

ENDURANCE support slides for the “**Batteries for electrified road vehicles: trends, challenges and opportunities**” WebTalk

@VTM, Vehicle & Transportation Technology Innovation Meetings
(Turin, September 17, 2020)

Claudio MUS

Endurance Overseas Technical- R&D director

Endurance Group Overview

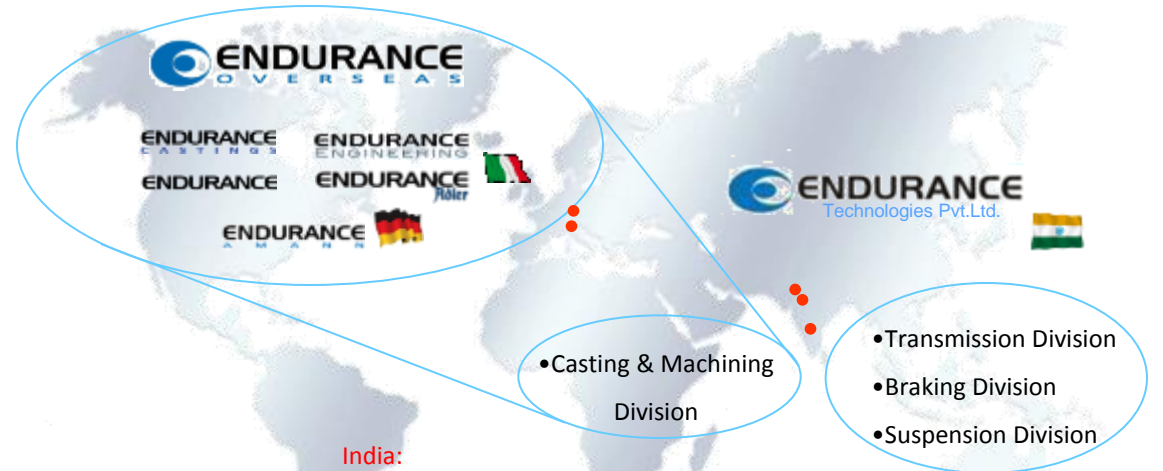
Promoter Group 75% Stock Market Investor 25%



Aluminum Casting & Machining, Suspension, Transmission and Brakes



A global presence with 26 Plants:



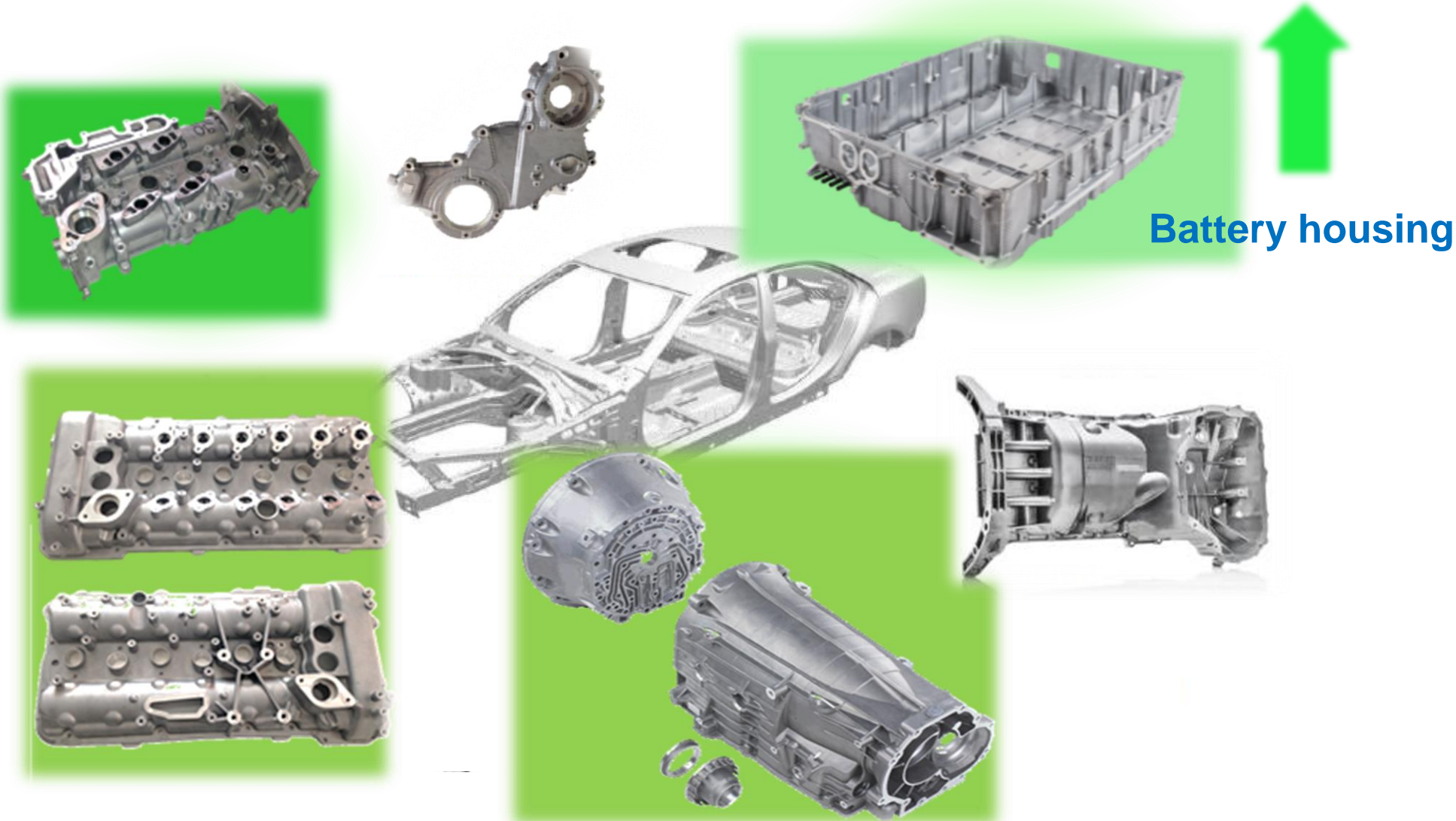
India:

- Aurangabad (Casting & Machining / Transmission / Braking / Suspension + R&D)
- Pune (Casting & Machining + R&D)
- Manesar (Casting & Machining)
- Pantnagar (Casting & Machining / Transmission / Suspension)
- Chennai (Casting & Machining)
- Sanand (Casting & Machining / Suspension)

Overseas:

- Germany: Massenbachhausen (Casting & Machining)
- Italy: Bione (Casting)
- Chivasso (Casting and Machining + R&D)
- Grugliasco (Casting)
- Lombardore (Machining)
- Rovereto (Braking / Transmission / Suspension + R&D)
- Torino (Injection Molding)

Endurance Overseas Innovative HPDC products



Battery housing



Growing product category

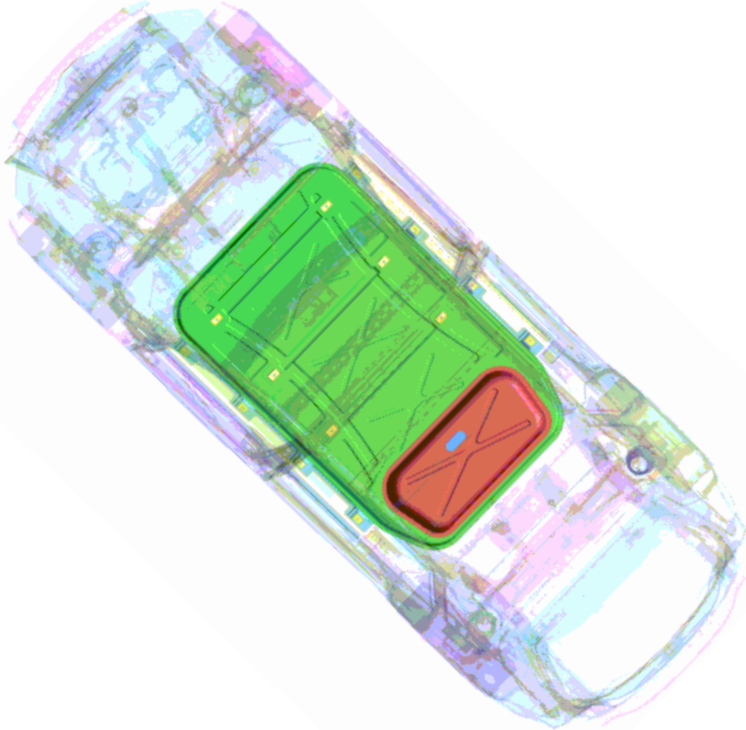
Different sizes under development :

