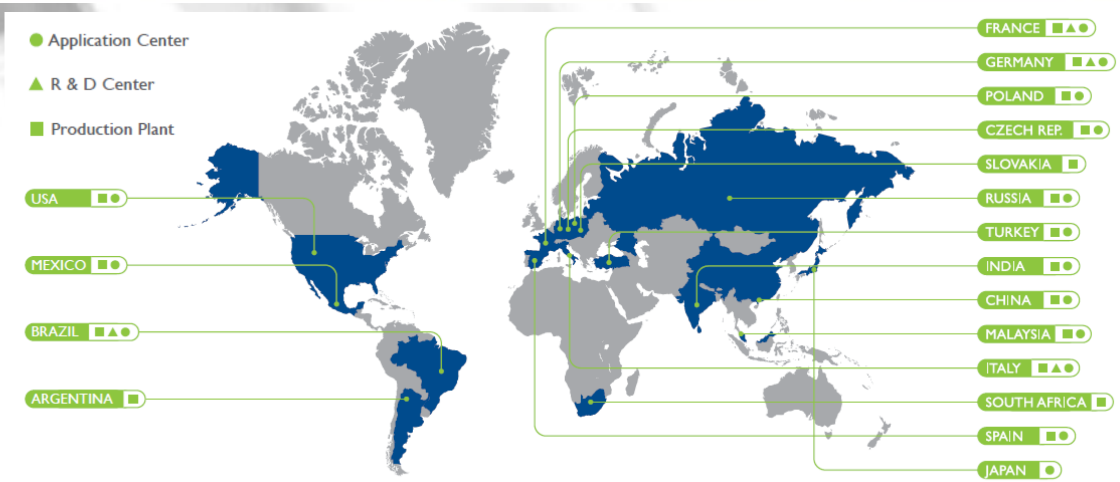
Automotive and Magneti Marelli FUTURE CHALLENGES

Giovanni Gaviani, Business Development VP PWT

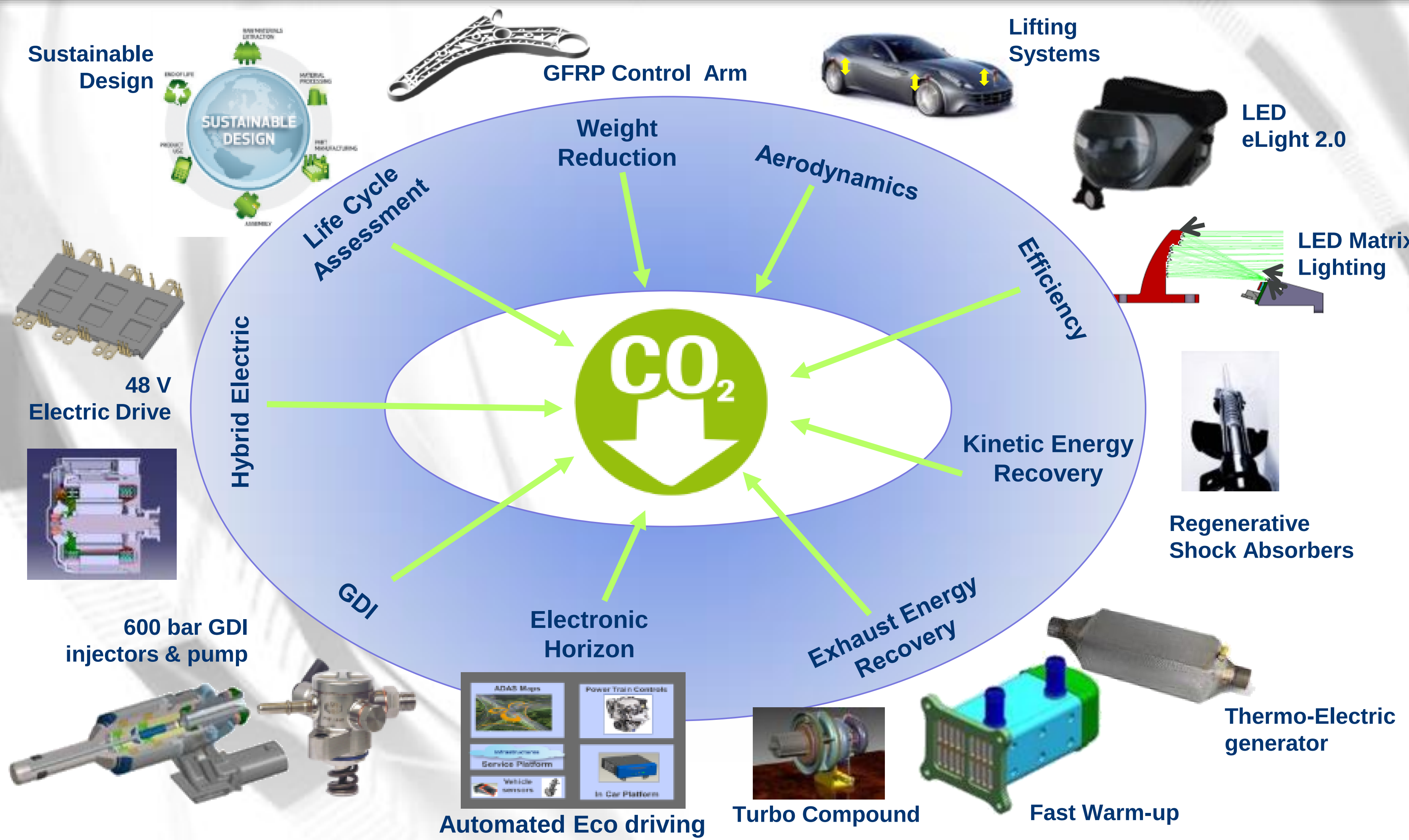
November 2016

Magneti Marelli Company Overview



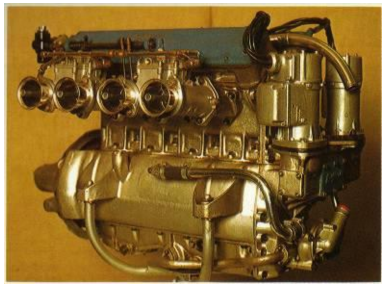
Sales 2015	7,3 **bn €**
R&D Centers	**12**
R&D (of sales)	**5.8%**
Production units	**86**
Application Centers	**26**
Investments (of sales)	**5.2%**
Employees	~ 41,900

