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The 27th INTERNATIONAL ELECTRIC VEHICLE SYMPOSIUM & EXHIBITION.

Barcelona, Spain
17th-20th November 2013

SEAM

Advanced Lightweight Electric Vehicle Architectures

ALIVE & the SEAM cluster

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Bax & Willems Consulting Venturing

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Introduction

Bax & Willems works with clients from all around **Europe**

- Since 1987
- Public and private clients

- (Multi-stakeholder) projects in European and regional level
- (Open) innovation processes
- Innovation and industrial policy
- Startups & coaching

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A selection of our clients

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Our work and network in automotive and lightweight materials fields

- **1996-1999:** MULTEXCOMP
- **2000-2004:** TECABS
- **2005-2009:** SuperLight Car
- **2010-2013:** ELVA
- **2010-2013:** DELIVER
- **2010-2014: HIVOCOMP**
- **2012-2016: ALIVE**
- **2012-2016: ENLIGHT**
- **2012-2016:** MATISSE
- **2012-2016:** SAFE-EV
- **2013-2016:** EPSILON
- **2013-2017:** IMPROVE

EUCAR
EUROPEAN COUNCIL FOR AUTOMOTIVE R&D

earpa
European Automotive Research Partners Association

SusChem
European Technology Platform For SUSTAINABLE CHEMISTRY

ESTEP

Smart Cities and Communities

European Commission

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Outline

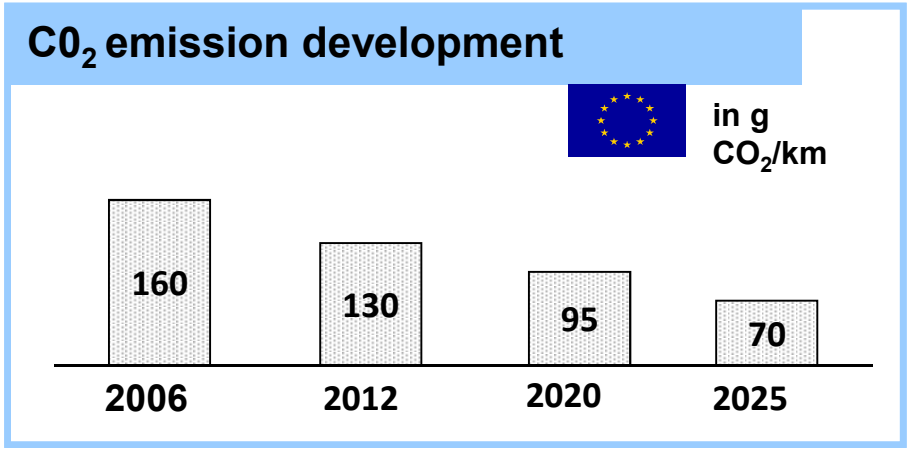
- **Setting the context**
- **Lightweight design for sustainable mobility**
- **The ALIVE project**
- **The ENLIGHT project**
- **The SEAM cluster**
- **How to keep in touch**

