



POLITECNICO
MILANO 1863



CLM

Cluster Lombardo della Mobilità
Lombardy Mobility Cluster

Il veicolo elettrico-digitale del futuro

Gianpiero Mastinu

Politecnico di Milano

Cluster Lombardo della Mobilità

Mega-Trends



Source: F&S

Megatrend - Urbanization

The new urban world

The earth reaches a momentous milestone: by next year, for the first time in history, more than half its population will be living in cities. Those 3 billion people are expected to grow to 5 billion by 2030 – this unique map of the world shows where those people live now

US
246.2
Urban population in millions
81%
Urban percentage

Mexico
84.392
77%

Mexico City
22.1

- Key**
- Predominantly urban 75% or over
 - Predominantly urban 50–74%
 - Predominantly rural 25–49% urban
 - Predominantly rural 0–24% urban
 - Cities over 10 million people (greater urban area)

At the beginning of the 20th century, the world's urban population was only 220 million, mainly in the west

By 2030, the towns and cities of the developing world will make up 80% of urban humanity

Urban growth, 2005–2010



3,307,950,000

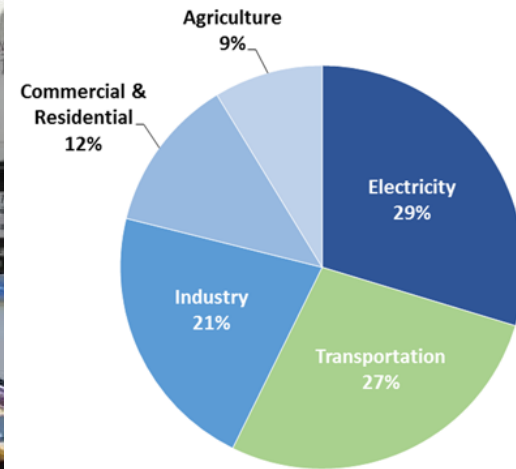
The world's urban population – from a total of 6,615.9 million

SOURCE: UNFPA GRAPHIC: PAUL SCRIBTON

Megatrend: local Air pollution in urban areas



29 billion tones of CO₂/Year



U.S. Environmental Protection Agency (2017). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015.

SENSEable City Lab, MIT

1 **Automotive 4.0**

The convergence of connected, shared, automated vehicles will result in a new reality that is more about how people are moved than what moves them

p. 4

2 **760,000 units**

Annual US sales could grow by 760,000 units to support Mobility-on-Demand services, even as the parc drops by 49 m