MM Technologies for CO_2 Reduction

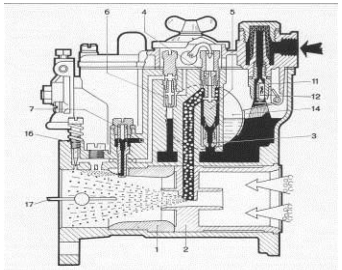


Magneti Marelli Powertrain
BEV & HEV High & Low Voltage

MM : F1 K.H. transferred to Serial Application

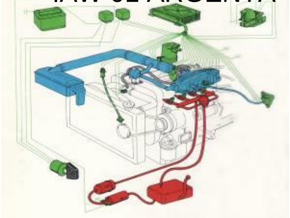


1952 → Twin Barrel Carburetor 1958



1984 → Ignition&Injection System 1985

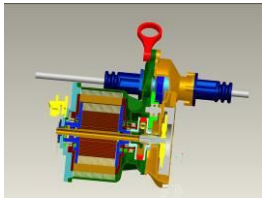
IAW 01 ARGENTA



1989 → Robotized Gear Box 1997

FERRARI 355 F1

2009 → K.E.R.S. F1 2011



MM : New F1 K.H. transferred to Mass Production

2009-13 …

KERS

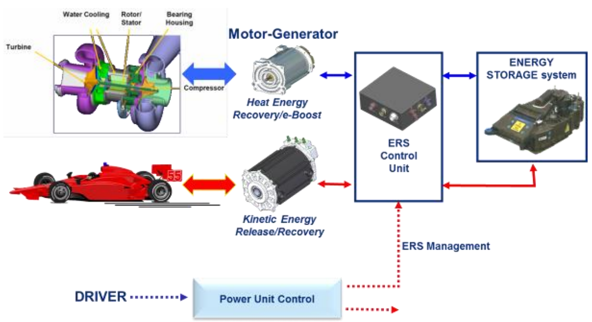
Kers control unit | E-Motor unit | Battery Module

CAR TELEMATIC SYSTEM | ELEC. UNITS | INJECTOR

… Magneti Marelli heavily invest in Racing arena to test new challenging technologies

In 2014

ENERGY RECOVERY SYSTEM



… performance will likely remain on par with today's cars but with a 35% fuel reduction

… in the next future

… we will be able to develop systems capable of delivering strong reduction in carbon dioxide emissions

from Racing experience, Technologies to mass market application

High Performance Vehicles

LaFerrari

ICE 12v	800 cv
E-motor1	163 cv
E-motor2	25 cv
CO_2	- 48%

SOP Q3 2013

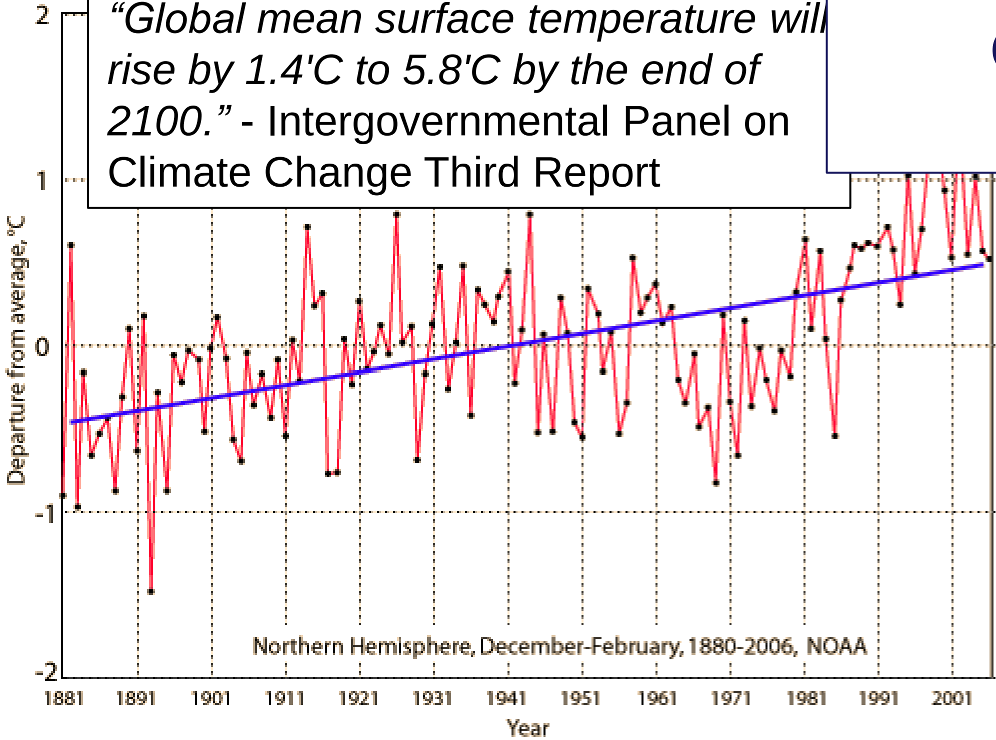
Future World.....

- Our aim is to give to you :
  - ***→Cars eco compatible***
  - ***→User friendly Vehicles***

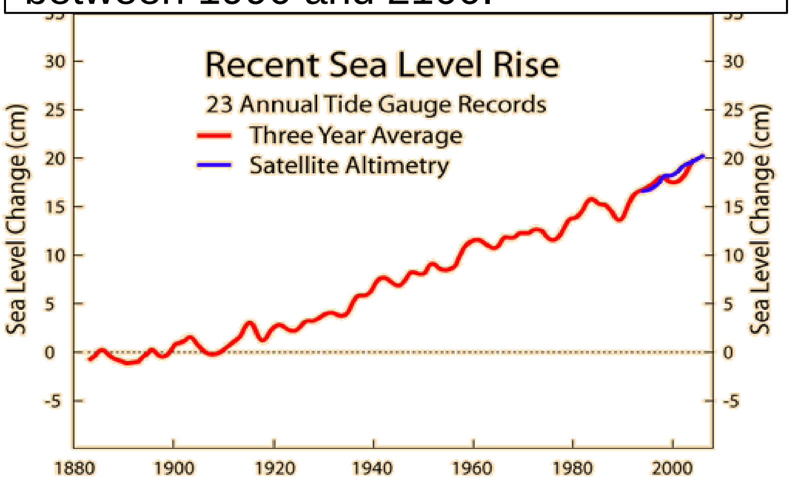
Thanks to STm

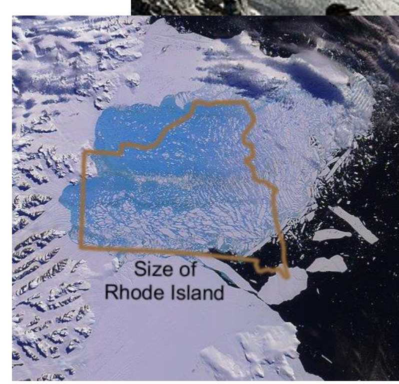
CO_2: Climate Change

"Global mean surface temperature will rise by 1.4'C to 5.8'C by the end of 2100." - Intergovernmental Panel on Climate Change Third Report



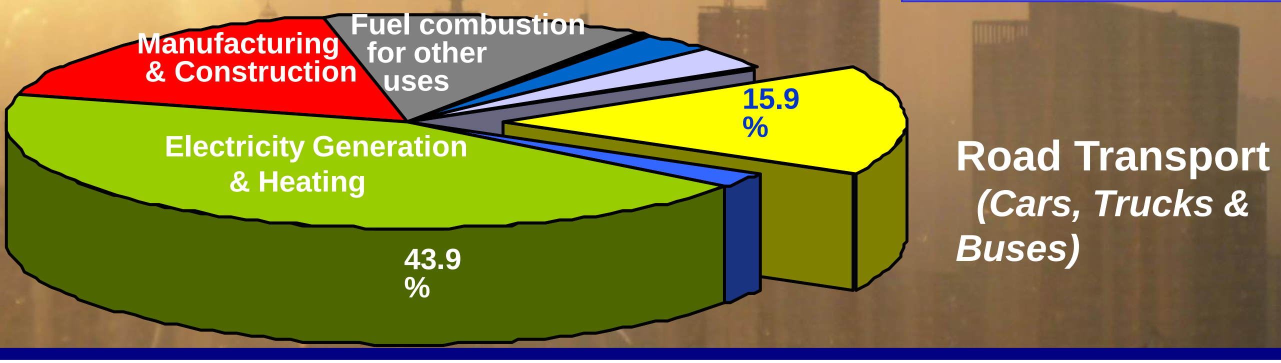
It is predicted that the Earth's average sea level will rise by 0.09 to 0.88 m between 1990 and 2100.