small on hybrid, medium-large on BEV

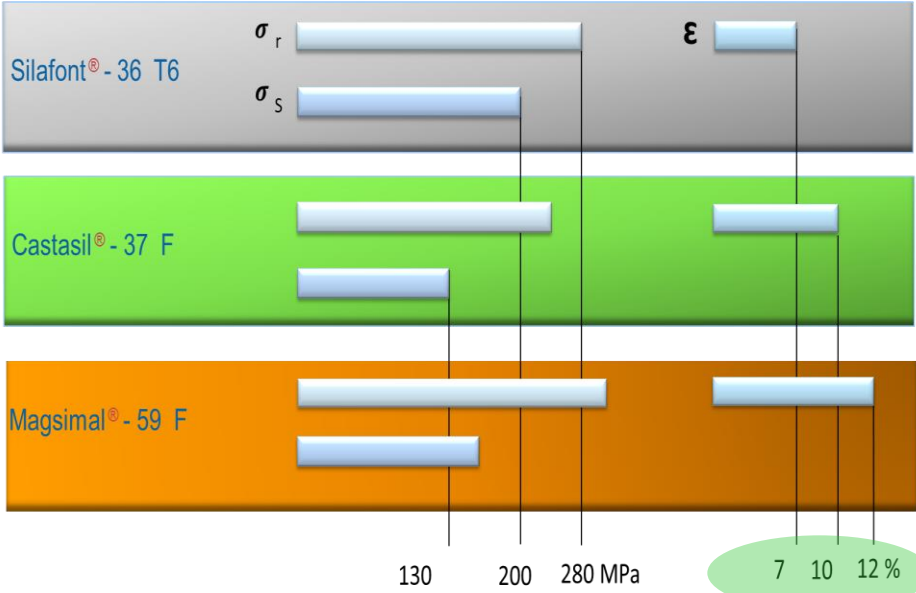
Material today specified : primary aluminum alloys - AlSi10MgMn (SF36)