p. 21

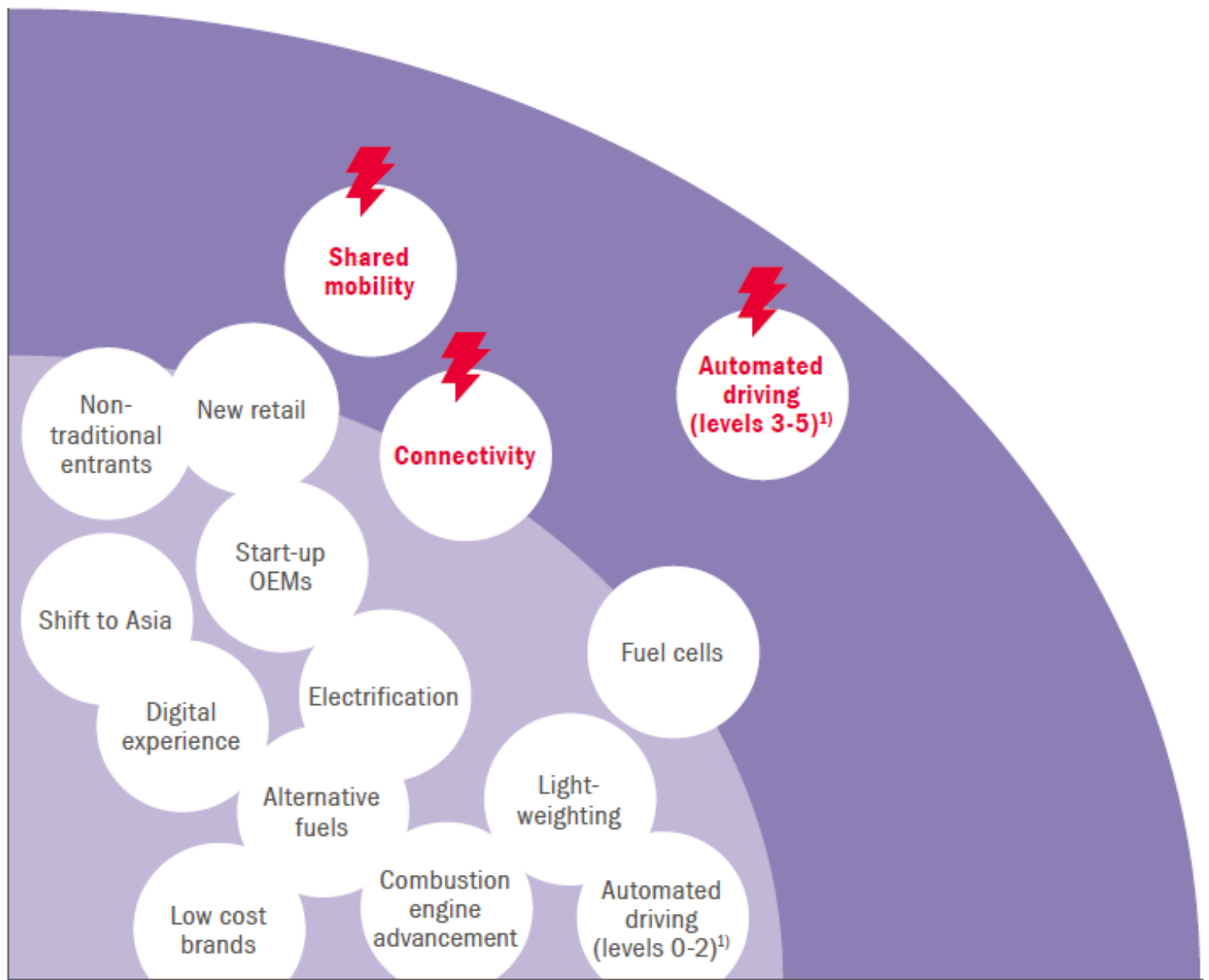
3 **USD 192 bn**

Traditional OEM addressable markets will shrink, but new revenue pools of USD 113 bn from Mobility-on-Demand services and USD 79 bn from low cost pod manufacturing present large opportunities

p. 28

**DISRUPTIVE
IMPACT ON THE
VALUE CHAIN**

**LIMITED
IMPACT ON THE
VALUE CHAIN**



**ITERATIVE
TECHNOLOGY
CHANGE**

**DISRUPTIVE
TECHNOLOGY
CHANGE**

Emission from Well to Wheel - Cradle to Grave.....