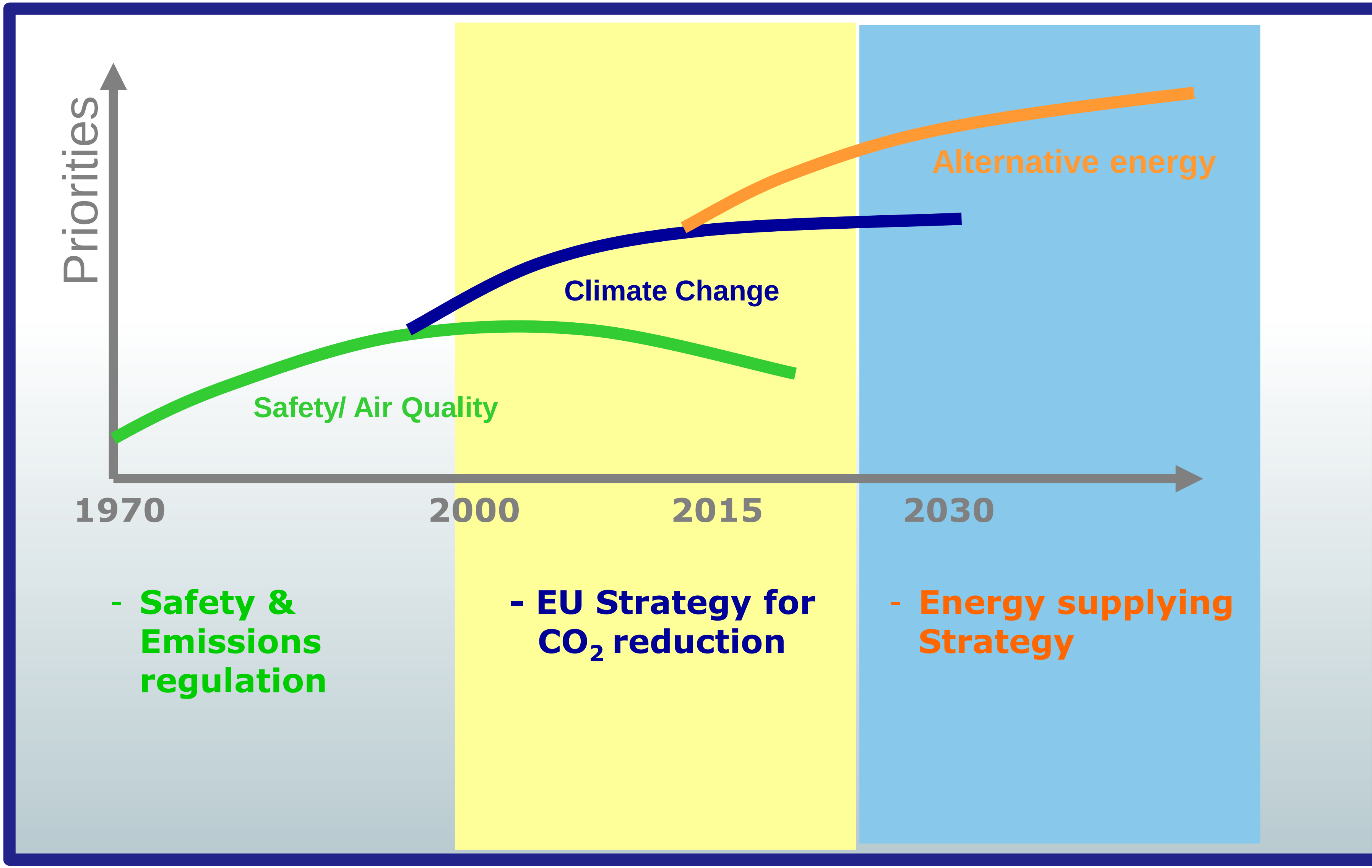
A sunny morning in Shangai : Air Quality

Source: EU Commission

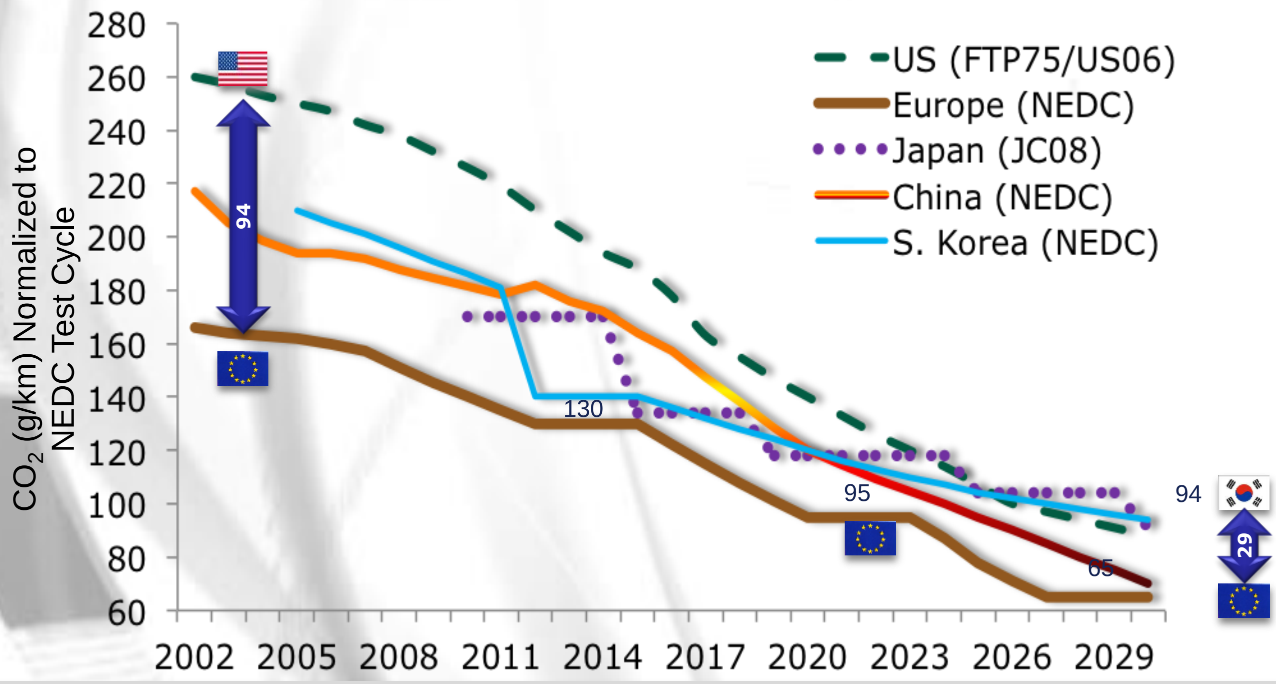


Following the present trend, an **80% increase in transport** emissions is expected on a worldwide scale, in 25 years.