Megacities : a global trend

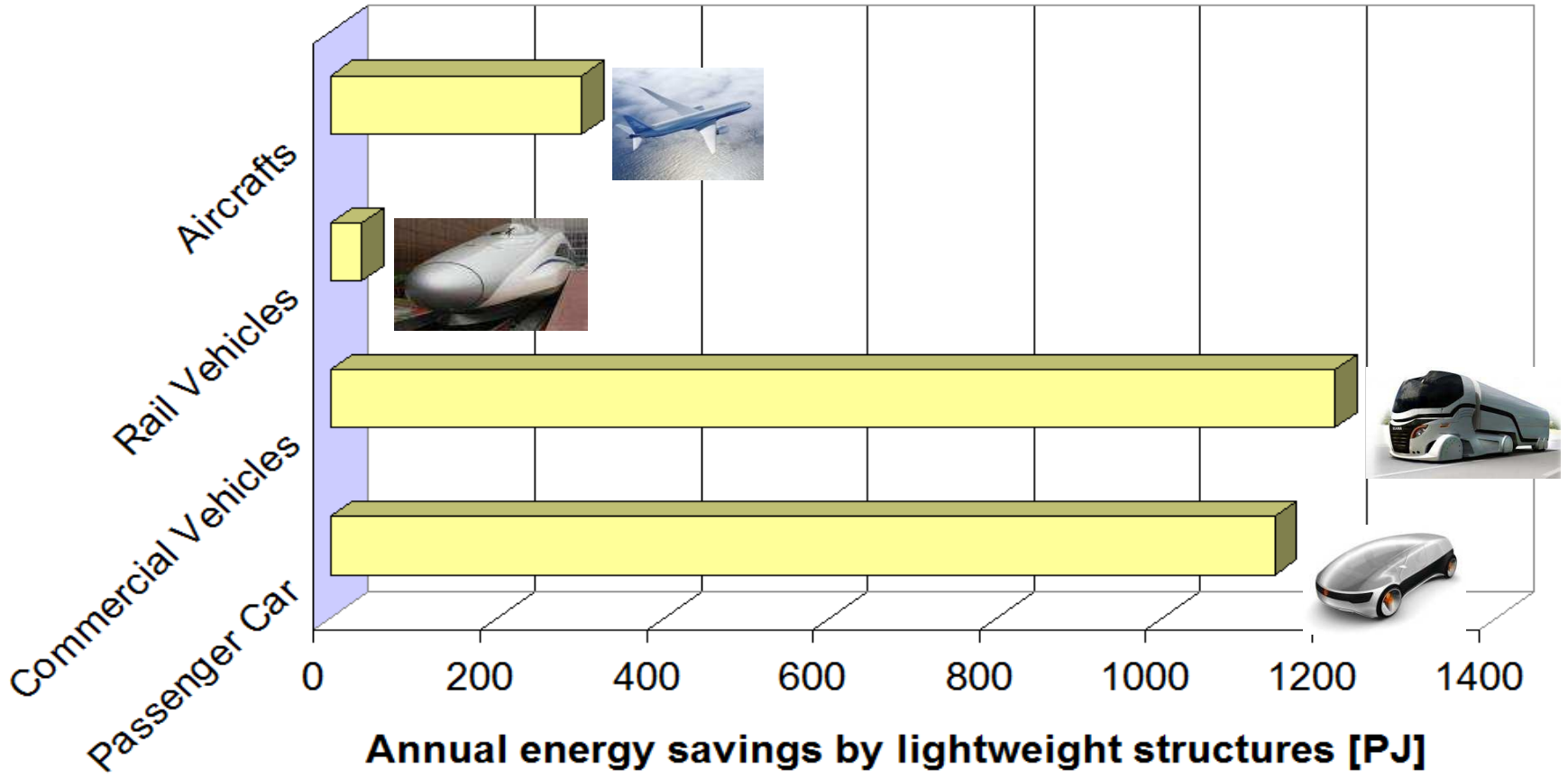
- In the year 2050 more than 9 billion humans will live on Earth, of which more than **5 billion will live in cities**. (UN)
- By 2030, there will be more than **500 cities** in the world with populations of more than 1 million each; more than half will be in Asia. **More than 27 will be megacities** with over 10 million inhabitants.

⇒ **Increasing demand on urban mobility**

… with zero-emissions ideally



Lightweighting can provide the solution!



Data from: Helms, LCA case studies – 2006

Impact of lightweighting in the city context