 **381** i GRAMS OF CO₂e PER MILE

 **209** i GRAMS OF CO₂e PER MILE

 **154** i GRAMS OF CO₂e PER MILE

Product life cycle



Production phase
Extraction, preparation,
production



Use phase
Fuel production and
consumption



End-of-life phase
Recycling and
disposal

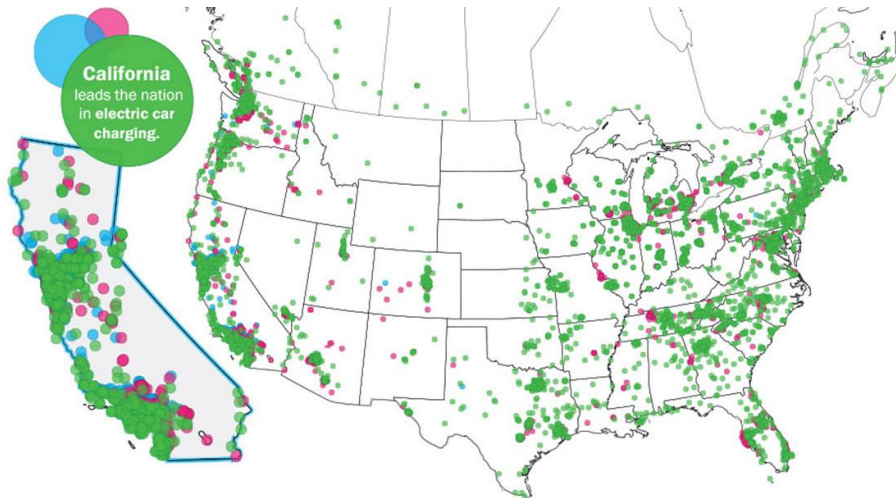
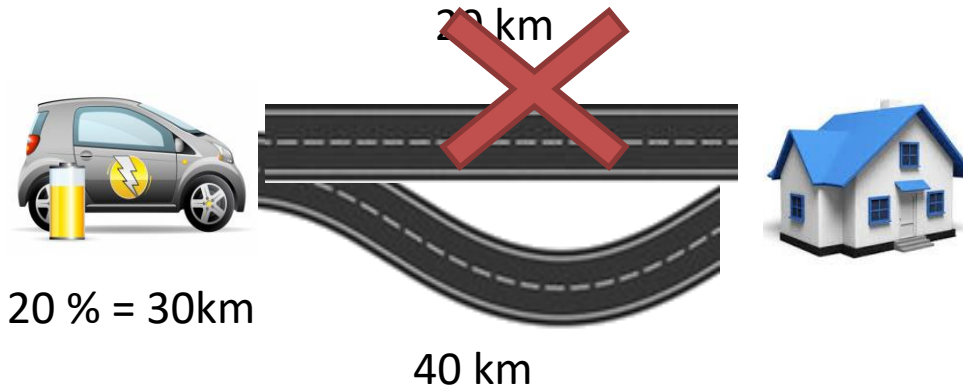
Report from the Union of Concerned Scientists