Sustainable Mobility challenge : vision 2008



CO_2 and EMISSION World Wide Legislations



- Within **2020** will be CO_2 emission reduction vs, 2012:
  - EU = -27%
  - US = -33%
- Within **2030**, all countries will have a target CO_2 **< 100 g/km**

Source of data: IHS GlobalInsight

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
US	T II B8	Tier II Bin 5							Tier II Bin 4		
Europe	Euro 4					Euro 5				Euro 6	
Japan	Japan ‘05				Japan ’09						
S. Korea	Euro 3	Euro 4				Euro 5				Euro 6	
China (Beijing)	Euro 3			Euro 4				Euro 5			

Outlook on the next ten years
Technologies

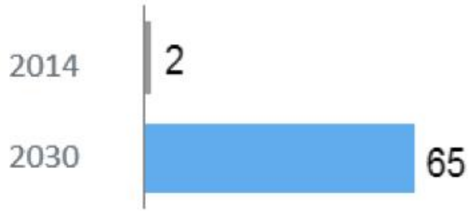
JAMA-CLEPA
BUSINESS SUMMIT

Electrification

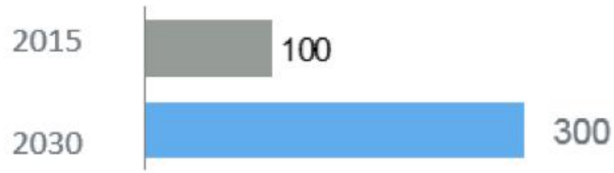
Stronger regulations on CO2 emissions, rising consumer demand, and government incentive programs for electric vehicles will boost electrical powertrain sales

Automated Driving

The technological advances and growth pockets for autonomous vehicles will drive increasing levels of autonomous vehicle features, leading to new market entrants, e.g., Google, and mergers and acquisitions



