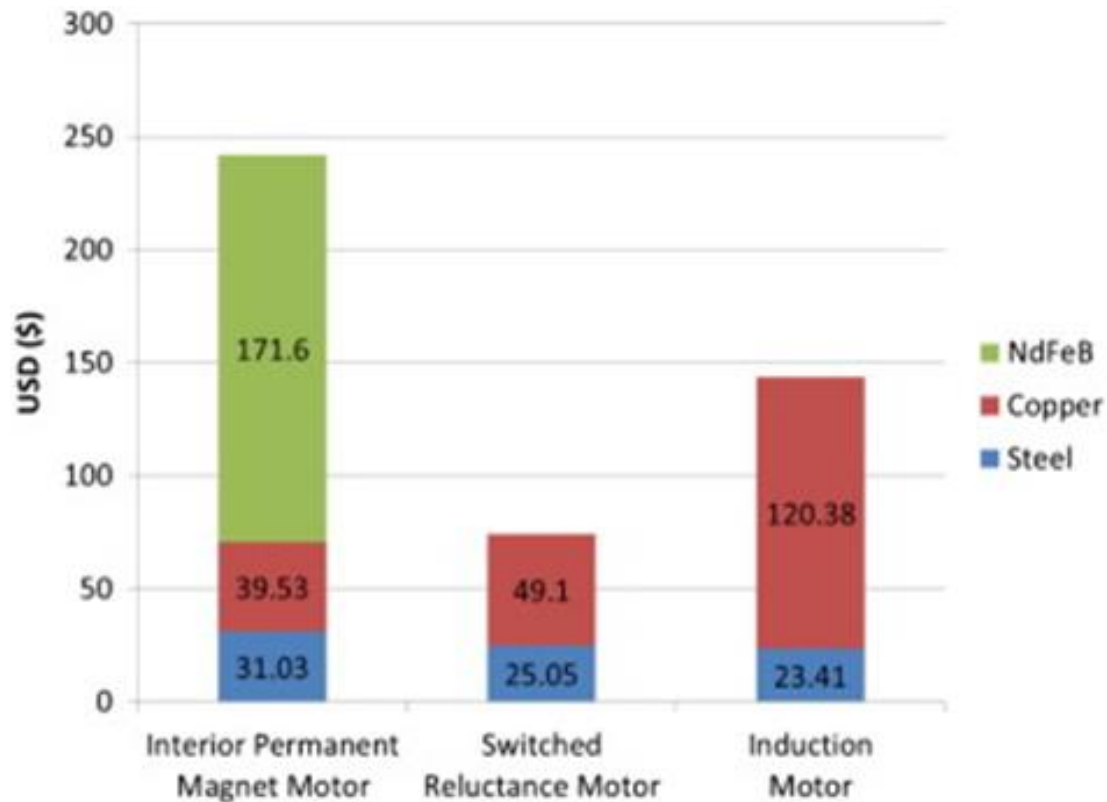
Why rare earth elements free?



