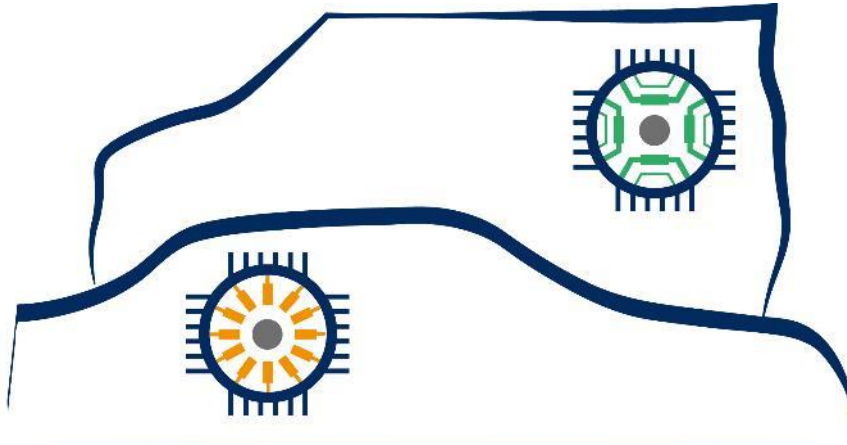




Rare Earth Free e-Drives Featuring Low Cost Manufacturing



ReFreeDrive

Collaborative Project

Grant Agreement Number 770143

Start date of the project: 1st October 2017, Duration: 36 months

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Abbreviations

PE: Power Electronics

SiC: Silicon Carbide

WP: Work Package

KPI: Key Performance Indicators



1 Executive Summary

The present report provides an overview on the activities inherent the design of the Medium Range Power Electronics (PE) (75kW) for the ReFreeDrive Project, Task 5.3.

The main goals of these activities are:

- Components Selections;
- Medium Power Range e-Drive Design;
- Mechanical Integration of the Medium Power Range e-Drive with the motor housing.

The Key Performance Indicators (KPI) at component level are (Table 1):

Table 1: CL-KPI of 75 kW power electronics drive

PE KPI	75kW baseline	Nissan Leaf 2012 (75kW baseline)	RFD GOALS	75 kW Design
Specific Power (kW/kg)	10 - 12	4,9	13,7	7,5
Power Density (kW/ liter)	10 - 12	5,7	12,9	9,47
Efficiency (%)	95 - 97	95	98-99	98,7
Power electronics Cost (\$/kW)	5 - 7	10	3,8	6

This report contains the design steps for medium power electronics drive and the mechanical integration proposal. Starting from Work Package 2 (WP2) requirements for power electronics and gathering the information about electric motor from WP3 & WP4 a full Silicon Carbide (SiC) inverter has been developed.

The activities mainly focused on:

- Selection and studies of various architectures;
- Selection of main components;
- Electrical boards design;
- Schematics and layout of electrical boards;
- Integration proposal;
- Developing IGBT based power electronics.



The results in Table 1 about KPI are inferior to the expectations because:

- The baseline values and the RFD goals were too optimistic for the 75kW, (see new data about Nissan Leaf).
- This power rating and the selected voltage rating (400V) is penalized by the package and voltage of commercially available SiC modules;
- The design choices was mainly focused to the 200kW target power application, which report outstanding performances (Specific power > 20kW/kg; Power Density >20kW/Liter). The scalability to 75kW do not gives advantages in terms of power density and specific power.
- Reference KPI was for peak performances of the PE of 75kW, while the developed PE has a rated power of 75kW.

Nevertheless, the comparison with the Nissan Leaf 2012 highlights a general improvement in the performances, including efficiency and price reduction confirming the validity of the design choices.

The impact of the tasks described in D5.3 are:

- Design of the medium range PE available for the project development;
- Increased know-how in the SiC technology;
- Increased know-how in components selection;
- Increased know-how in mechanical integration;

The recognized barriers and risks do not affected the development of the task 5.3.

According to the consortium agreement each partner involved can use their own work and related results included in this deliverable for dissemination.

In D5.3 there have been no relevant deviations in content or time for the deliverable objectives set out in the ReFreeDrive Grant Agreement. Activities have been anticipated from M19 (April 2019) to M7 (April 2018) to support the motor design tasks without impact on the budget.