Market share of electric vehicles (incl. hybrids) / Percent of units produced

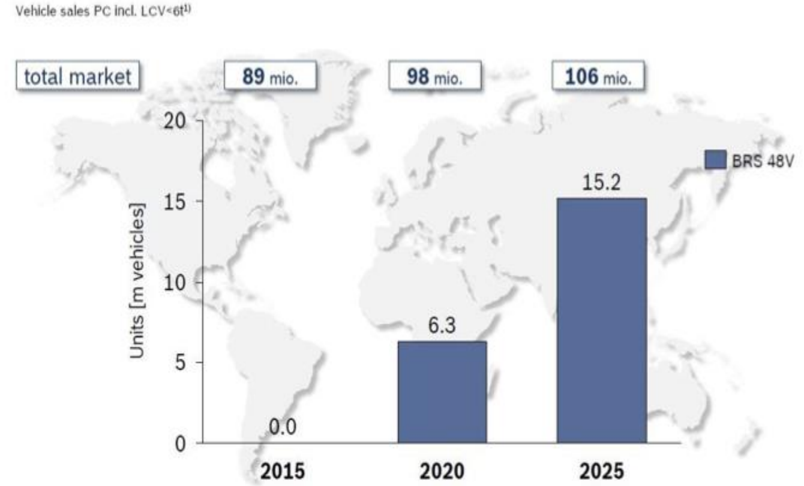


Lines of software code per vehicle
Million units

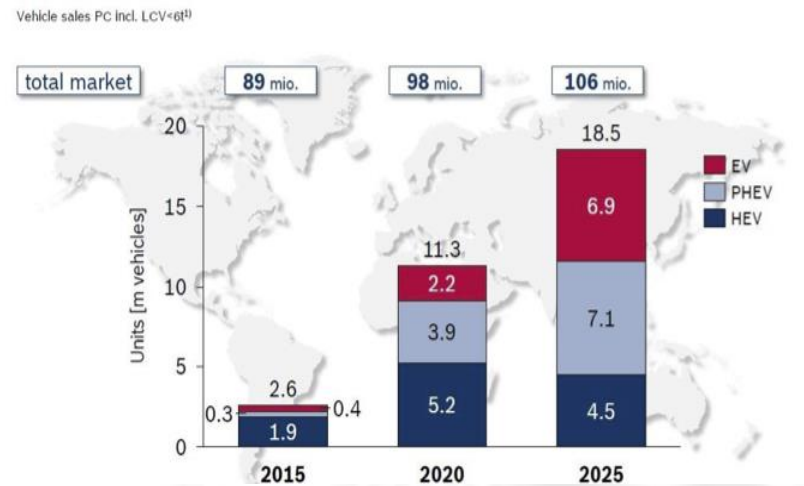
Source: McKinsey study for CLEPA

EY

Electrification : Growing share



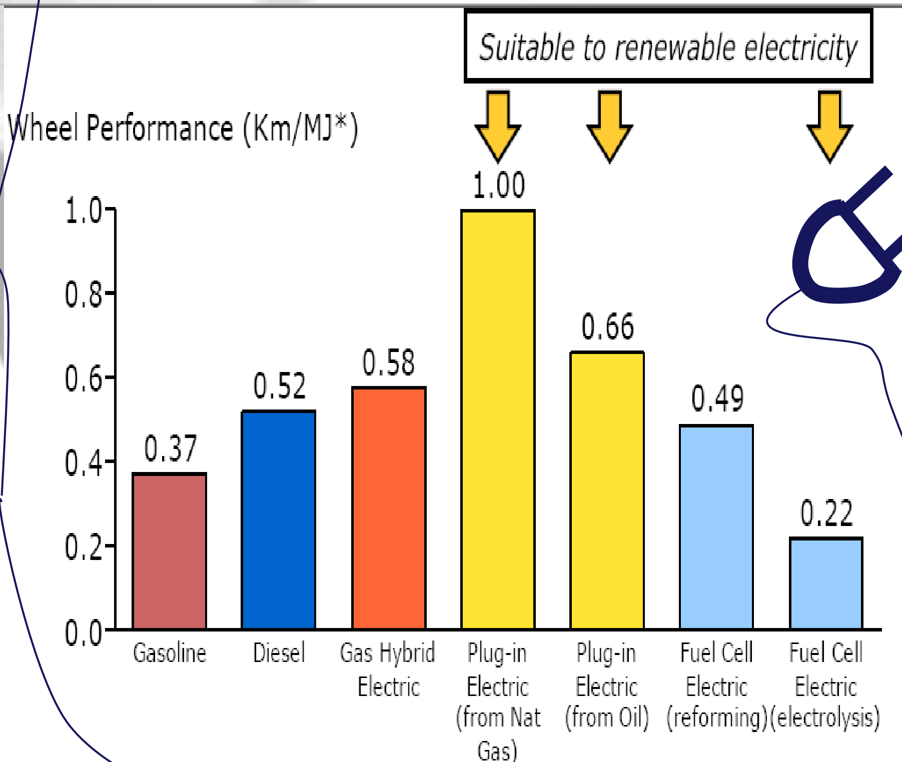
BRS 48V – Boost Recuperation System



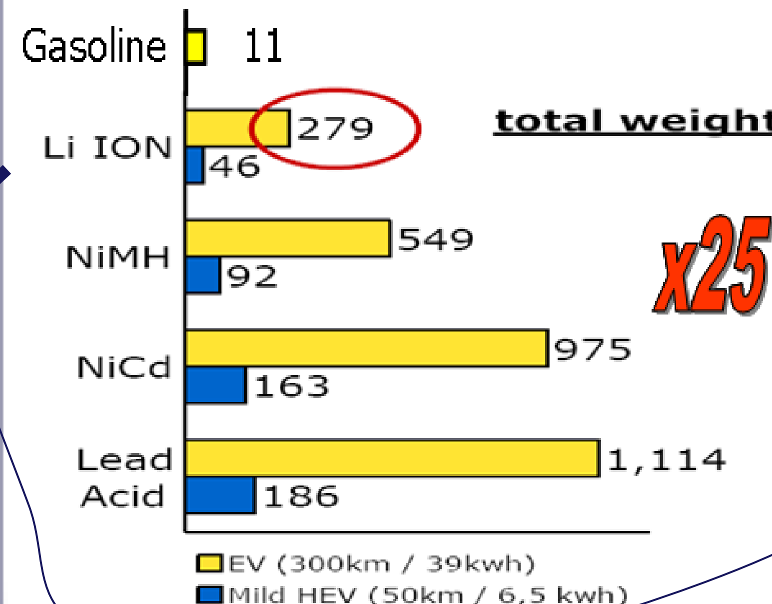
- Growing share of market
- Huge potential due to:
  - Consumers demand and political pressure for greener vehicles
  - Development of infrastructures
  - Technological progress (batteries)
  - Instability of oil price

BEVvsICE : Efficiency/Weight Comparison

- Electrical Vehicles give the **best efficiency** Well to Wheel 70%
- Max efficiency achievable is 25% in ICE and 35% in HEV



- Battery is key Factor for BEV success
- Mileages cannot be higher then 120 – 150 Km/recharge
- Battery (Li-ion) can achieve a cost < 200 €/kwh



Hybrid Systems:
key element in the discontinuous technologies

In the evolution of technology hybrid systems are pretty frequent. They are where a strong **discontinuity** is fulfilled by **temporary** elements coming from both old and new technologies.

During the years of sailboats and engine boats hybrid systems had a great application in both modalities of propulsion. As sailboats did not have enough autonomy to cross the Ocean.

The evolution of hybrid systems thought us some lessons:

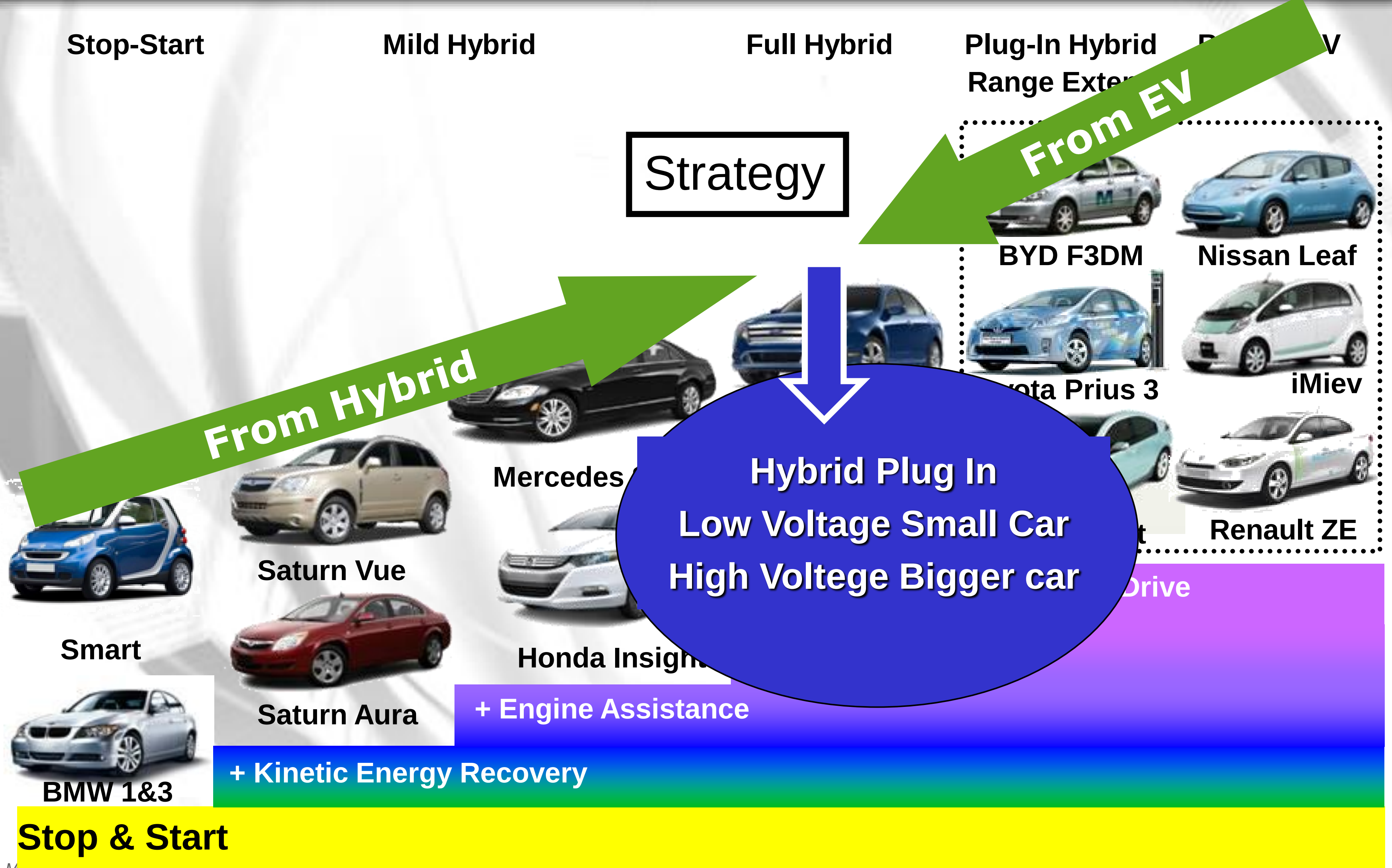
1. The transitional period (so called **Hybrid Kingdom**) can be long-term.

It occurred almost 90 years to navigate the Atlantic Ocean by the Savannah (first sailboat with an auxiliary engine – **1819**) and the T.W. Lawson (last pure commercial sailboat -**1907**).

2. **Initially hybrid systems** were probably **considered** to have a competitive **advantage only for specific application.**

The main reason to hybridize sailboats was to speed them in the dead zone (so called the doldrums) in the Ocean. As in those routs with trade wind sailboats remained the best solution to navigate.

