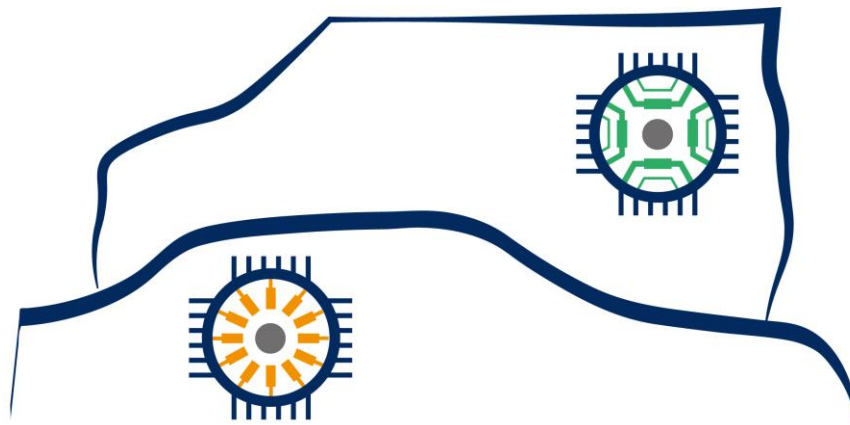




Rare Earth Free e-Drives Featuring Low Cost Manufacturing



ReFreeDrive

Collaborative Project
 Grant Agreement Number 770143

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Participants(s):	All project partners
WP contributing to the deliverable:	WP3, WP4, WP5, WP6, WP8
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Abstract:

This report describes the progresses and achievements of ReFreeDrive project in the period from 01.07.2018 (M10) to 31.07.2019 (M22). In this period several management procedures have been carried out, such as risk management, open data management, reporting to the EC, monitoring of the project progress, etc. Design of induction motor, pure synchronous reluctance motor and permanent magnets assisted reluctance motor has been carried out, ensuring the accomplishment of the Key Performance Indicators defined in the project proposal. Power electronics and control algorithm for all motor topologies have been developed. Some integration activities have also been made. The first draft of the techno-economic evaluation and results exploitation is summed up, as well as the first iterations of the Life Cycle Analysis. Although the information is individualized for each Work Package, interactions between them are also considered. All the Work Package Leaders have participated in the writing of this report.

Abbreviations

ATF: Automotive Transmission Fluid	MDL: Motor Design Limited
AUR: Aurubis	MOS: Metal-Oxide Semiconductor
BEM: Boundary Element Method	NGO: Non-Grain Oriented
BOM: Bill of Materials	OD: Outer Diameter
CAN: Controller Area Network	OEM: Original Equipment Manufacturer
CFD: Computer Fluid Dynamics	OR: Outer Rotor
CID: Fundación Cidaut	PCB: Printed Circuit Board
CPU: Control Power Unit	PM: Permanent Magnets
CR: Copper Rotor	PMA Synrel: Permanent Magnets Assisted Synchronous Reluctance Motor
Cu-ETP: Copper Electrolytic Tough Pitch	PRI: Privé
DRV: Drivers	PSU: Power Supply Unit
GA: Grant Agreement	SG: Spiral Groove
ECI: European Copper Institute	SynRel (SyncRel): Synchronous Reluctance
ECU: Engine Control Unit	UAQ: Università dell’Aquila (University of L’Aquila)
EV: Electric Vehicle	WJ: Water Jacket
EWG: Ethylene-Water-Glycol	WLTP: Worldwide Light Vehicle Test Procedure
FE: Finite Element	WP: Work Package
FEA: Finite Element Analysis	
FEM: Finite Element Method	
GO: Grain Oriented	
HMI: Human-Machine Interface	
IFPEN: IFP Energies Nouvelles	
IGBT: Insulated Gate Bipolar Transistor	
IM: Induction Machine	
IPR: Intellectual Property Rights	
IR: Inner Rotor	
JLR: Jaguar Land Rover	
KPI: Key Performance Indicator	
LCA: Life Cycle Assessment	
MAV: Mavel	

Executive Summary

This document reports the project progress during the period from M10 (July 2018) to M22 (July 2019). It reviews the technical achievements of the Work Packages (WPs), the work carried out and the coming activities for the next period. The main objective of this deliverable is to provide a summary of the work done so far and reflect the project current status from a global perspective:

- WP3 and WP4 have optimized the designs of their respective technologies, Induction Machines (IM, WP3) and Synchronous Reluctance machines (SynRel, WP4) with respect to the preliminary analysis shown in D1.1 (M9). Different motor configurations have been studied for each technology from an electromagnetic, mechanical and thermal point of view, in order to ensure the accomplishment of the Key Performance Indicators (KPIs) defined in the proposal stage, as well as their right operation in their final application. Downscaling procedure from 200kW to 75kW has been defined.
- WP5 has been kicked off in advance (M9) to follow the progress of the motor designs. This WP has defined the most suitable motor control algorithms for IM and SynRel motors using simulation platforms (D5.1), the motor electronic control unit and power electronics for the High Power Range Electric Drive (D5.2) and for the Medium Power Range Electric Drive (D5.3).
- WP6 has defined single actions for each manufacturing activity planned. Sub-contractors have also been identified, who will deal with some processing and motor assembling activities. The risks deriving from the prototyping steps and the mitigation actions have also been highlighted.
- WP8 covers the exploitation of the technological solutions developed within the project, for which a first Intellectual Property Rights (IPR) draft and a business plan have been defined. A technological watch of the main Electric Vehicles (EVs) markets and electric motor technologies has been performed.

This D1.2 deliverable has fully met its objectives. No deviations have been found in the deliverable or in the project progress in content, time or impacts, as set out in the Grant Agreement (GA).