Barcelona has more than 600.000 vehicles, producing about half of all emissions.

A reduction of vehicles' weight by 100 kg could lead to a total annual reduction of CO2 emissions in the city of Barcelona of some **30.000 tonnes of CO2 per year**.

The substitution of perhaps 100.000 conventional vehicles in Barcelona with EVs would eliminate some **90.000 tonnes CO2 emissions** annually, while save **€28 million annually** on environmental costs of the city.

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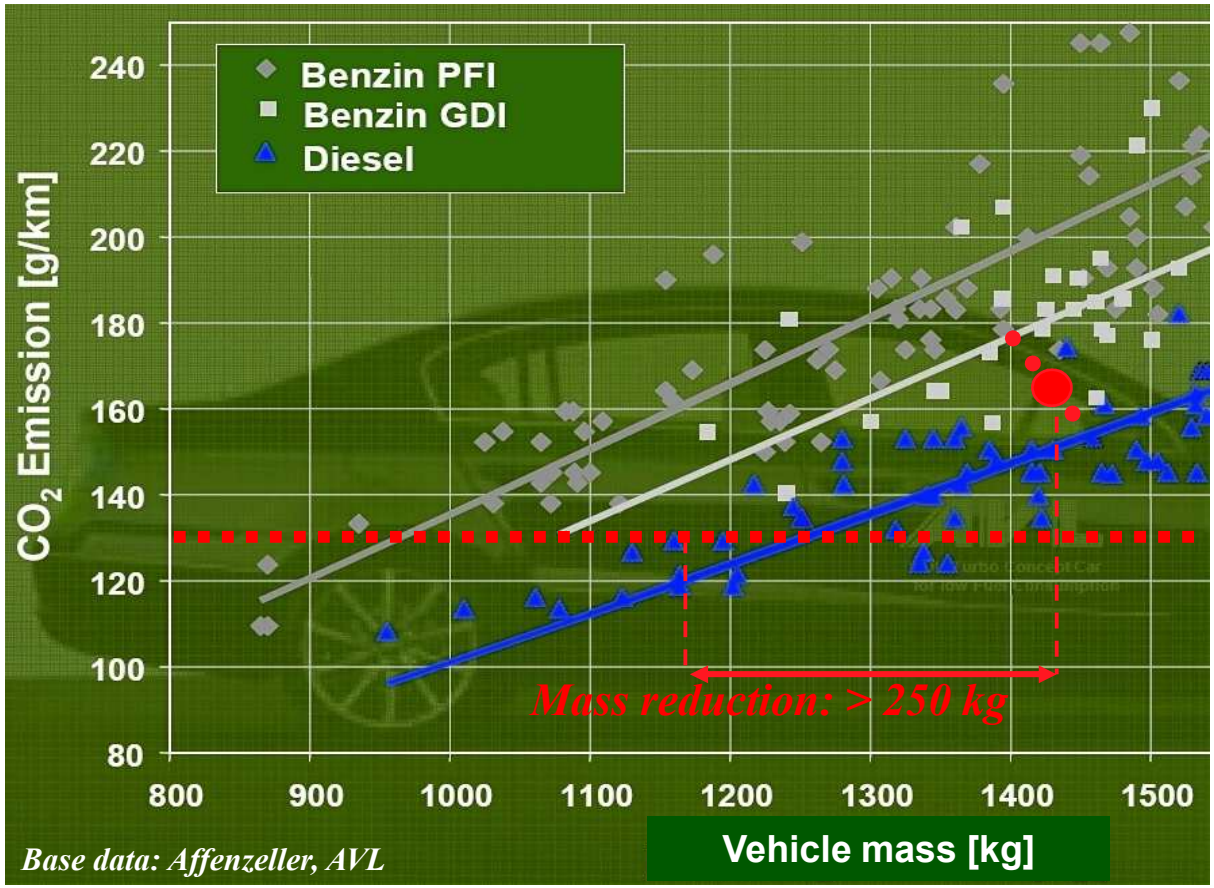
Photo by Openhouse via Wikimedia Commons