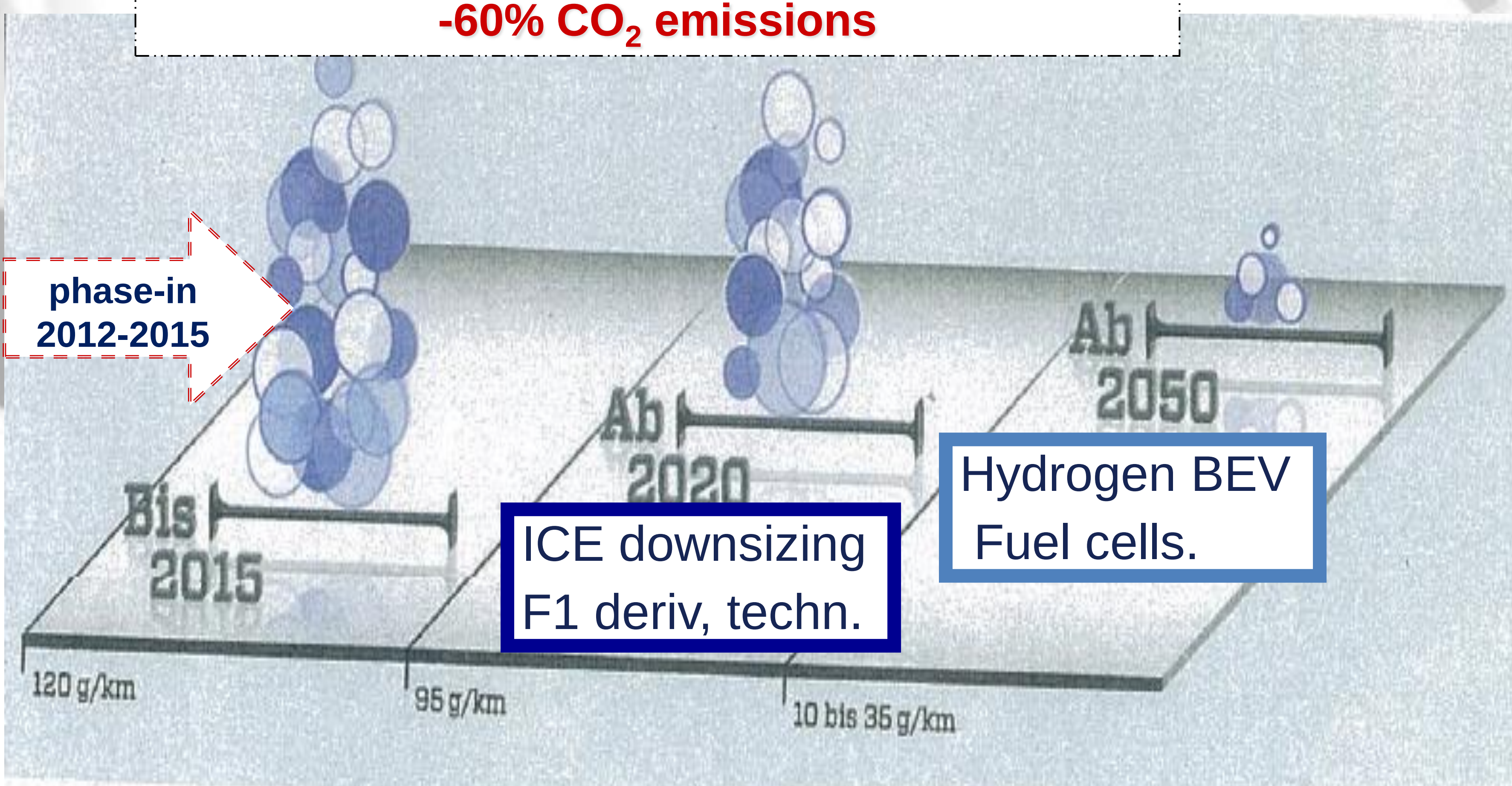
From HEV and BEV to Hybrid Plug In



CO_2 European Passenger Car Regulation

CO_2 European Regulation in next four decades

-60% CO_2 emissions



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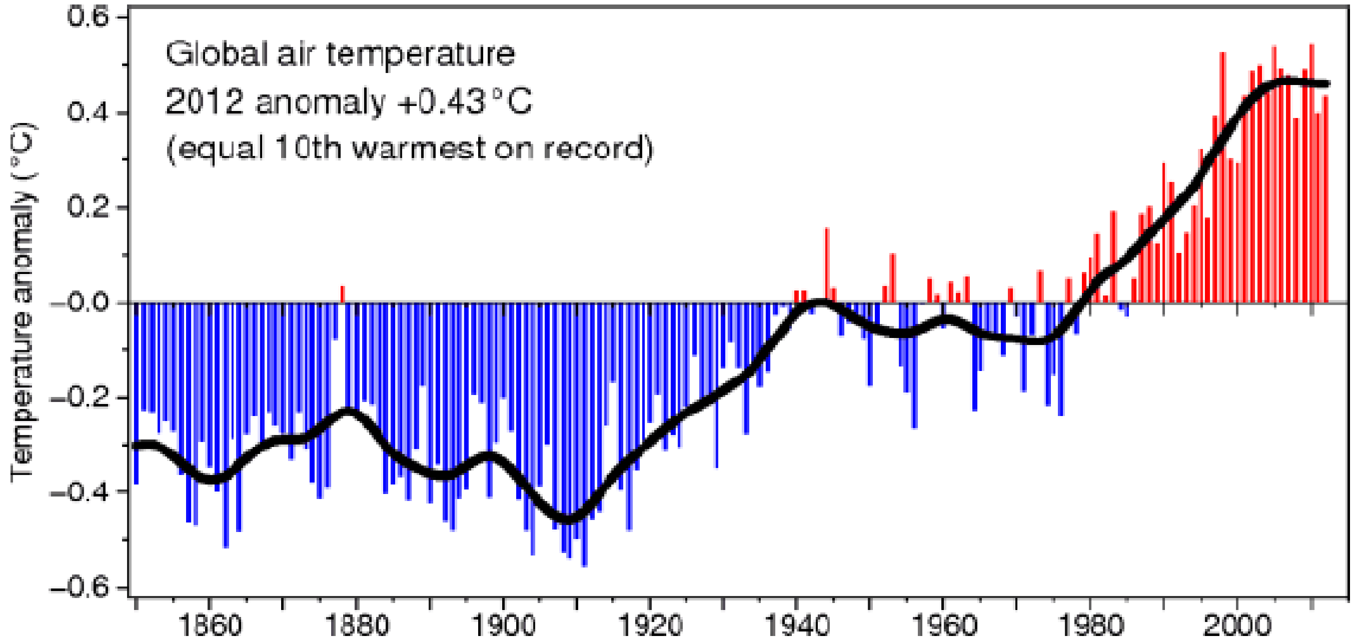
All Starts from these analysis