## SUPPLY RISK

# ReFreeDrive Project Overview

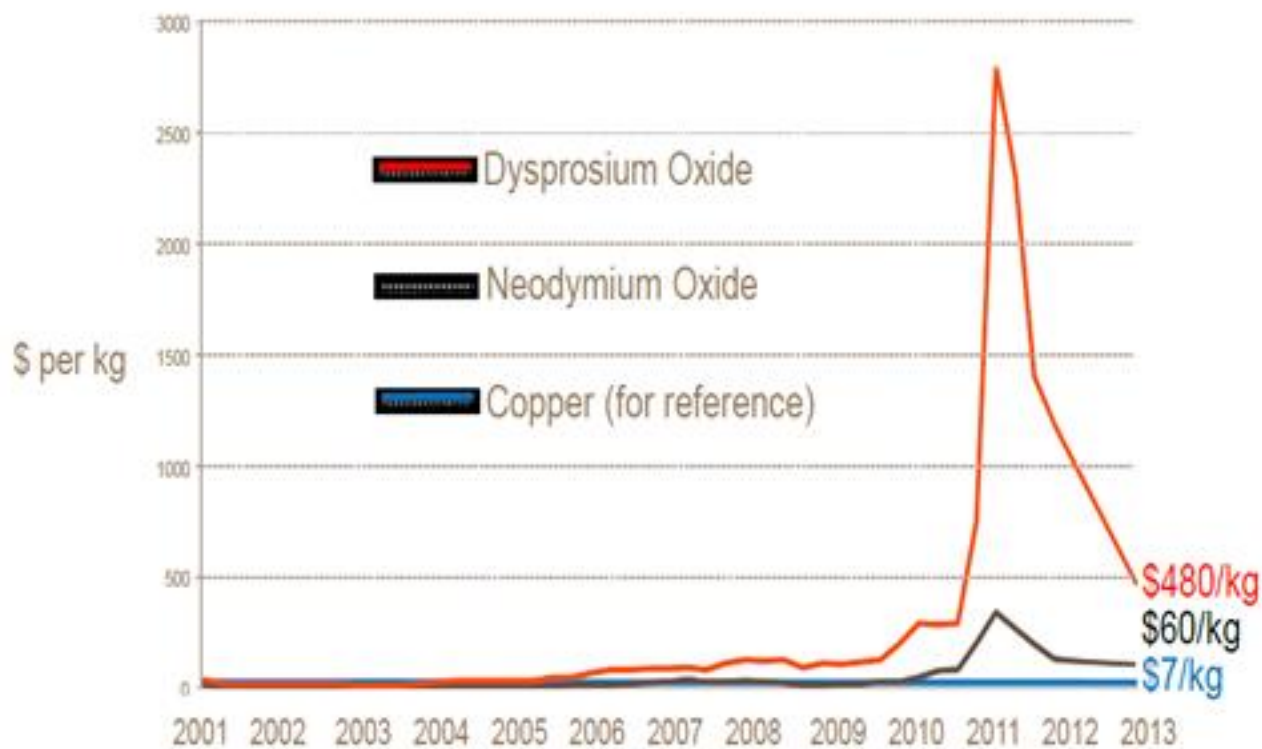
Why rare earth elements free?



**COST**

# ReFreeDrive Project Overview

Why rare earth elements free?



