Editorial

Dear reader,

After two years of active efforts, the design and prototyping phase of our project has been finalized and components and subsystems have been released; bench and laboratory tests have confirmed results from simulations.

Outcomes achieved so far make some of RESOLVE strategies concrete. One of the barriers that limits a widespread adoption of L-Category electric vehicles is the cost; so, in order to overcome such a barrier, RESOLVE has been following different but complementary strategies: modularity, scalability, functional integration and technology transfer of existing solutions.

The modular battery pack is obtained by assembling a base module; this brings flexibility in terms of shape, volume and energy capacity; at the same time, it provides economies of scale. See page 3.
Scalability offers economies of scale too: in the Drivetrain Management Module (DMM) solution, the same hardware and reconfigurable software allow adaptability to different vehicle requirements. Moreover, the sought-after functional integration (all-in-one) reduces design complexity, number of components and related costs. See page 2.

Finally, RESOLVE aims to increase knowledge in automotive field, applying technological transfer to L-category vehicles. Therefore, e-motors designed for vehicle demonstrators represent a further step of solutions already developed. See page 2.

Besides drivetrain and electronics control, a relevant effort has been devoted to HMI development, looking for features to improve comfort and attractiveness of riding experience. See page 3.

Enjoy your reading and do not lose the next issue of newsletter!

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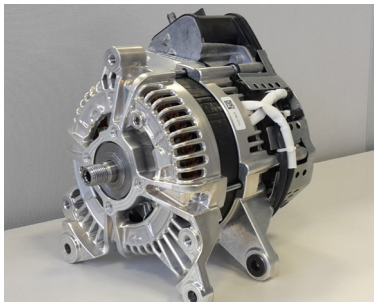
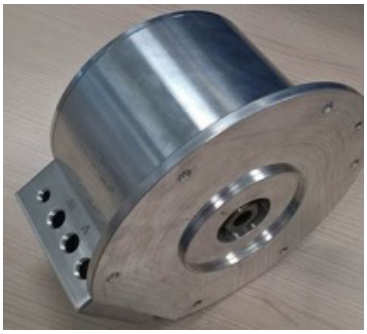
Innovation in RESOLVE

Use of state of art low-cost solutions

Two drive-train solutions have been realized for RESOLVE vehicle demonstrators, following similar criteria of adapting state of art solutions from automotive field to L-category vehicles requirements. The demonstrator D2 will be equipped with an electrical drive unit from Bosch. The unit consists of an electrically excited synchronous machine with an inverter that is directly mounted to the machine. This concept helps to reduce the costs because external wiring for the energy supply of the machine as well as the signal transmission can be realized internally, without the need of expensive connectors and shielded cables.
A further measure to reduce the cost of the drive is the use of ferrite magnets instead of expensive rare earth magnets: a very high power density can be achieved thanks to the optimized electro-mechanical layout of the e-motor.



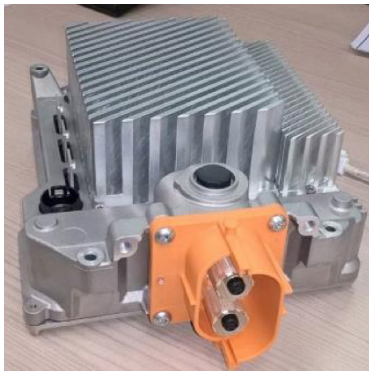
D2 - E-motor and inverter



D1 - E-motor

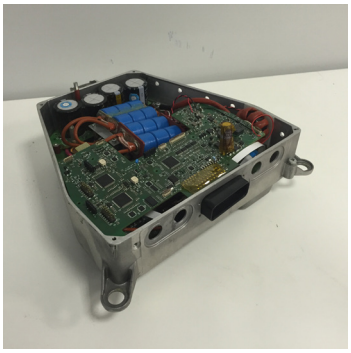
The efficiency of the drive is an important key factor for an electric vehicles, due to the high cost of energy storage: from using energy stored inside of battery the mileage of the vehicle should be as long as possible. The efficiency map for motor operation with a maximum value of approx. 88%. This value includes engine not only energy consumption and cooling losses (electrical, mechanical, cooling) and of the machine but also losses of the inverter losses.

The electric motor that will power Demonstrator D1 Powertrain is developed by Magneti Marelli. It is directly derived from a BSG (Belt-driven Starter Generator), that is an IPM motor (Internal Permanent Magnet) for automotive applications. Inverter is separated from the engine in order to handle severe thermal operating conditions. Power density, low electric losses and magnetic flux are such to fit with performance requirements of RESOLVE. Nevertheless, it is the base for developing a high performancehigh-performance drivetrain, suitable for more powerful electric motorcycles or small cars, enabling economies of scale. As a simple mechanical design was adopted, aluminum casing can be manufactured directly from casting in order toto reduce production costs.



