

---

## Executive Summary

---

Electro-mobility is considered as a key technology to achieve green mobility and fulfil tomorrow's emission standards. However, different challenges still need to be faced to achieve comparable performances to conventional vehicles and finally obtain market acceptance. Two of these challenges are vehicle range and production costs. In that context, the aim of INCOBAT (October 2013–December 2016) was to provide innovative and cost efficient battery management systems for next generation HV-batteries. INCOBAT proposes a platform concept that achieves cost reduction, reduced complexity, increased reliability and flexibility while at the same time reaching higher energy efficiency.

- Very tight control of the cell function leading to a significant increase of the driving range of the FEV.
- Radical cost reduction of the battery management system with respect to current solutions.
- Development of modular concepts for system architecture and partitioning, safety, security, reliability as well as verification and validation, thus enabling efficient integration into different vehicle platforms.

The INCOBAT project focused on the following twelve technical innovations (TI) grouped into four innovation groups (see Figure 1):

## 2 *Executive Summary*

**Customer needs and integration aspects:** These innovations ensure a correct identification of customer needs and enable efficient integration into different platforms.

**Transversal innovation:** This second group targets the optimisation of the system architecture and its consistent definition in the technologies and in the system hierarchies. The focus was set on providing a consolidated basis to simplify later industrialization of the proposed technologies.

**Technology innovation:** This third group aims at improving the components of the E/E control system, including topics such as smart sensors, innovative computing platforms or control strategies.

**Transversal innovation:** This last group targets the evidences related to the trust in the technical solutions with respect to correct operation, functional safety, security and reliability. This group of technical innovations is an indicator for the maturity of the proposed technology and further provides information on the efforts required for proper integration and validation of the system.

The main INCOBAT technical achievements can be summarized as follows:

- Improving the range of the electric vehicle by better use of the electrical energy stored within the battery, realized by a combination of TI01 (mission profiles), TI03 (efficient partitioning), TI05 (multicore computing platform), TI06 (smart module management unit) and TI08 (improved BMS control algorithms).
- Significant decrease of costs for BMS hardware, realized by a combination of TI03 (efficient partitioning), TI04

(integration of multiple functionalities within the same control unit), TI05 (multicore computing platform), TI06 (smart module management unit), TI07 (modular SW platform) and TI08 (improved BMS control algorithms).

- Provide modular concepts for efficient integration into the vehicle, realized by TI02 (model-based systems engineering), TI03 (efficient partitioning), TI05 (multicore computing platform), TI07 (modular SW platform), TI09 (safety and security co-engineering), TI10 (design and validation plan) and TI11 (reliability and robustness validation).

Achievements regarding dissemination and exploitation of the INCOBAT outcomes include 21 peer-reviewed publications and a dedicated cluster workshop to exchange information between related projects, as well as the development of a dedicated exploitation plan and sustainability model should be highlighted.