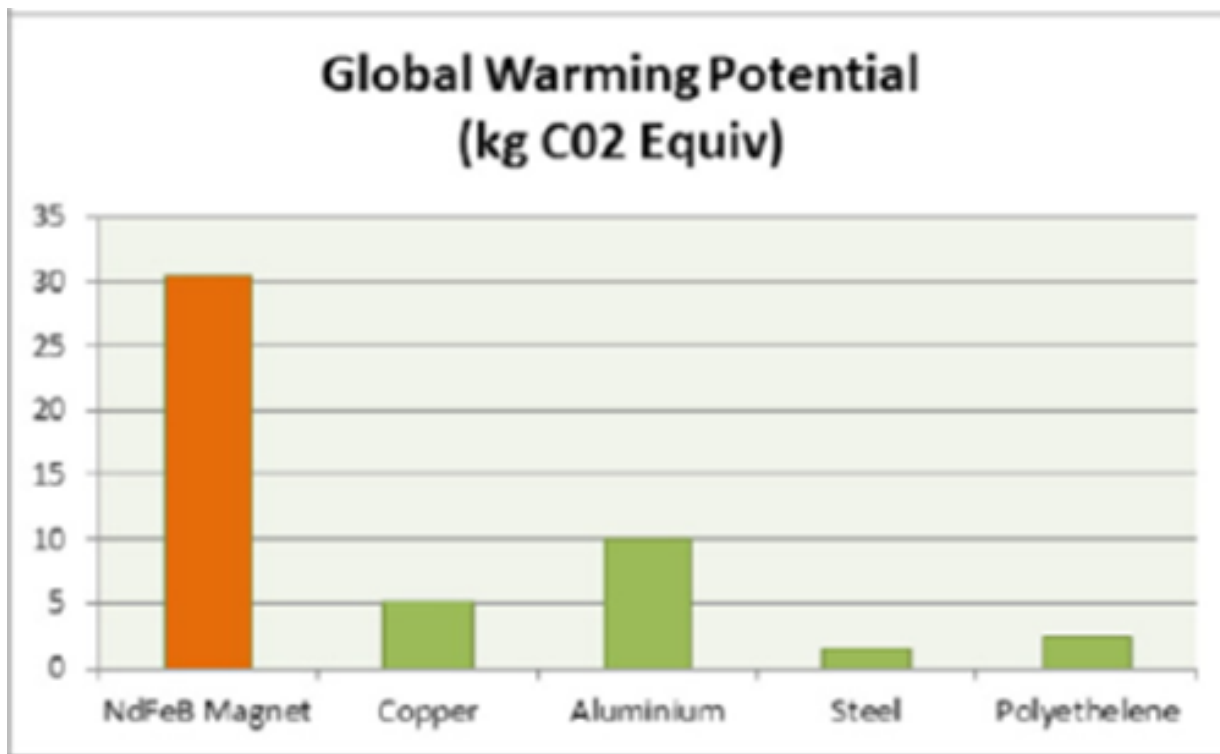
Source: metal-pages.com, Kidela Capital

## MARKET UNCERTAINTIES



# ReFreeDrive Project Overview

Why rare earth elements free?



## ENVIRONMENT & LCA

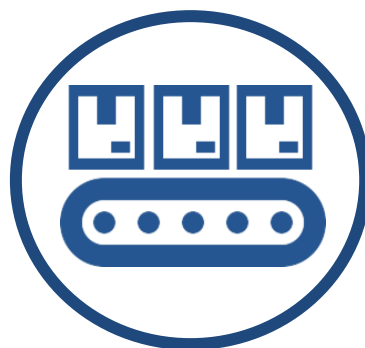
# ReFreeDrive Project Overview

## Project Objectives

- The main aim of this project is to develop **rare earth-free traction technologies**