1: Global Temperature Record

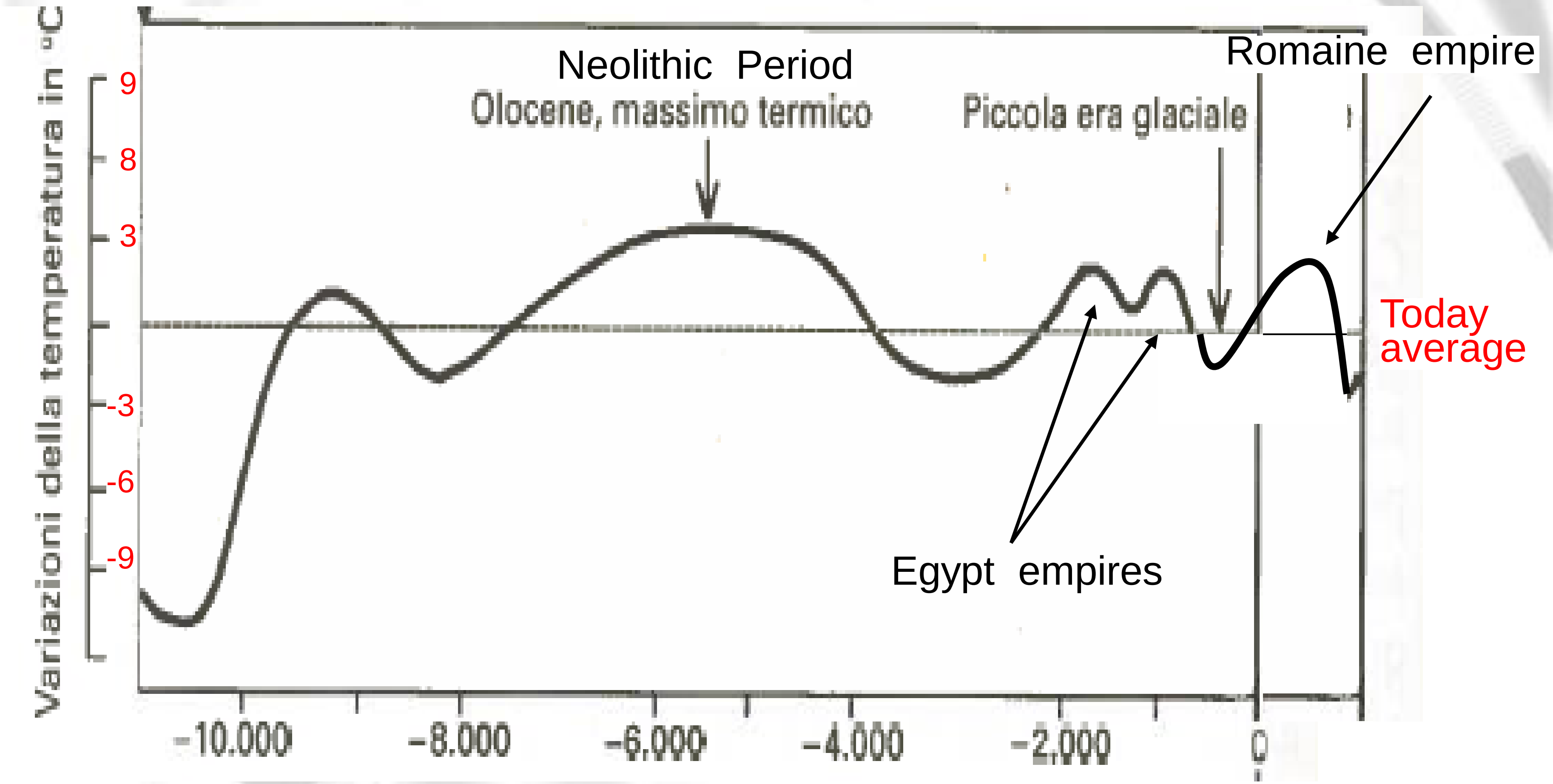
Phil Jones



(this graph of HadCRUT4 is also available as Encapsulated PostScript and PDF suitable for publication and the data are available as Comma-Separated Values)

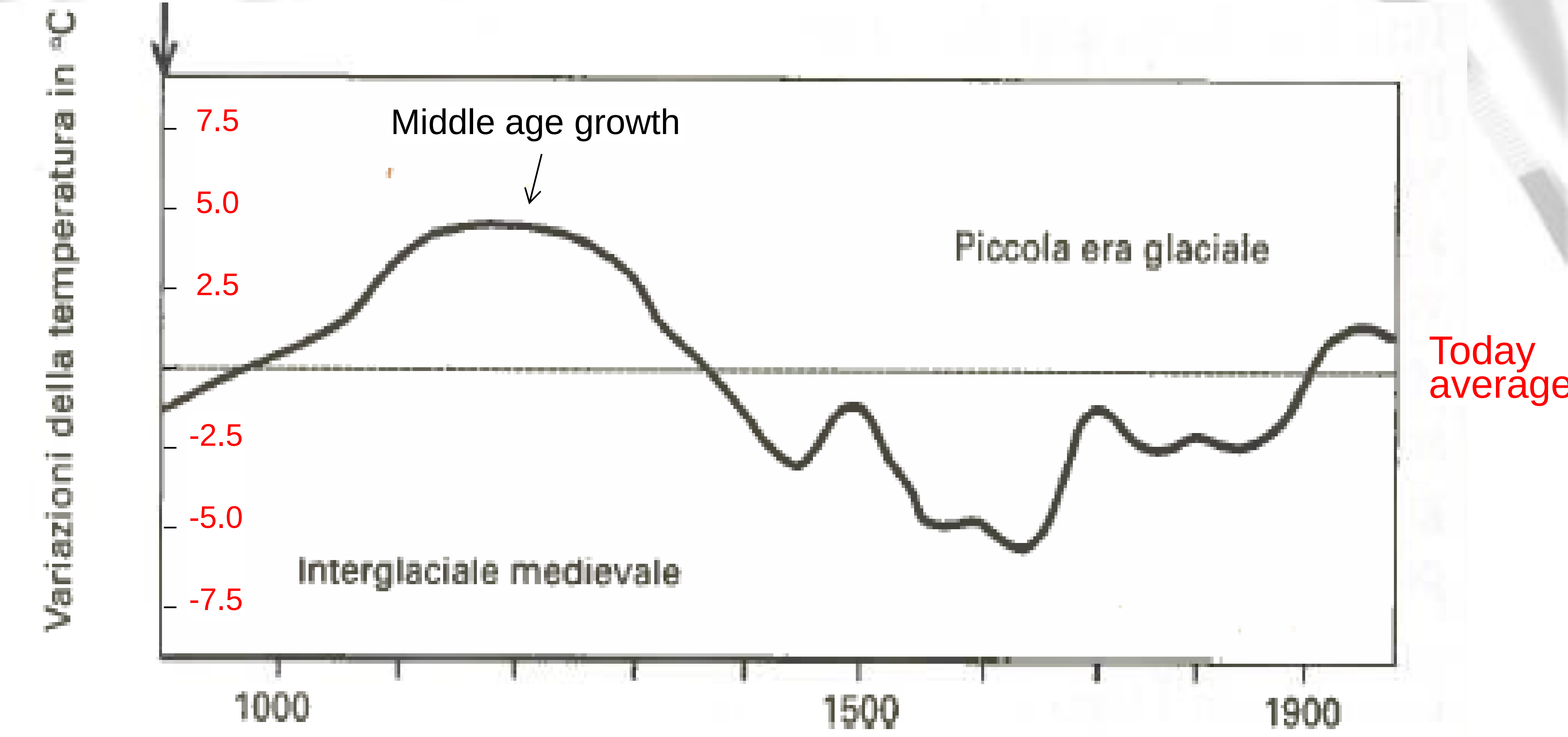
The time series shows the combined global land and marine surface temperature record from 1850 to 2012. This year was the tenth warmest on record. This record uses the latest analysis, referred to as HadCRUT4 (Morice *et al.*, 2012).

All Starts from these analysis….***but***
When temperature is higher ….