Famoso veicolo elettrico USA

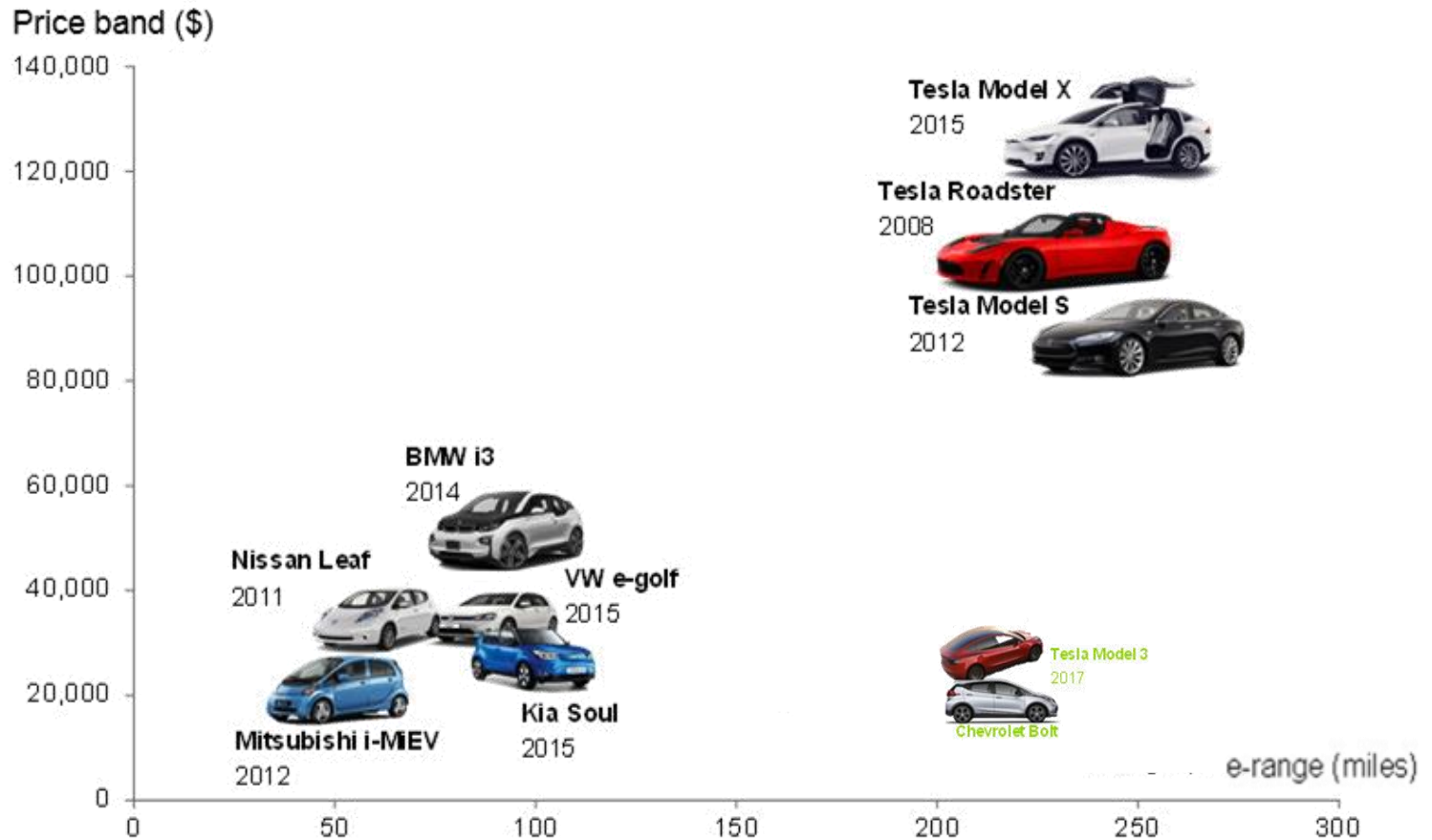
- **100 mila km prima di iniziare a risparmiare**
- 2000 batterie (da smaltire e ri-costruire), 50 maggiori produttori in Cina, terre rare da Cina
- 700 kg zavorra
- Cattivo NVH
- Neppure fun-to-drive: accelerazione elevata ma per poco tempo!