**INDUSTRIAL  
FEASIBILITY**



**MASS  
PRODUCTION**

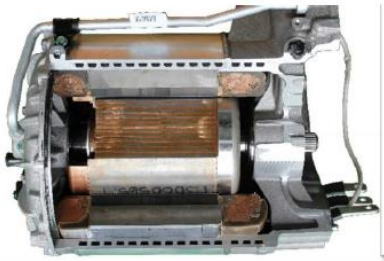


**LOWER  
COSTS**

# ReFreeDrive Project Overview

## Target figures

**Benchmark  
Tesla S60**



**30% INCREASE  
SPECIFIC TORQUE**



**50% MOTOR  
LOSSES REDUCTION**

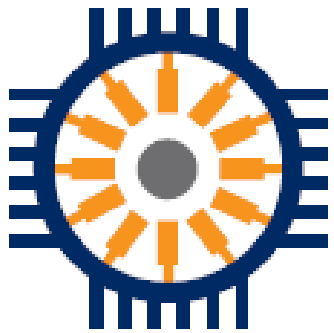


**15% COST  
REDUCTION**



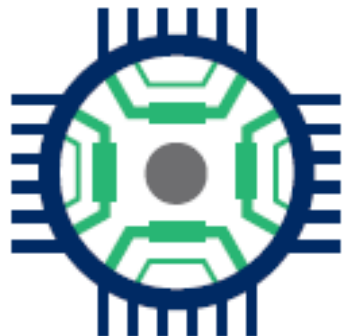
**50% INCREASE OF  
POWER DENSITY IN  
POWER ELECTRONICS**