Lightweighting helps reduce fuel consumption in ICE cars



- ✓ Lightweighting is necessary in order to meet the CO_2 targets of ICE-driven cars (-100 kg = 8.5 gCO_2/km)

…but with the same safety and comfort!

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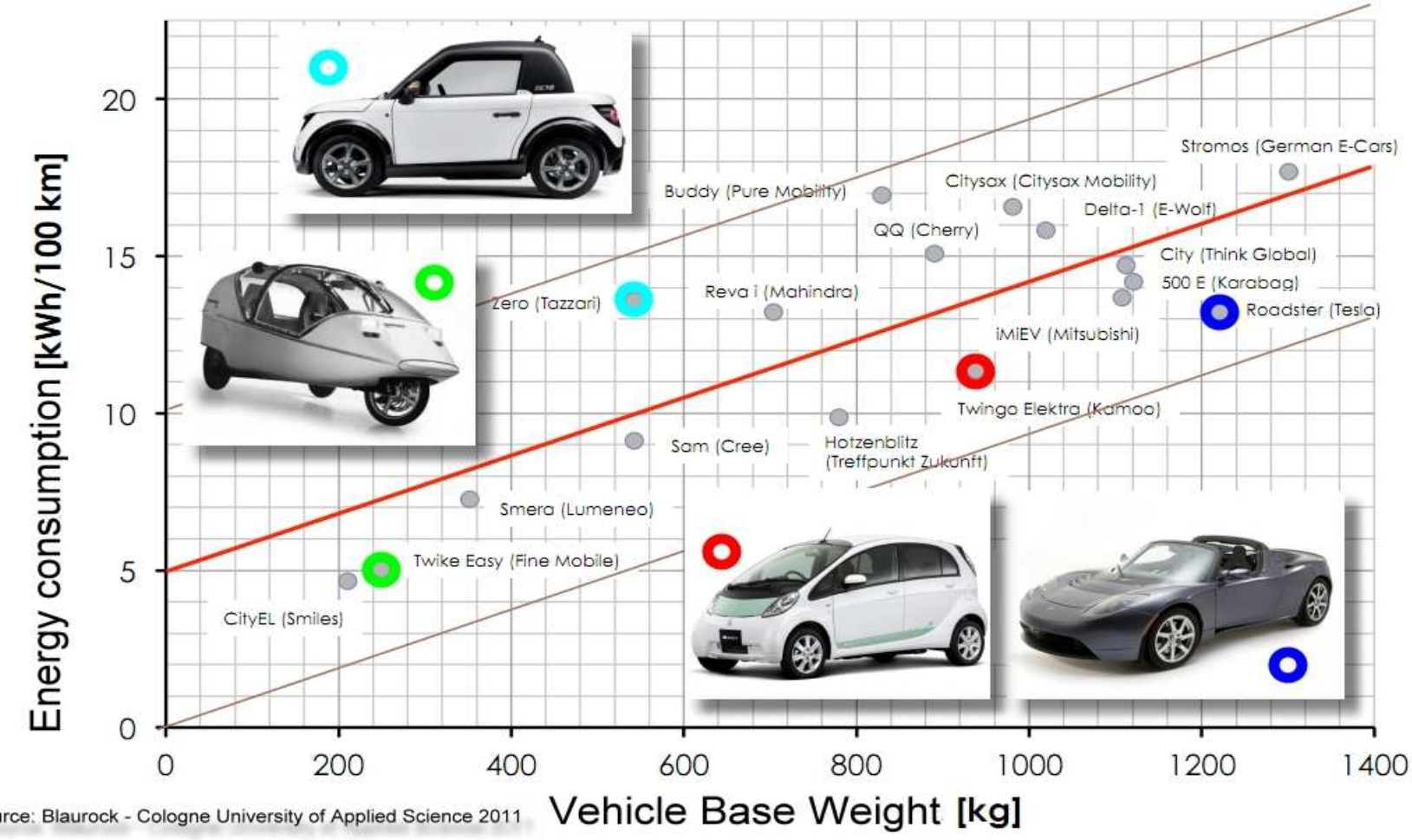
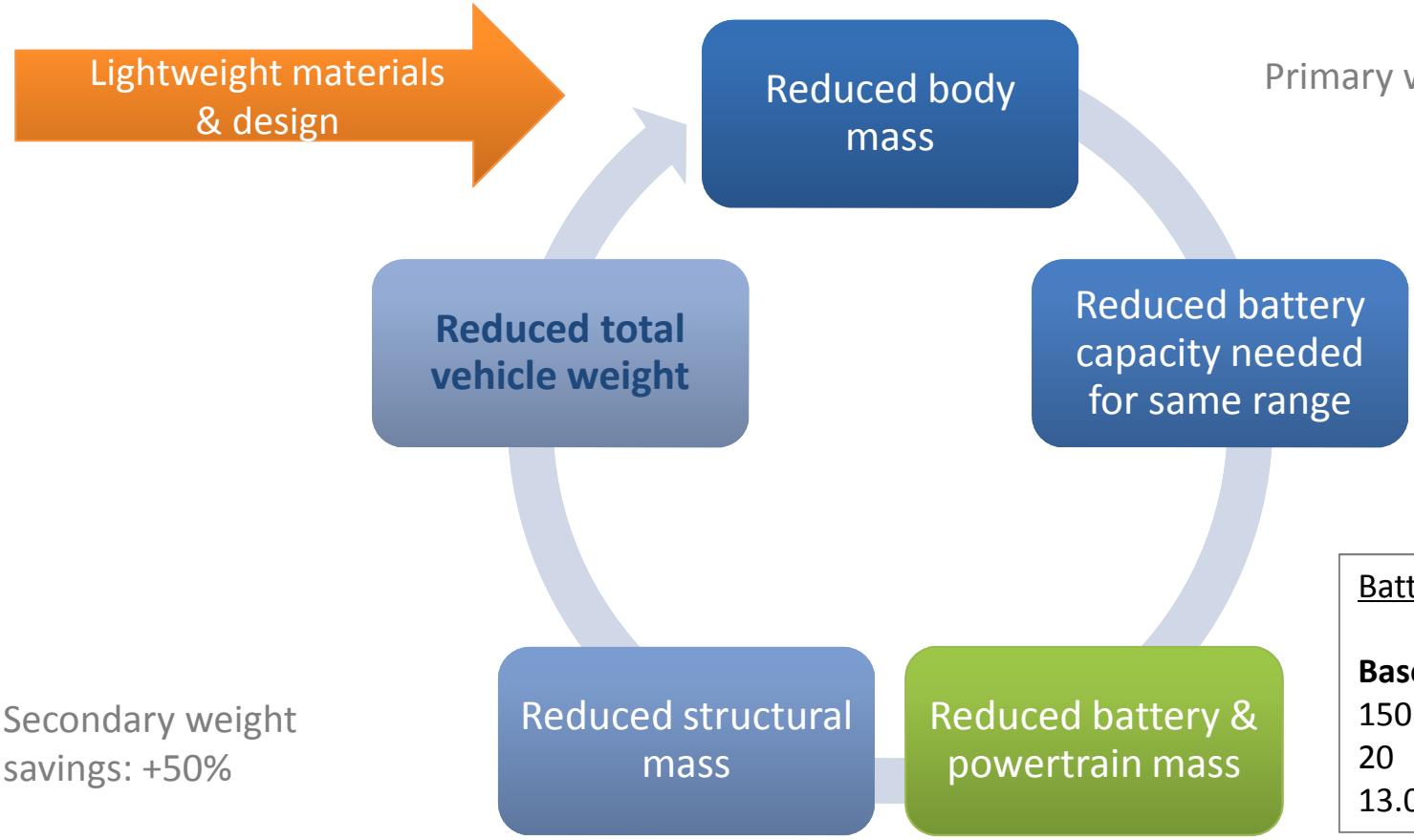
Lightweighting helps improve the driving range