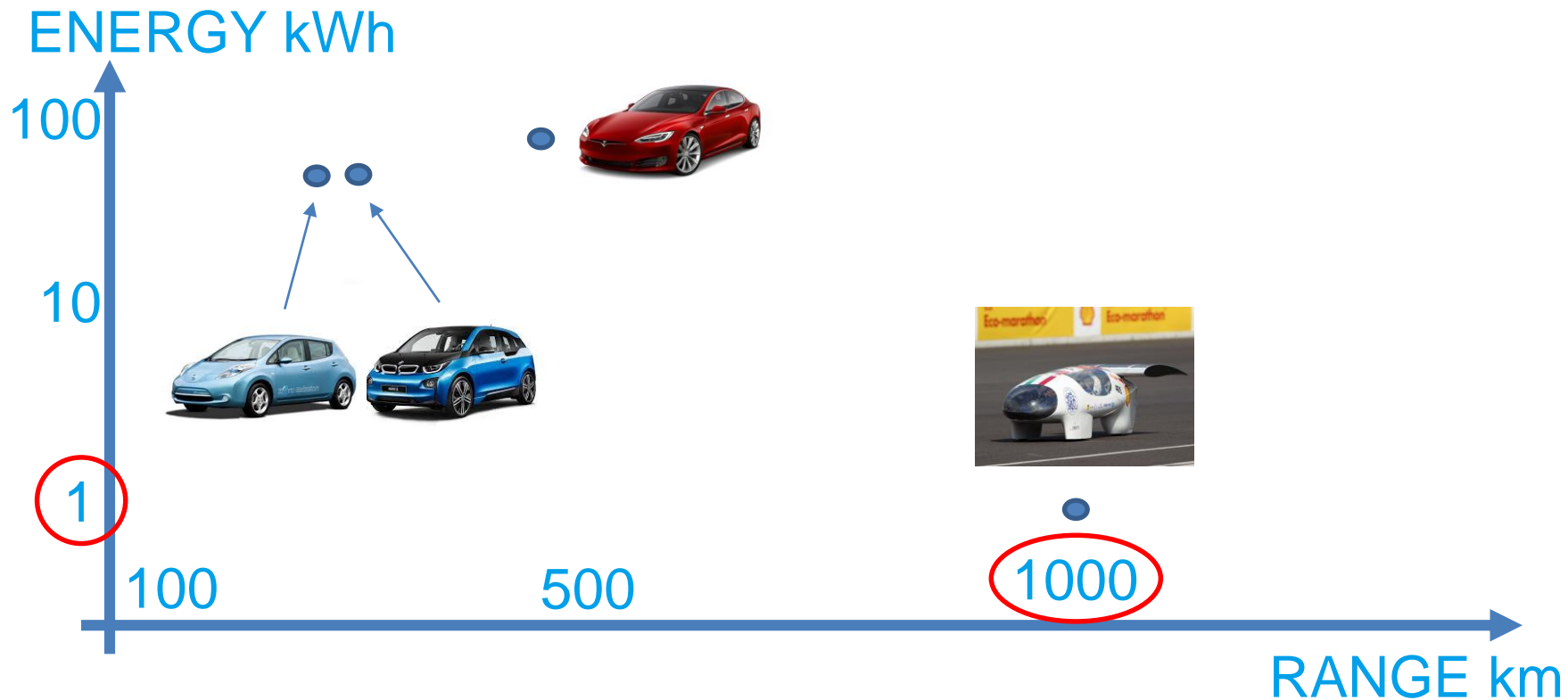
Influencing factors



RANGE



RECORD MONDIALE DEL POLITECNICO DI MILANO, SHELL ECO MARATHON, LAUSITZ, 2011

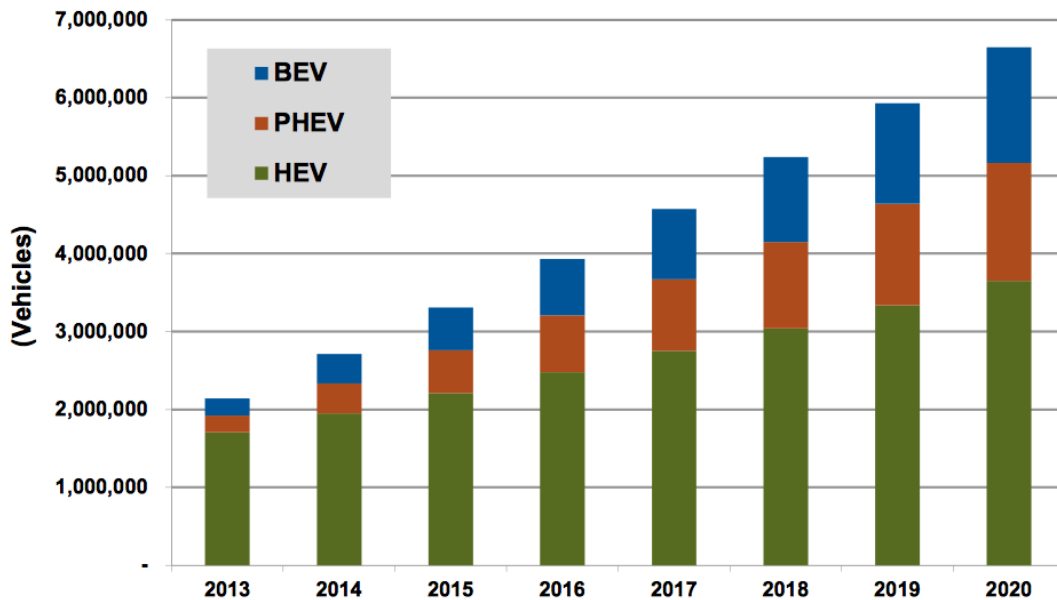


SAE Paper # 17M-0147/2017-01-0389

Market: PRODUZIONE VEICOLI 2016: 95 mln!