### Induction machines with copper rotor

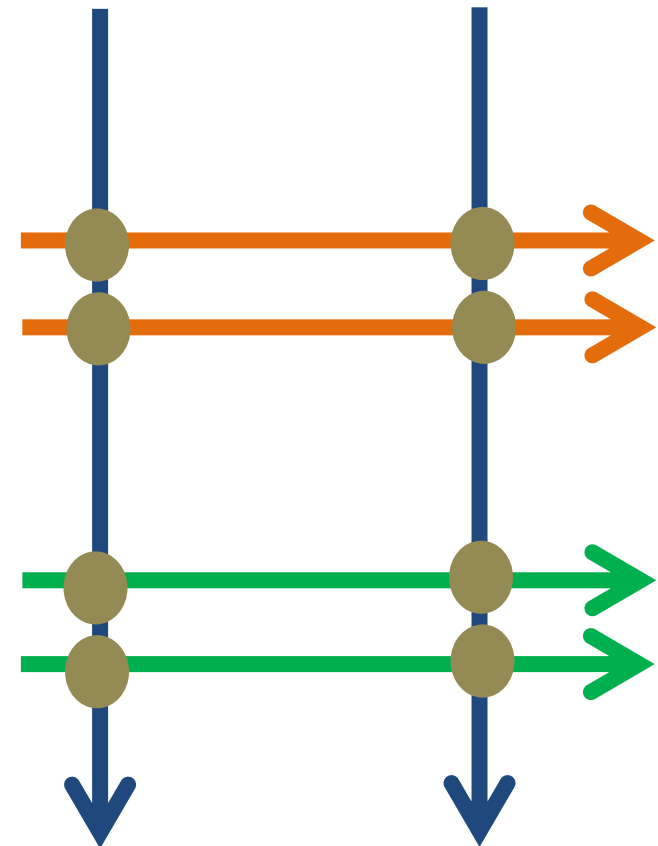
Fabricated  
Die Cast



### Synchronous reluctance machines

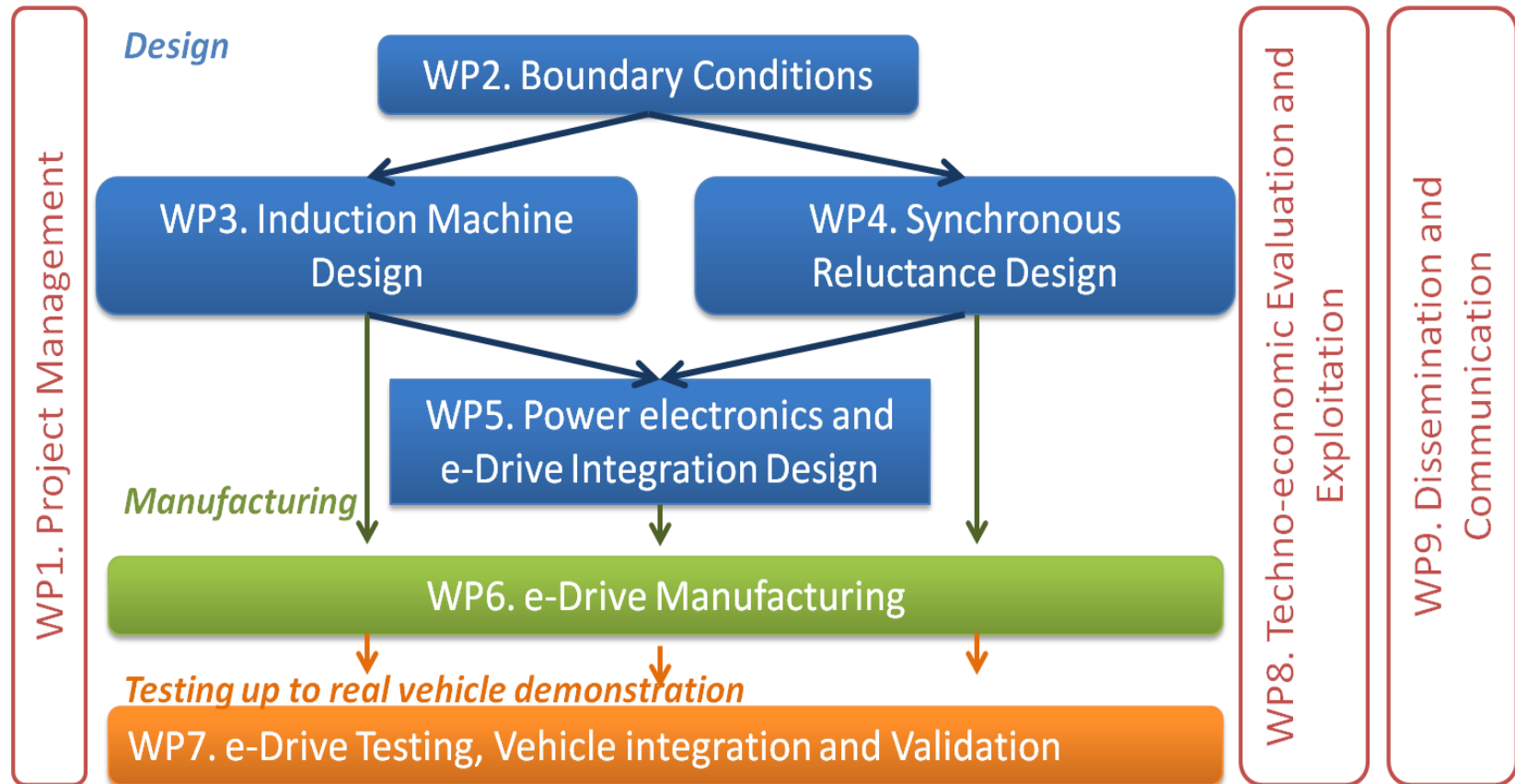
PMassisted  
Without PM

75kW and 200kW



# ReFreeDrive Project Overview

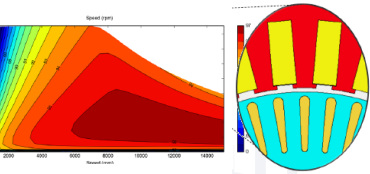
## Project Structure



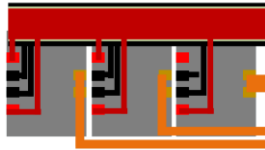


# ReFreeDrive Project Overview

## Consortium tasks



**Motor Design & Manufacturing**



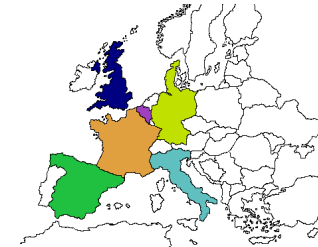