Source: Blaurock - Cologne University of Applied Science 2011

…or it can help reduce the size => cost of the battery



Battery cost savings example

Baseline	Light	
150	150	km
20	16	kWh
13.000	9.500	€

However, vehicle weight has been historically rising

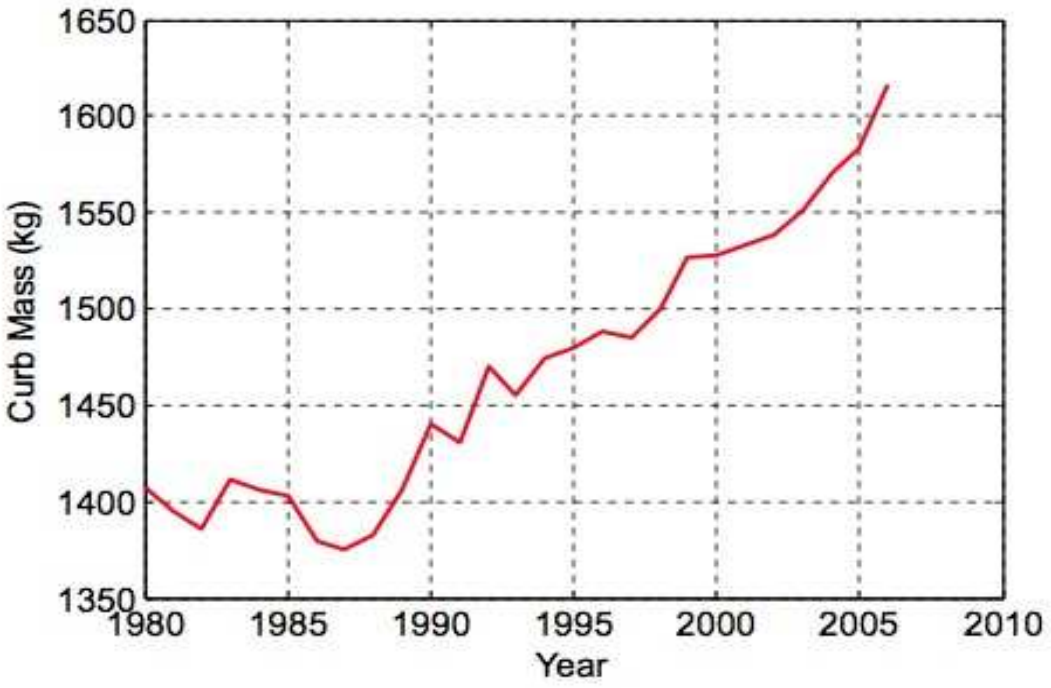


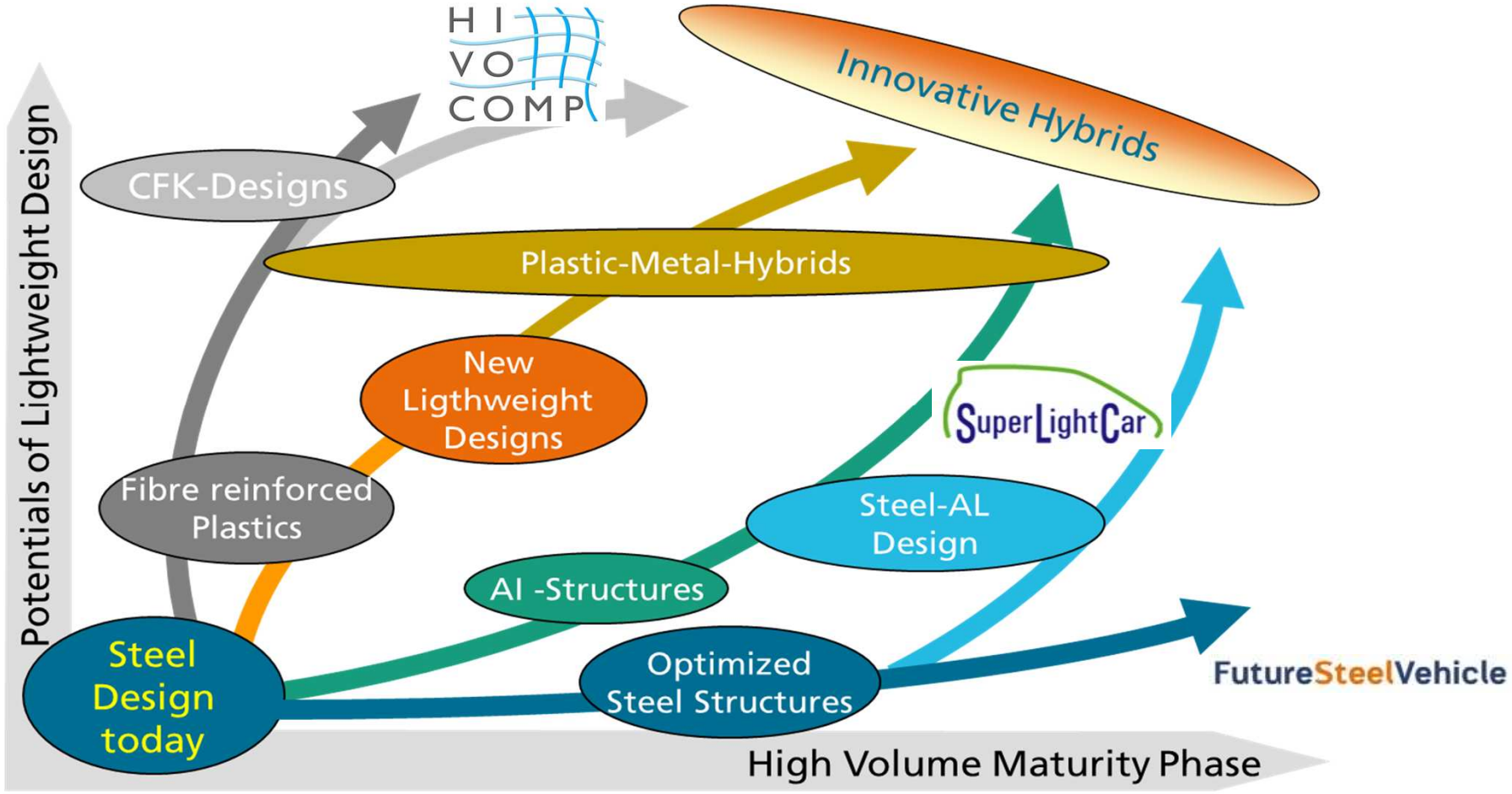
Figure 1-1: Increasing trend in automobile curb mass since 1980.
Source: MIT, 21006