2017	2018	2019	2020
BMW i3 S & facelift Citroën E-Berlingo Jaguar E-Pace mild hybrid SUV Kia Niro Hybrid & PHEV, Soul EV long-range	Audi Q6 e-tron BMW i3 roadster Faraday Future FF91 Honda CR-V hybrid Jaguar I-Pace Land Rover R-R Evoque mild hybrid Nissan All-new Leaf Renault Mégane Hybrid mild-hybrid Volvo XC60 T8 plug-in hybrid	Aston Martin DBX Audi e-tron A7 Sportback BMW X3 EV DS B-SUV EV Hyundai Ioniq SUV Mazda EV Mercedes-Benz EQ C Mini Mini E Peugeot 208 & 2008 EVs Porsche Mission-E saloon, Macan EV Seat e-Mi Skoda Superb hybrid Testa Model Y SUV Volvo e-S60 EV saloon	Audi Q4 e-tron Citroën B-SUV EV, C4 Cactus EV DS DS4 EV Ford Model-E SUV Honda Jazz EV Jeep Wrangler hybrid Kia C-SUV Land Rover Discovery Sport hybrid Lexus LS Fuel Cell Maserati Alfieri-E Mercedes-Benz EQ A compact SUV Peugeot B-SUV EV Renault All-New Zoe Seat e-SUV Skoda Vision-E SUV Toyota iRoad Volkswagen ID hatch

Annual Light Duty Electric Vehicle Sales by Drivetrain, World Markets: 2013-2020



(Source: Navigant Research)

VEICOLO ELETTRICO ETERNA PROMESSA



**PORSCHE
1898**

**IDENTIFICATO UN IMPORTANTE FATTORE DI INSUCCESSO
DEGLI EVs**

EVS30 – Stoccarda, Ottobre 2017

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October 9-11, 2017

Co-located with BATTERY+STORAGE and f-cell

Messe Stuttgart
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Your search phrase



EVS30 - Electric Vehicle Symposium & Exhibition

Look forward to elect! 2018

www.elect-expo.com

EVS30 – the Electric Vehicle Symposium & Exhibition, held October 9-11, 2017, was the most important industry meeting point for the entire electromobility industry. Manufacturers, users and decision-makers could get the latest picture of all forms of electric mobility in Stuttgart and discuss new trends and possible uses of electric power transmission.

Partners and Sponsors



DAIMLER



COMPONENTS TOO HEAVY !

Battery technology



- SDIBS- Samsung batteries launched in Frankfurt Auto-show 2017
- lithium-sulphur technology from OXIS Energy
- Magnesium batteries by Toyota