**Power electronics**



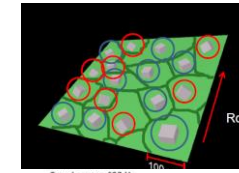
**Vehicle integration & testing**

**Project coordination**

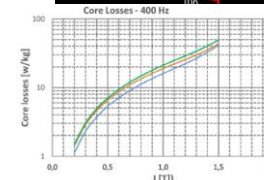
**Copper**



**OEM Validation**



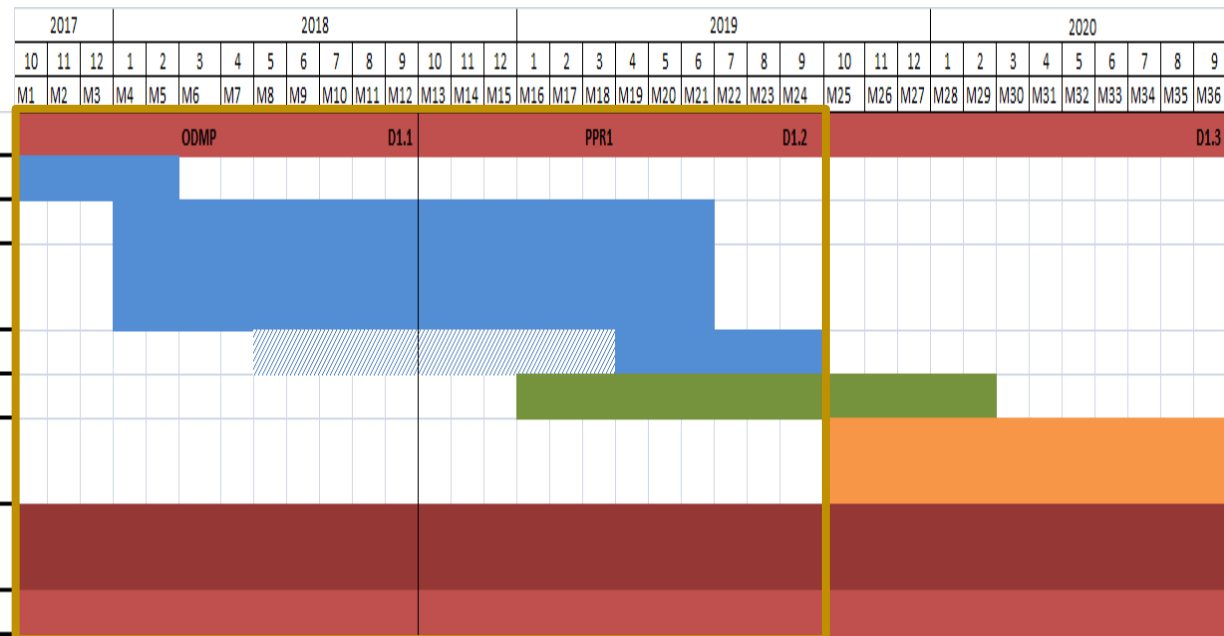
**Steel**

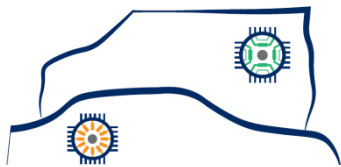




# ReFreeDrive Project Overview

## First Year

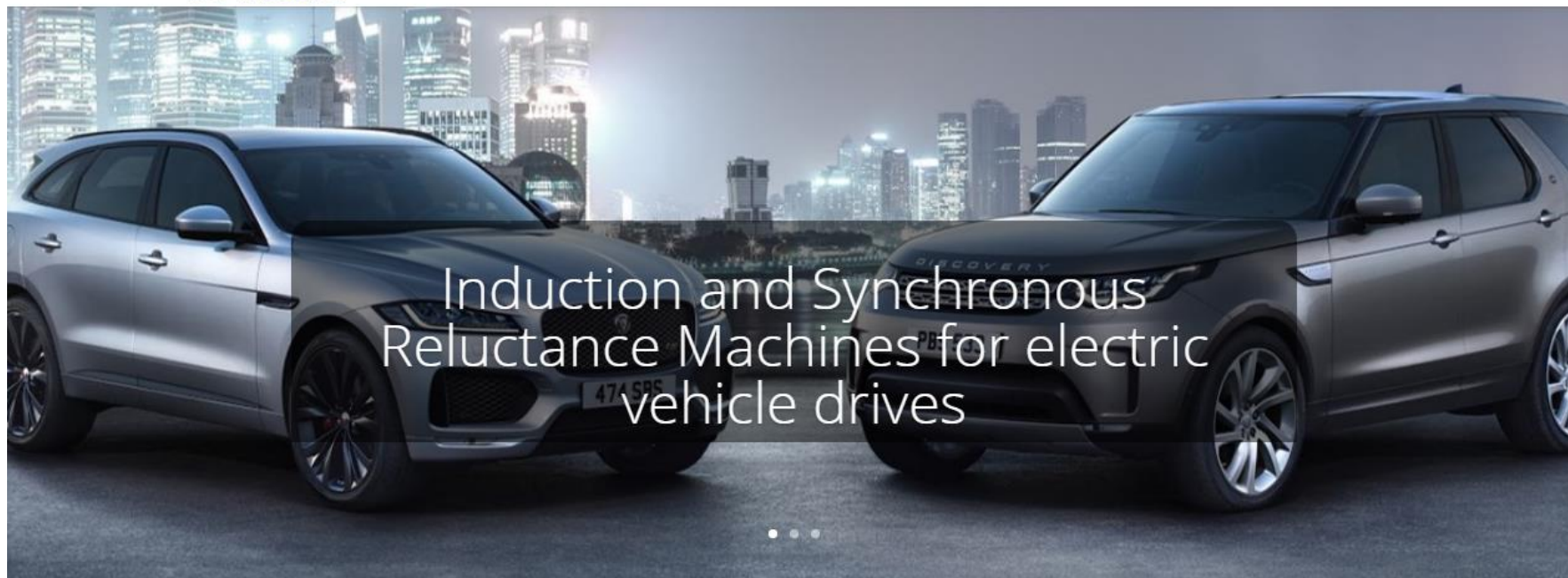




www.refreedrive.eu