Main causes are the **rising customer demands** for additional:

- performance
- comfort
- safety
- electronics

Example: http://www.bmw.com

Mix of advanced materials needed to lower vehicle weight

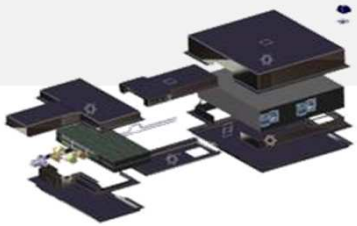


Source: M.Goede, VW Group Research, SLC

Relation with past projects

SmartBatt

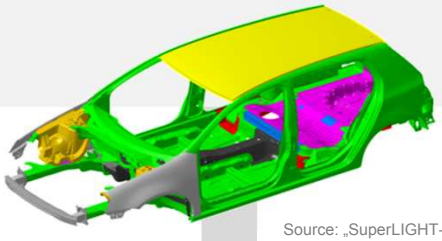
- Fully integrated battery housing
- Lightweight battery concept
- New materials for battery systems



Source: Fraunhofer LBF, „SmartBatt" project"

SuperLIGHT-Car

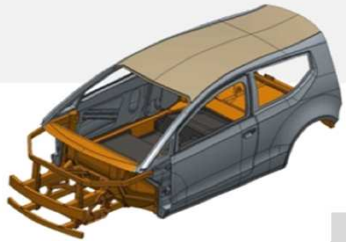
- Economic demonstration of multimaterial vehicle structures for high-volume produced combustion cars



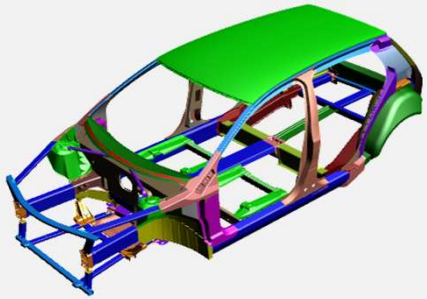
Source: „SuperLIGHT-Car" project, 2009

ELVA

- Concept of light BiW for EV´s
- Space frame design
- Modularity in battery and BiW design



