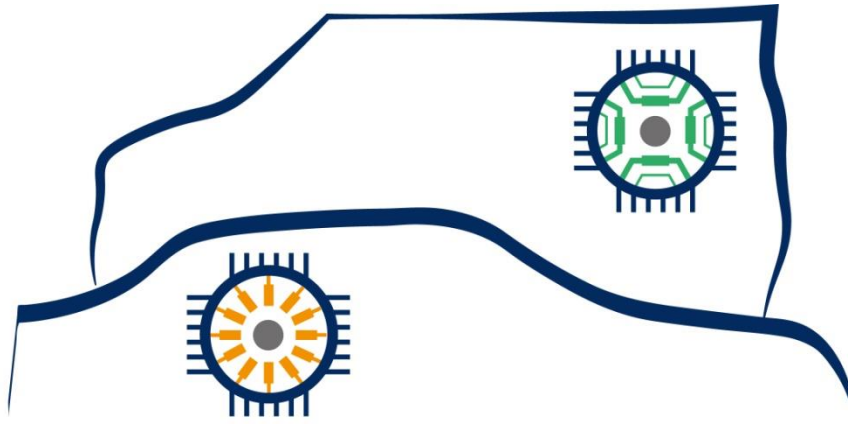


Rare Earth Free e-Drives Featuring Low Cost Manufacturing



ReFreeDrive

Collaborative Project
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Executive Summary

This report aims to show the findings extracted for a Life Cycle Assessment (LCA) performed on the motors developed within the REFREEDRIVE project. This study has been carried out by CIDAUT, in Task 8.2 within REFREEDRIVE Work Package 8 (WP8).

To performance this LCA task within the REFREEDRIVE project, as part of the final evaluation of the developed motors (environmental impact), it has been necessary to handle information previously generated in activities mainly related with WP3 (Induction Machine Design), WP4 (Synchronous Reluctance Machine Design) WP5 (e-Drive Design) and WP6 (Prototypes manufacturing).

The fulfillment degree of the objectives in D8.2 is complete, without any deviations on time or content with respect to what was stated in the Grant Agreement..

LCA is the methodology used for evaluating the environmental loads of manufacturing processes for the electrical motors developed within REFREEDRIVE, according to ISO 14040:2006 and ISO14044:2006 standards, from a "Cradle-to-Gate" approach.

With this LCA, an estimation of the potential environmental impacts related to the manufacturing process for each REFREEDRIVE electric motors (75 kW and 200 kW) has been performed, taking into account the different technologies employed during the project (Induction machines and also Permanent Magnet assisted (PMA) and Pure Synchronous Reluctance (SynRel) machines).

That LCA has provided an accurate comparison of environmental impacts among the different developments within the REFREEDRIVE project, but also in comparison with a representative motor type for electric vehicles (NdFeB permanent magnet - NdFeB PM - SynRel machine), currently employed in automotive industry.

In general, and as a result of the findings obtained from the Life Cycle Assessment, it can be confirmed that the motors developed in the REFREEDRIVE (RFD) project present a lower environmental impact than the motors used as reference in the study (NdFeB PM SynRel). This is mainly due to an optimized design, which results in a proper use of materials (less material needed, less environmental impact), but above all, to the elimination of the use of NdFeB permanent magnets.

The use of NdFeB PM significantly marks the environmental impact of the manufacturing process for the reference motors, despite its small contribution to the overall motor weight (just 3%). Therefore, the lack of this material (NdFeB magnets) in the manufacture of RFD motors makes its environmental impact significantly lower than impact of reference motors.

The present report provides the Life Cycle Inventory (LCI), involving data collection and modelling of the manufacturing processes for the different RFD motor technologies and power, but also, the manufacturing processes of the benchmarking motors. For each identified manufacturing process, data for incoming/outgoing flows are presented in tables along the report.

Finally, Life Cycle Impact Assessment (LCIA) results from the different electric motors within the performed LCA are introduced, for each environmental impact category related with the selected method (ILCD - International Life Cycle Data system) for the environmental impact evaluation.