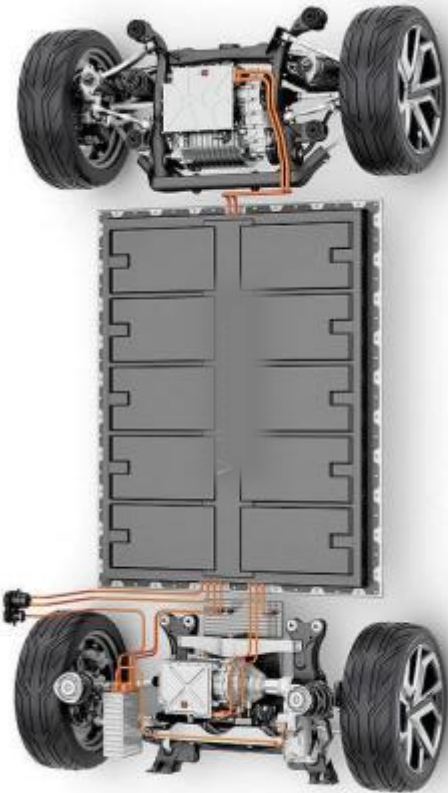
Impact / crash behaviuor



High ductility HPDC alloys



Battery modules for repurposing



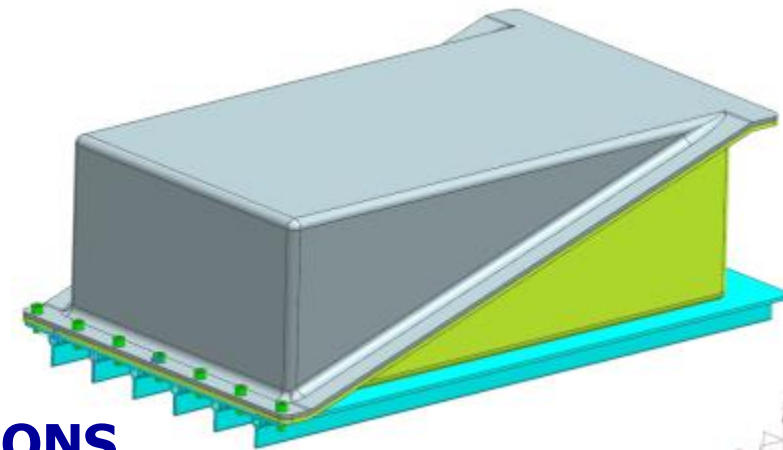
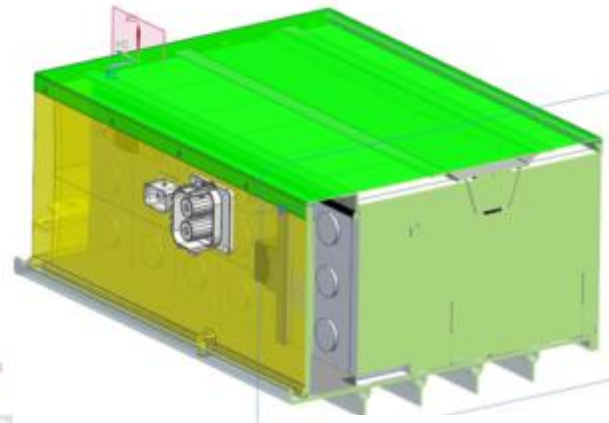
Design for easy assembling & di-assembling