Source: „ELVA" project, 2013



ALIVE

- High volume
- Low weight
- Low costs

Source: M. Kurz , Volkswagen Group Research, K-EFFG/L, 2013

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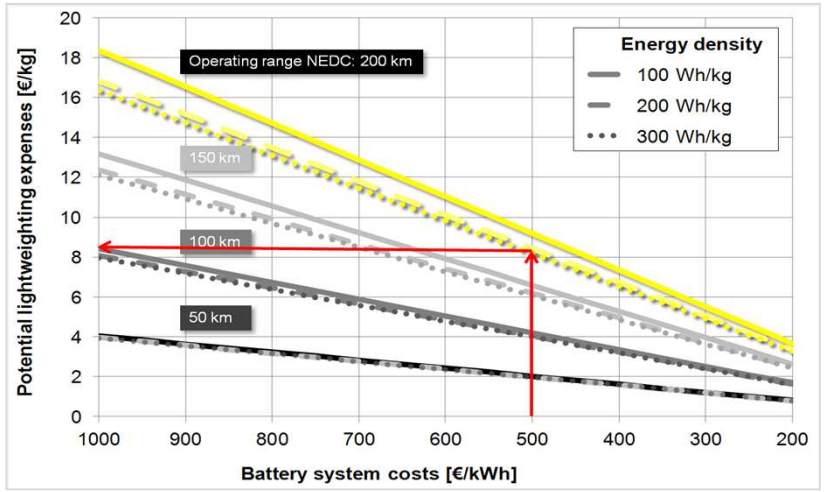
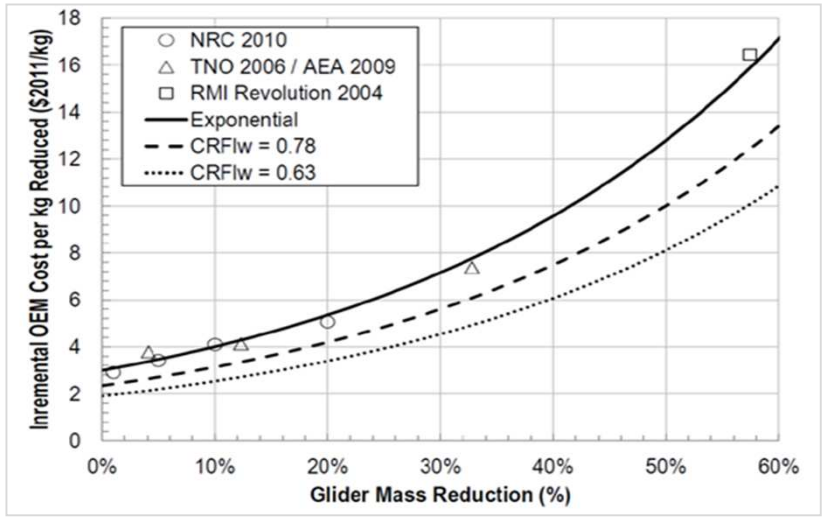
Motivation

- **Affordable weight reduction for electric vehicles**
- For an EV with 200 km range (and with battery capacity of 200 - 300 Wh/kg) the allowable costs of weight saving would be around **€8/kg**
- More than **40% of weight reduction** seems to be obtainable for that price.
- Avoiding exponential cost increase for further weight reduction





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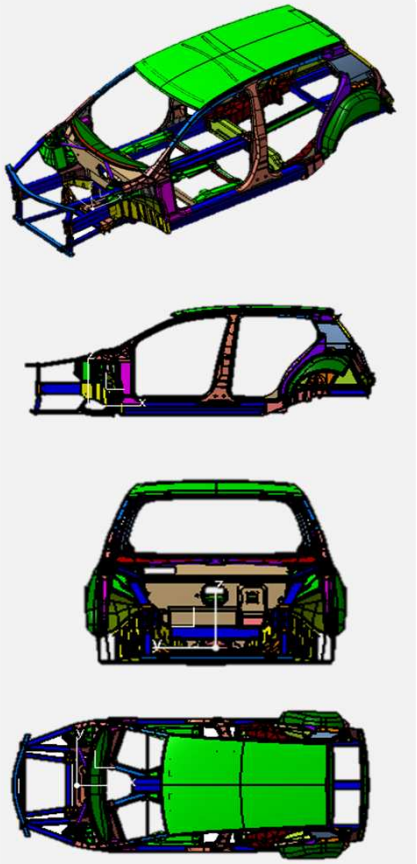
ALIVE Objectives

1. Significant **reduction in weight**
   - **BiW** with integrated battery housing: approx. **45 %** targeting 200 kg
   - **Chassis**: approx. **25 %**
   - **Hang-on parts**: at least **25 %**
   - **Interior** components: in the range of **30 %**
2. Cost-efficient application of a variety of **advanced materials**, mainly HS steel, aluminium and magnesium alloys
3. Development of **design and simulation** capabilities including **LCA**
4. Full scale **demonstrator** vehicle for showcasing and testing
5. Advancements in **multi-material joining** technologies for mass production



Source: M. Kurz , Volkswagen Group Research, K-EFFG/L, 2013

Expected results and timing

- ALIVE will run from October 2012 **until September 2016**.