Light weight engineering



BMW i3
Carbon fiber body



Fisker Karma
Aluminum space frame

Improved aerodynamics



Tesla Model s
Drag coefficient 0.24

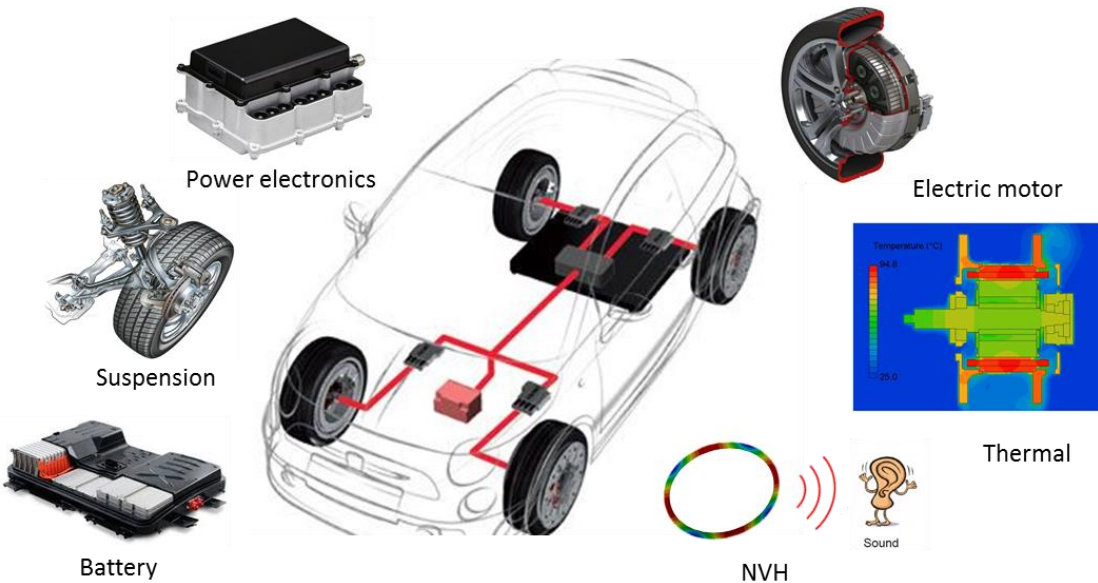


Tesla Model 3
Drag coefficient 0.21

Design solutions to improve range

Complex system optimization

Research project under Horizon 2020



In-wheel motor electric vehicle design optimization



ADEPT

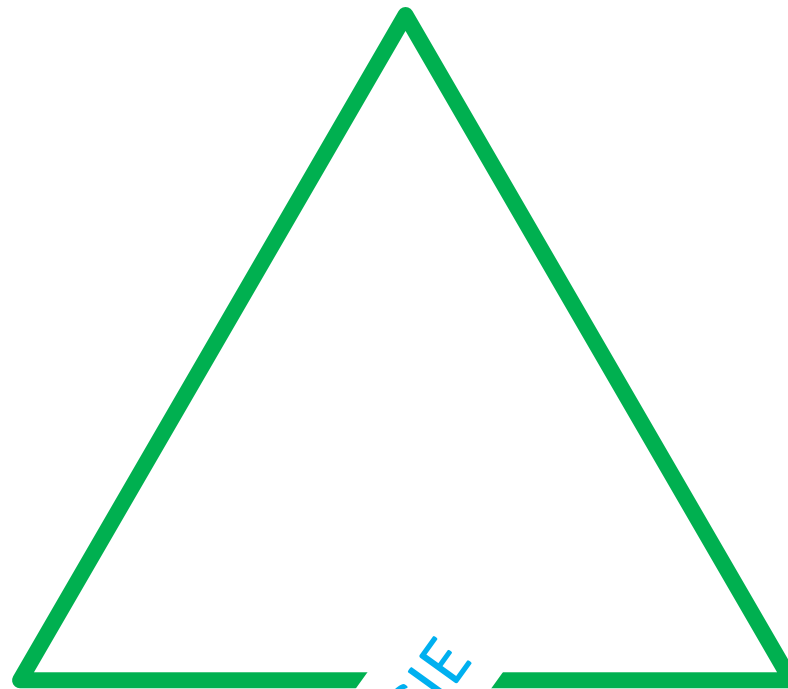
ADvanced Electric Powertrain Technology



INDUSTRY 4.0 E PRODOTTI AUTOMOTIVE PER VEICOLI ELETTRICI