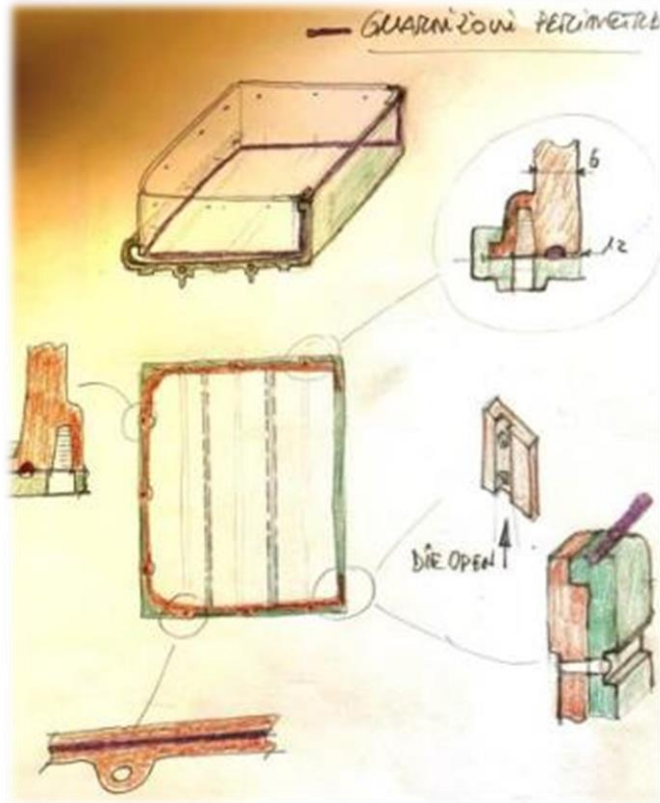
Design for repurposing



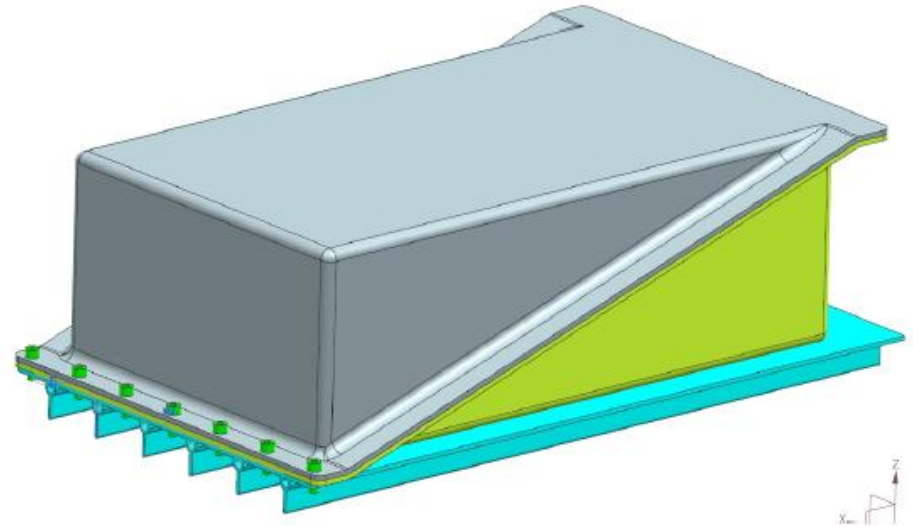
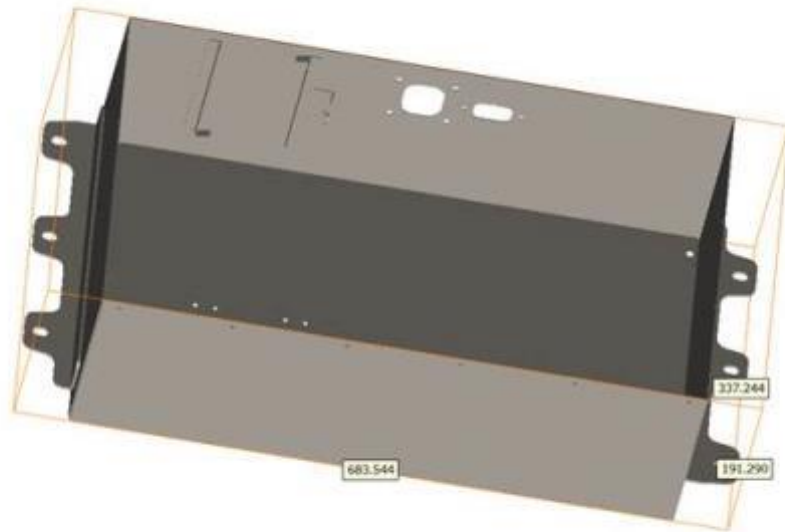
HPDC : FUNCTION INTEGRATION



ESTRUSION : COOLING OPTIONS



Steel / aluminum comparison



	ORIGINAL DESIGN	HPDC NO COOLING	HPDC WITH COOLING
WEIGHT [Kg]	8,2	6,4	7,6
	-	- 21%	- 7%

Partnership in action within the Batteries IPCEI 1 frame

- **Integrated design approach (E/E , mechanical , NVH , safety , mission cycle)**
- **Integration with battery housing supplier since start of project**
- **Module and Battery Pack architecture and mission profile definition**
- **Concept&Design of Battery Pack layout (mechanical and electrical)**
- **Proto (from alfa to gamma) battery housing integrated in vehicle layout**
- **Internal subsystem (cells connection , cell support , cooling system) design**
- **Battery system Vehicle integration**
- **BMS (battery management system) knowledge**
- **Full testing (electrical / mechanical /extreme environmental condition, durability)**