



## **Cross-Company Collaboration for Identifying Pre-Competitive Research Needs for Power Electronics**

- Working Group 1: ClusterTeam 2 for Power Electronics -

**DG-ENER Round Table, Brussels**

**4.09.2017**

## Overview

- Overview of the National Platform for Electric Mobility (NPE)
- Cross-Company Team for Power Electronics
- Power Electronics in Vehicle Systems
- Roadmap Overview of the „Need for Action“ for Pre-Competitive Research\*

\*) Note: Additionally these results will be actively shared with EU-Funded CSA FUTURE-RADAR

**Project ID:** 723970,

**Funded under:** H2020-EU.3.4. - SOCIETAL CHALLENGES - Smart, Green and Integrated Transport

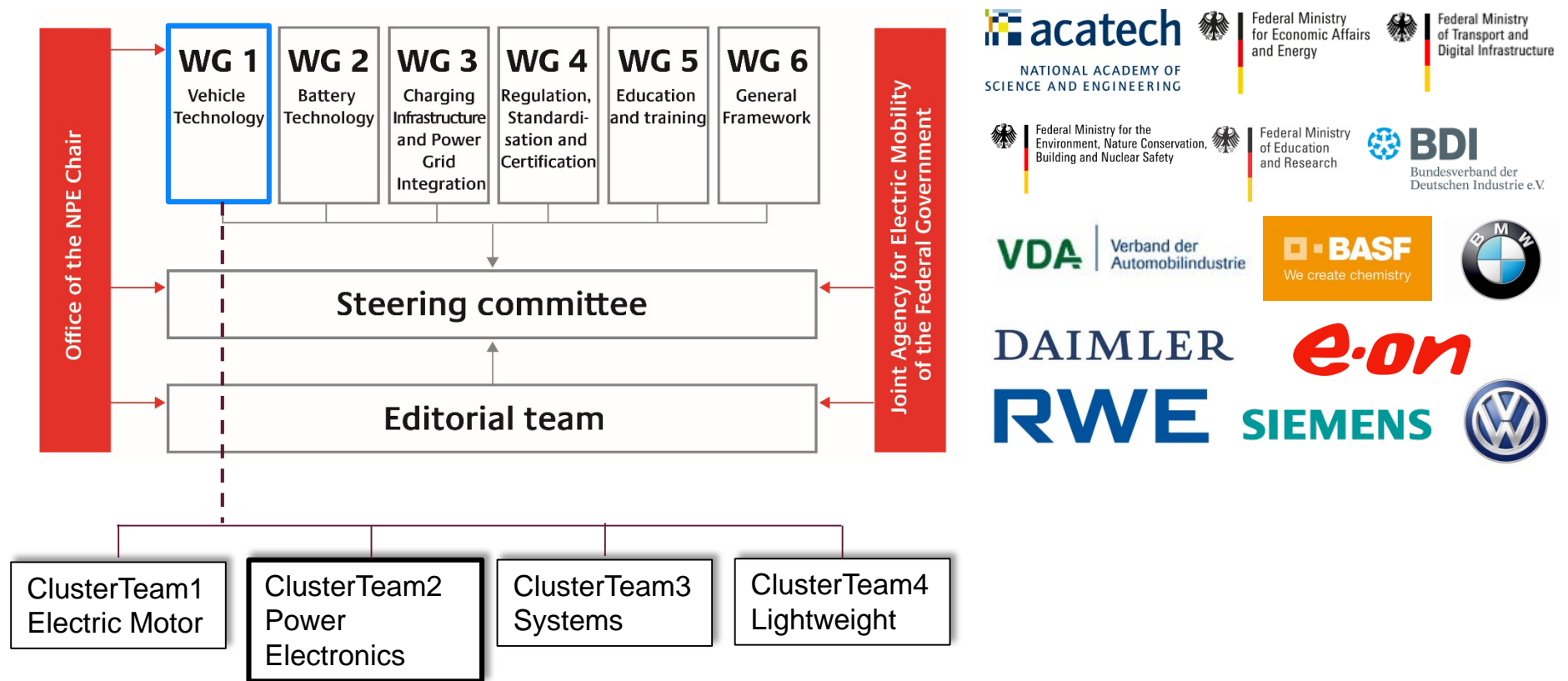


# Cross-Company Collaboration for Power Electronics

## ClusterTeam 2 in the Working Group 1 (AG1)

### Establishment of the National Electric Mobility Platform in May 2010

150 partners from government, business, the research community and civil society



# Cross-Company Collaboration for Power Electronics

## Working Members of ClusterTeam 2

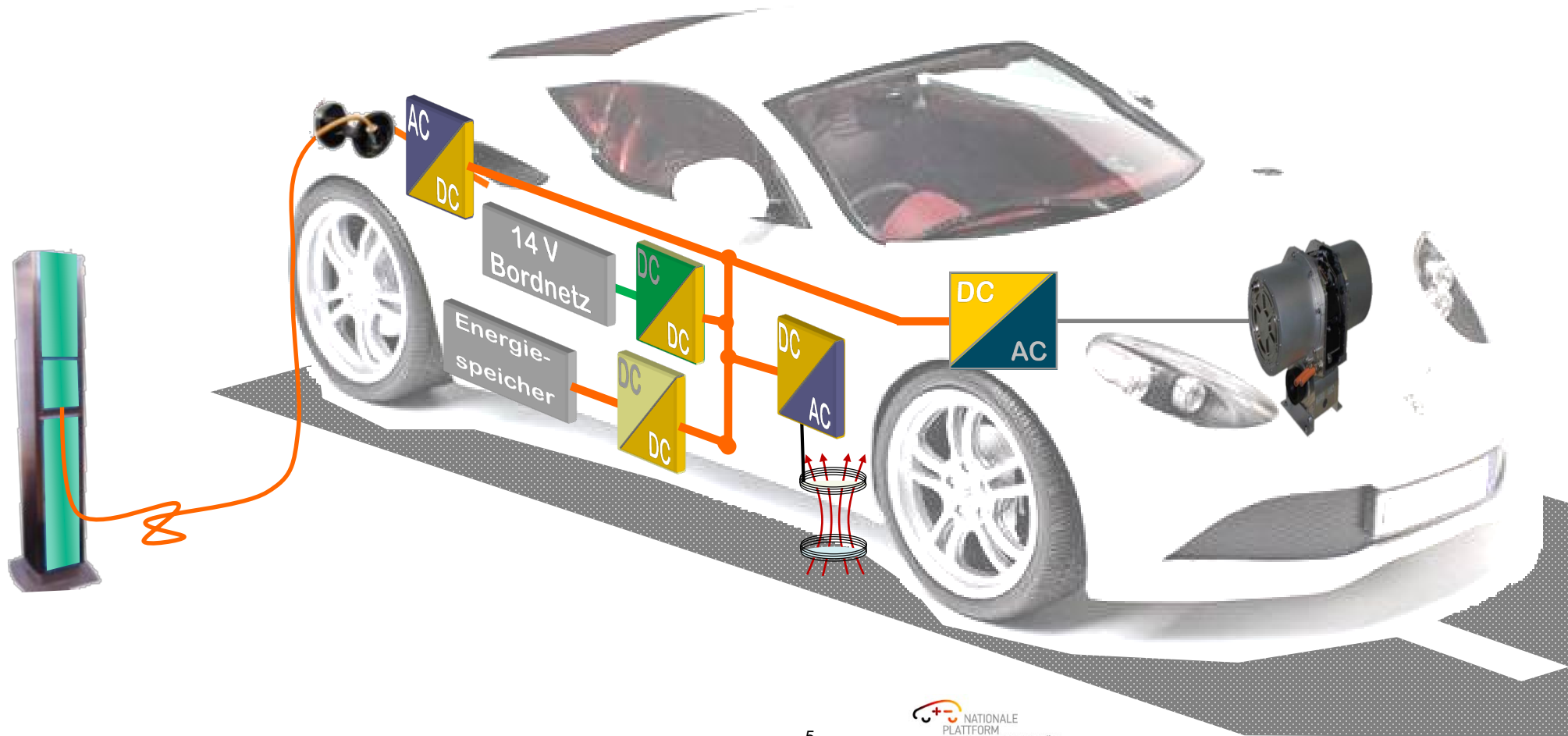


Infineon	Lenze	Daimler	Leibniz Universität Hannover	Volkswagen	BMW	Siemens
ZF Friedrichshafen AG	Fraunhofer IISB			Bosch	Continental	AVL
	RWTH ISEA	Heraeus				

# Cross-Company Collaboration for Power Electronics

**Power Electronics is Key Technology for Electric Mobility**

**More than just the Drive Train!**



### Overview

Topics	2014	2017	2020	2022	2025
	Optimal design and construction of power units (Inverter, DC/DC-traction-converter, charging units) and their interfaces (both internal and external) Vision: Increasing intelligence of PE (e. g. Condition Monitoring)				
System-partitioning/-integration	Standardized modular housing and connectors	Modularization and scaling Standardized auxiliaries	Highly integrated power electronics, component integration (e. g. 3D component groups)		
Circuit concepts and control	Optimized Topologies to reduce switching losses & EMC, max. integration capability			Advanced/optimized circuitry for new component technologies	
	Holistic approach for controlling highly integrated electronics				