D1 - Inverter

Scalability and functional integration: DMM

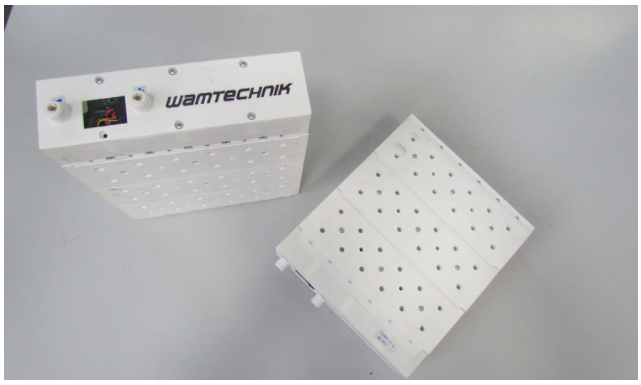


DMM - Drivetrain Management Module

Drivetrain Management Module (DMM) is conceived to integrate all functions (inverter, battery charger, DC/DC converter and VMU) in one scalable component, to reduce design complexity and hardware development costs. On the other hand, a huge effort has been devoted to develop a generic overall software architecture. It is composed of five different software layers and designed in a modular way, providing great flexibility for vehicle management strategies to different hardware. The high-level part of the DMM management is designed in a Matlab/Simulink environment for automatic code generation and possibility of hardware/software in the loop simulation. Therefore, the strategies developed for the DMM will be used as basis for the D1 and D2 vehicle demonstrators with minimal adjustment to the specific parameters of the two vehicles, like engine torques and battery capacity.

Modularity and scalability of Battery Pack

WAMTECNICK created innovative design of a universal 48V battery module, suitable to different types of ELVs (Electric L-Vehicle). It improved modularity and scalability of battery pack by using specially designed connection tabs, snap fasteners and covers: this flexible design ease positioning, mounting and connecting basic modules, adapting the battery to vehicle's characteristics and enabling capacity expansion. Moreover, battery module can be assembled in flexible ways which allow to fit battery within a customer's vehicle.

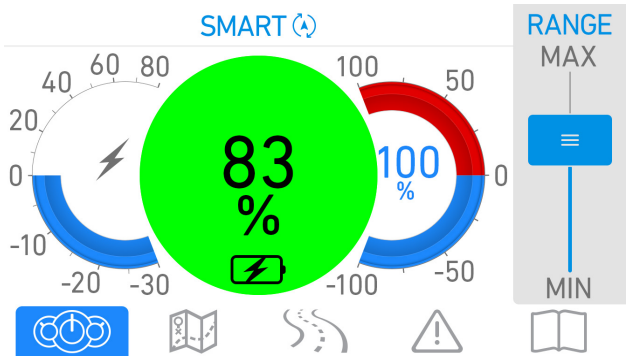


Battery pack

Improving riding experience: HMI

RE:LAB is in charge to design and develop a HMI (Human Machine Interface) within the RESOLVE project. It includes a TFT cluster and an iOS smartphone supported app.

Information provided to the user via TFT cluster and app offers an extended framework of vehicle data, integrating them with navigation-related information: thus the riding experience is enhanced; in order to relieving range anxiety, an energy smart management is implemented. The so-called Smart Range Management is based on intelligent algorithms which targets the destination in terms of distance and altitude to calculate the energy needed to reach it; then, taking in account the State of Charge of battery and checking conditions in a loop, continuously manages the torque output in order to guarantee the reaching of chosen destination.



Smartphone app - Dashboard

The reader interacts with a user-friendly and clear interface via touch-mode or via a joystick on the handlebar if the vehicle is stationary, or only via joystick if the vehicle is moving.

Communication Activities

In the past months RESOLVE has been presented at the following events:

Workshop organized by EU projects Esprit and Weevil - Reggio Emilia, July 4 2017
"The transition to light electric vehicle: an opportunity to disrupt urban mobility?"

RESOLVE joined the debate on how light electric vehicles can contribute to sustainable mobility, together with other projects funded within the H2020 Green Vehicle call: Jospel, Esprit, Weevil

EATC 2017 9th European Altair Technology Conference - Frankenthal, June 26-28 2017

Presentation on "Simplifying a full vehicle model for FE analysis"
Authors: Stefan Scheiblhofer, Matthias Hartmann (AIT)

Exchanges: The Warwick Research Journal - Vol 4, No 1 (2016)

Paper on Modelling and Simulations of a Narrow Track Tilting Vehicle
Authors: JJ Chong, James Marco, David Greenwood

To learn more about RESOLVE please visit the project website:

www.resolve-project.eu

Contact

Coordinator: Piaggio & C. S.p.A.
Mario Santucci
Marco Pieve: marco.pieve@piaggio.com

Dissemination Manager: Re:Lab srl
Roberto Montanari
Serena Fruttaldo: serena.fruttaldo@re-lab.it

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