Industry 4.0 Digitalizzazione di prodotto e processo

DIGITALIZZAZIONE



PRODOTTO

PROCESSO

SINERGIE

Progetto CLM: INPROVES 7.5 mln



CLM

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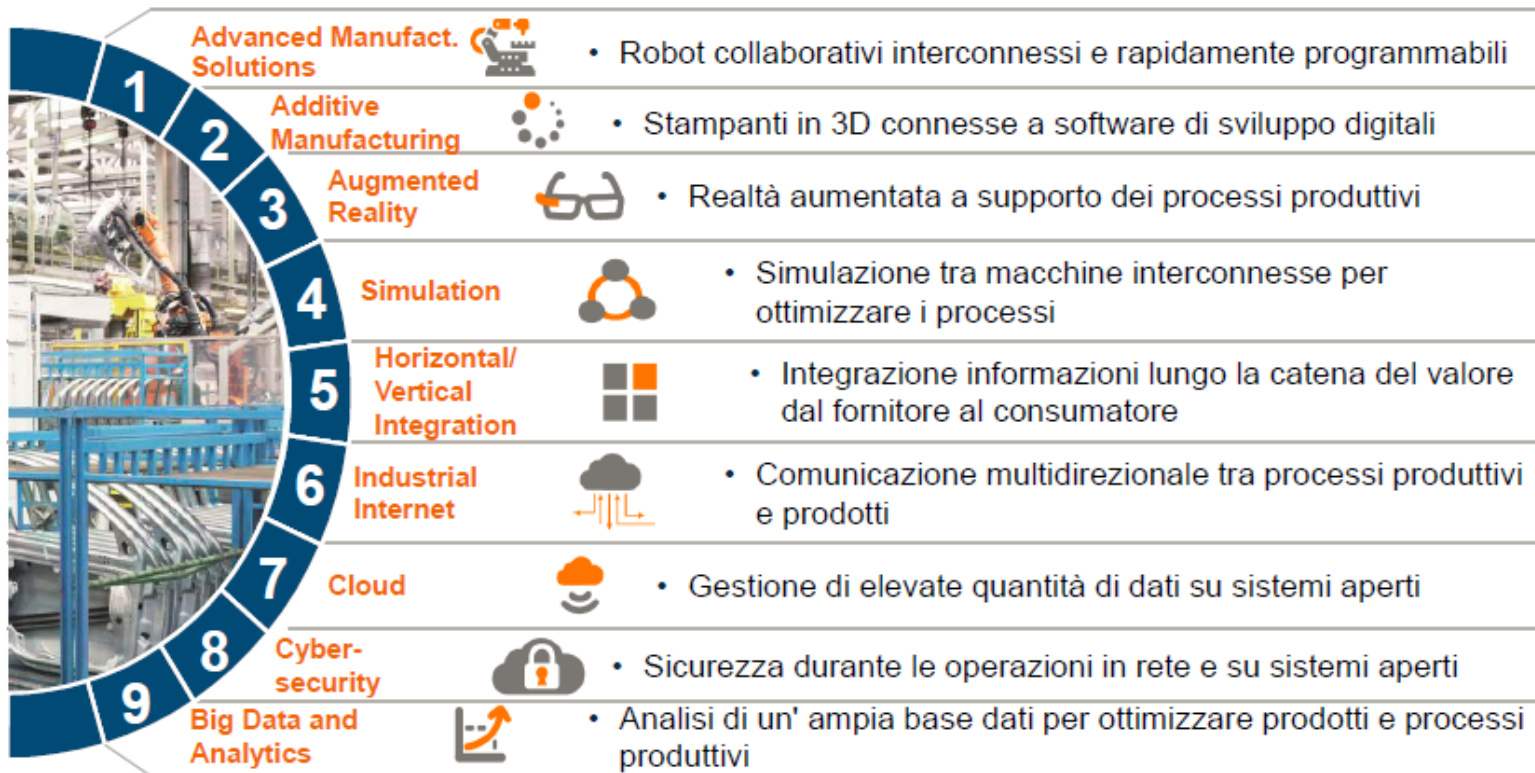
+ 2 UNIVERSITA' + 4 PMI

Ieri: prodotto & processo



Oggi: prodotto & processo con digitalizzazione

Industria 4.0: Le tecnologie abilitanti



2

Esempio: veicoli elettrici, autonomi & connessi + Industry 4.0 ...**SOLO SE COMPONENTISTI ABILITERANNO**



VEICOLI AUTONOMI «**INNERVATI**»
INDUSTRY 4.0 COME ABILITATORE DELLA NUOVA TECNOLOGIA



Thank you!