Semiconductors	Si-IGBT	New semiconductors (Wide Band Gap, SOH, Si-IGBTs optimized for partial load operation)			
	Non-integrated Gate driver	Integrated Gate Driver IC (also in the power module)			
Passive components	Components for standard temperature op.	Capacitors and inductances stable at higher temperatures and with improved cooling			
		Capacitors and inductances better suited for integration and operation with new semiconductors			
Interconnect devices	Circuit boards DBC & AMB	Robust assembly and interconnect technologies better suited for integration, including capability for higher temperatures, higher currents and extension to 3D design			
Joining and connecting technologies	Wide portfolio on procedures, components and assembly partitioning	Compact power modules with extended temperature range and optimized cooling		Power output stages with increased robustness to temperature cycling and low impedance connection	
		Embedding to achieve highly integrated concepts, incl. 3D-Integration			
Thermal Management		Module and component concepts with reduced thermal resistance. Concepts for integrating cooling in housings, assemblies and component groups			
Simulation/Prediction	Physics-based models for robust design and lifetime prediction, as well as observers and real-time models		Holistic simulation chain: e. g. along the value-chain: Vehicle / Motor / Electronics / IC / AIT		

# Summary: Research areas of action for highly integrated systems

---

## ➤ Robust and safe systems

- System reliability
- EMC / Design rules / 3D
- Diagnostic capabilities
- Acceptable fault tolerance / „Limp-always“ functionality capability

## ➤ System integration and miniaturization

- Assemblies for higher voltages >400V
- Assemblies for higher currents >500A
- System design based on new power semiconductor materials (GaN, SiC)

## ➤ Efficient development and manufacturing processes

- Holistic simulation environment (mechanical, electrical and thermal)
- Standardization / principle of common/shared parts
- Reduction of “margin stacking” by leveraging system knowledge (today concerns leading to “add-on” technical margins).