- **A full-scale demonstrator vehicle** will be fabricated and showcased
  - covering BiW, hang-on parts, chassis and heavy interiors, including battery pack integration,
  - innovative safety mechanism and
  - several new materials and manufacturing technologies

Follow updates and results at:
http://www.project-alive.eu

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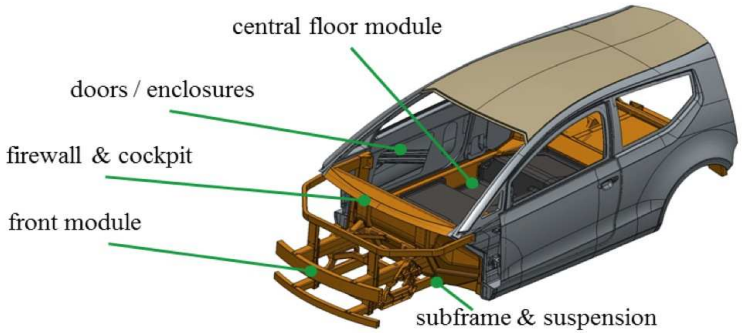
- Development of highly innovative **lightweight / low embedded CO_2 materials,** mainly composite plastics and hybrids
- Design, manufacturing, simulation and joining capabilities, incl. LCA / LCC
- affordable application in **medium-volume** automotive production (50.000 units/year).
- Aims at a **further 20% weight reduction** over ALIVE targets.



- Demonstration of the proposed solutions through the realization of **5 full scale demonstrator modules.**

http://www.project-enlight.eu

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The largest EU cluster of lightweight automotive design

SEAM

ALIVE

Advanced high volume affordable lightweighting for future electric vehicles

Coordinator: Jens Meschke

ENLIGHT

Enhanced lightweight design by advanced lightweight materials

Coordinator: Thilo Bein

Liaison Team
CRF, VW, fka, TU Graz, LBF, B&W

MATISSE

Modeling and testing for improved safety of key composite structures in alternatively powered vehicles

Coordinator: Roland Wohlecker

SafeEV

Safe small electric vehicles through advanced simulation methodologies

Coordinator: Andreas Teibinger

www.seam-cluster.eu

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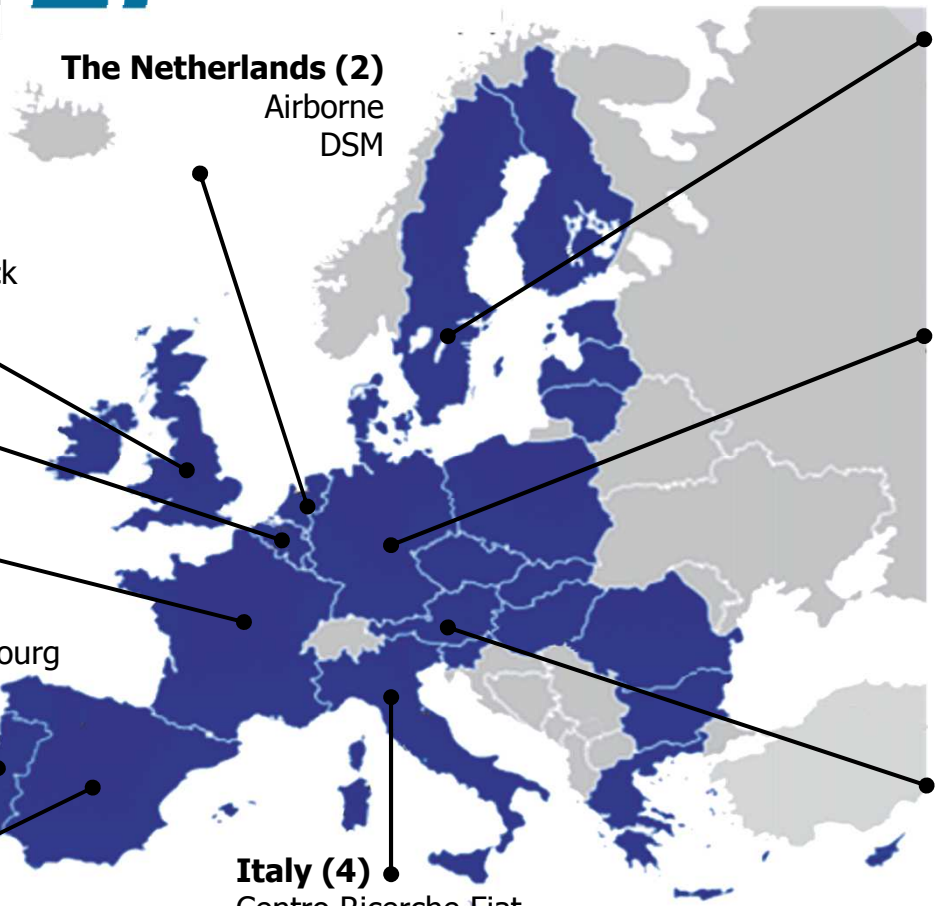
47 partners from 10 countries



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DSM

UK (2)
Jaguar Landrover
University of Warwick

Belgium (2)
LMS
KU Leuven

France (3)
Renault
Faurecia
Université de Strasbourg

Portugal (1)
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Spain (3)
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Sistemas y Procesos Avanzados

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