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Rare Earth Free e-drives featuring low cost manufacturing

LATEST NEWS





# ReFreeDrive in the Electric Drivetrain Innovation Cluster



<https://www.linkedin.com/company/electric-drivetrain-innovation-cluster/>

Contact us



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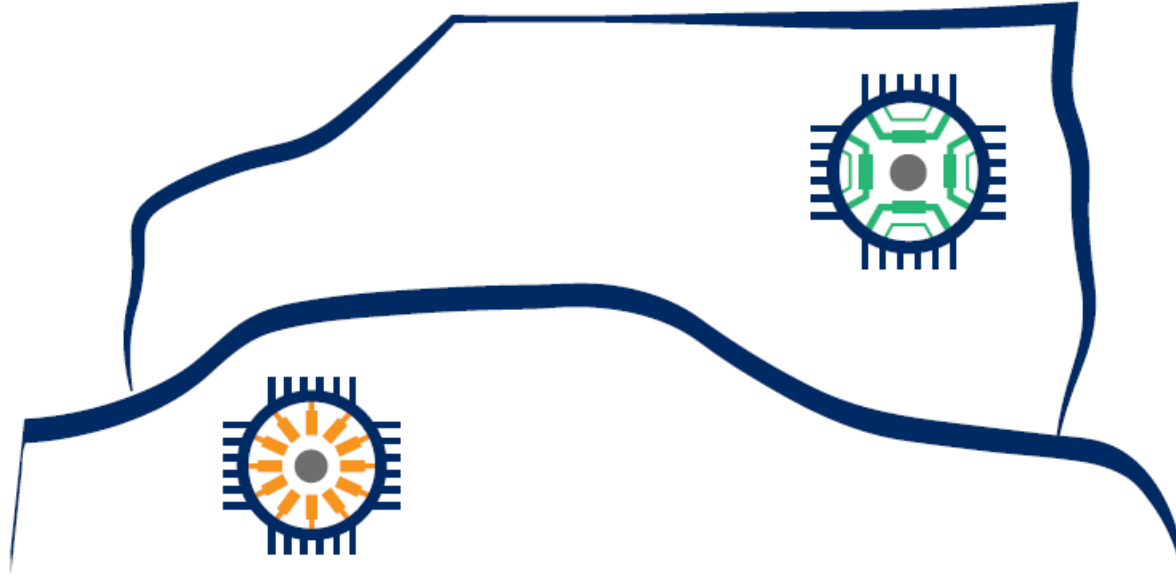


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# ReFreeDrive

Thank you for your attention!