Wolfang Bering *Effeti sociali del Clima" ediz. Boringhieri

All Starts from these analysis….*but*
When temperature is higher ….



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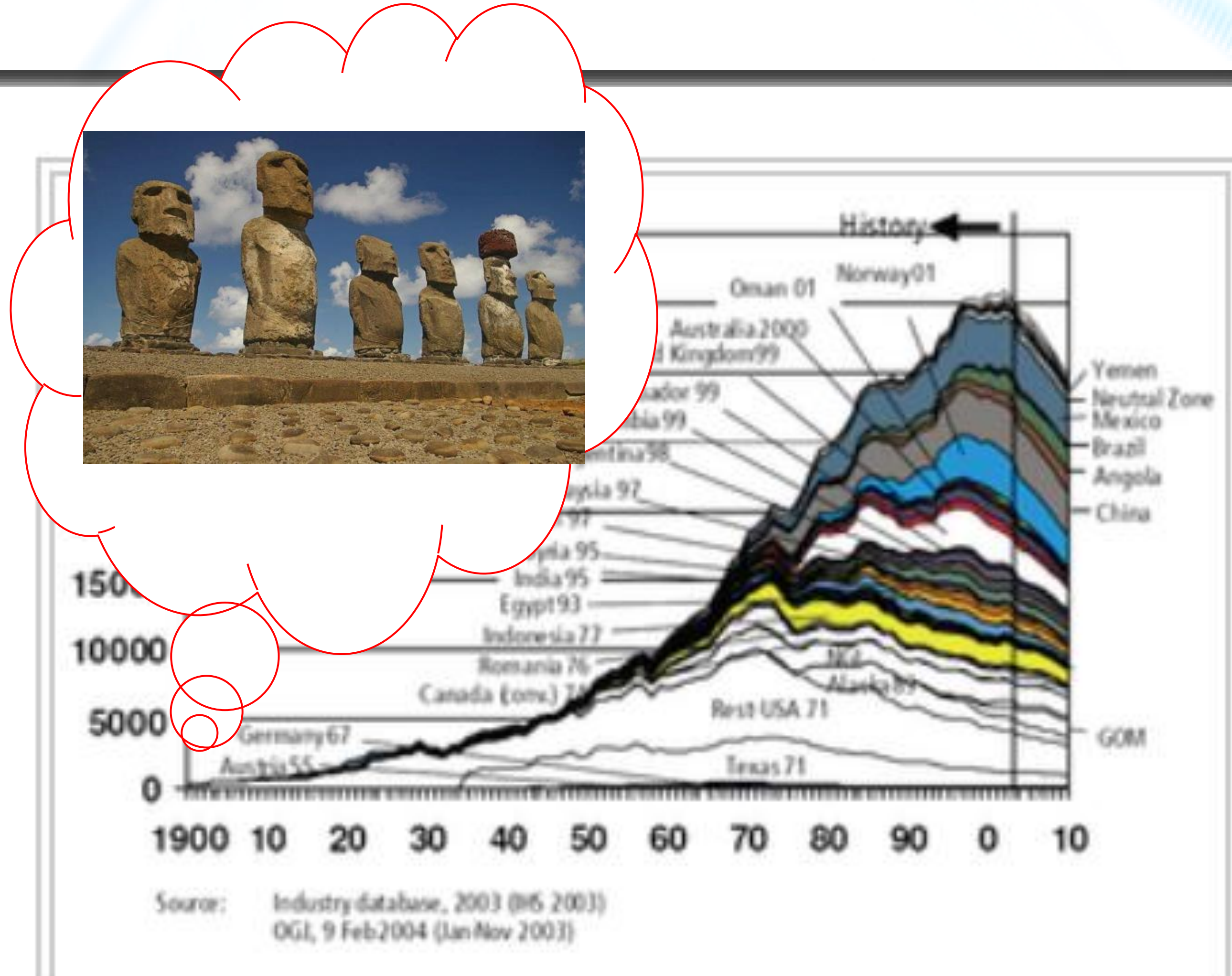
Oil WW Production and Hubbert peak



CO2 is a basic KPI to drive the improvement

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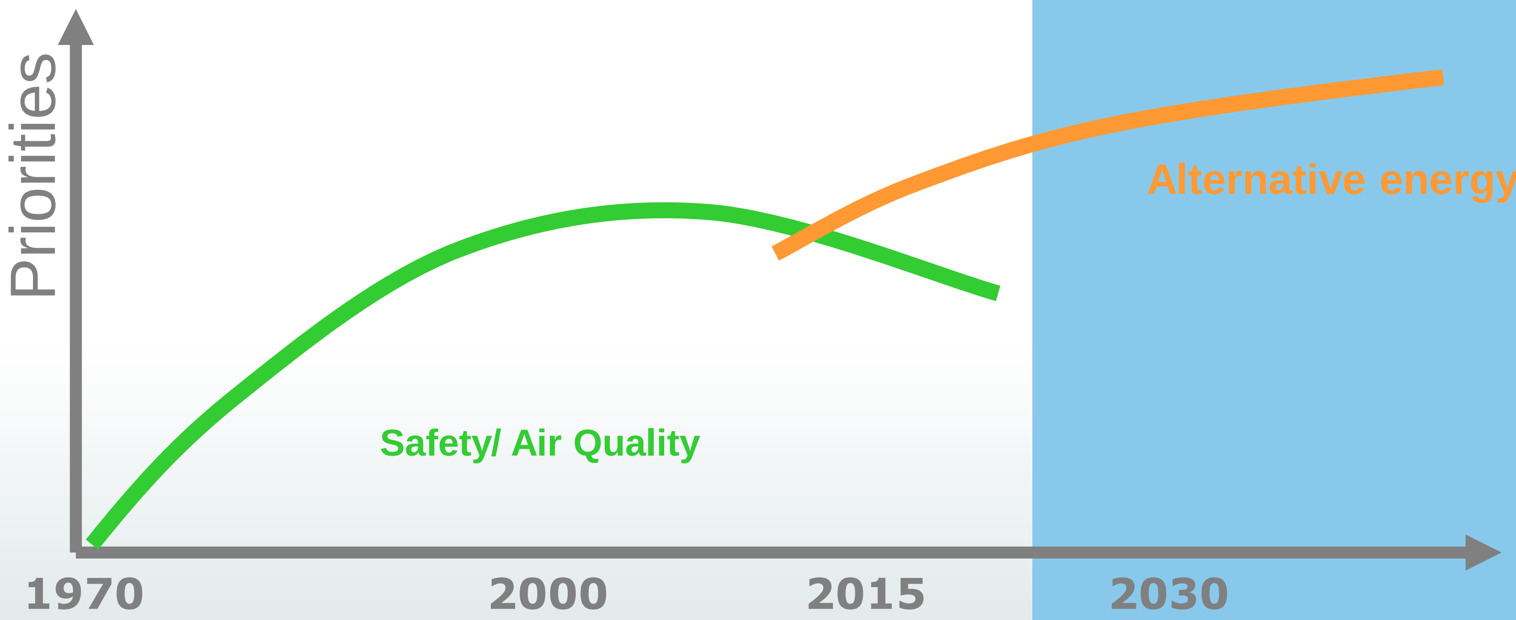
Sustainable Mobility challenge : vision 2016

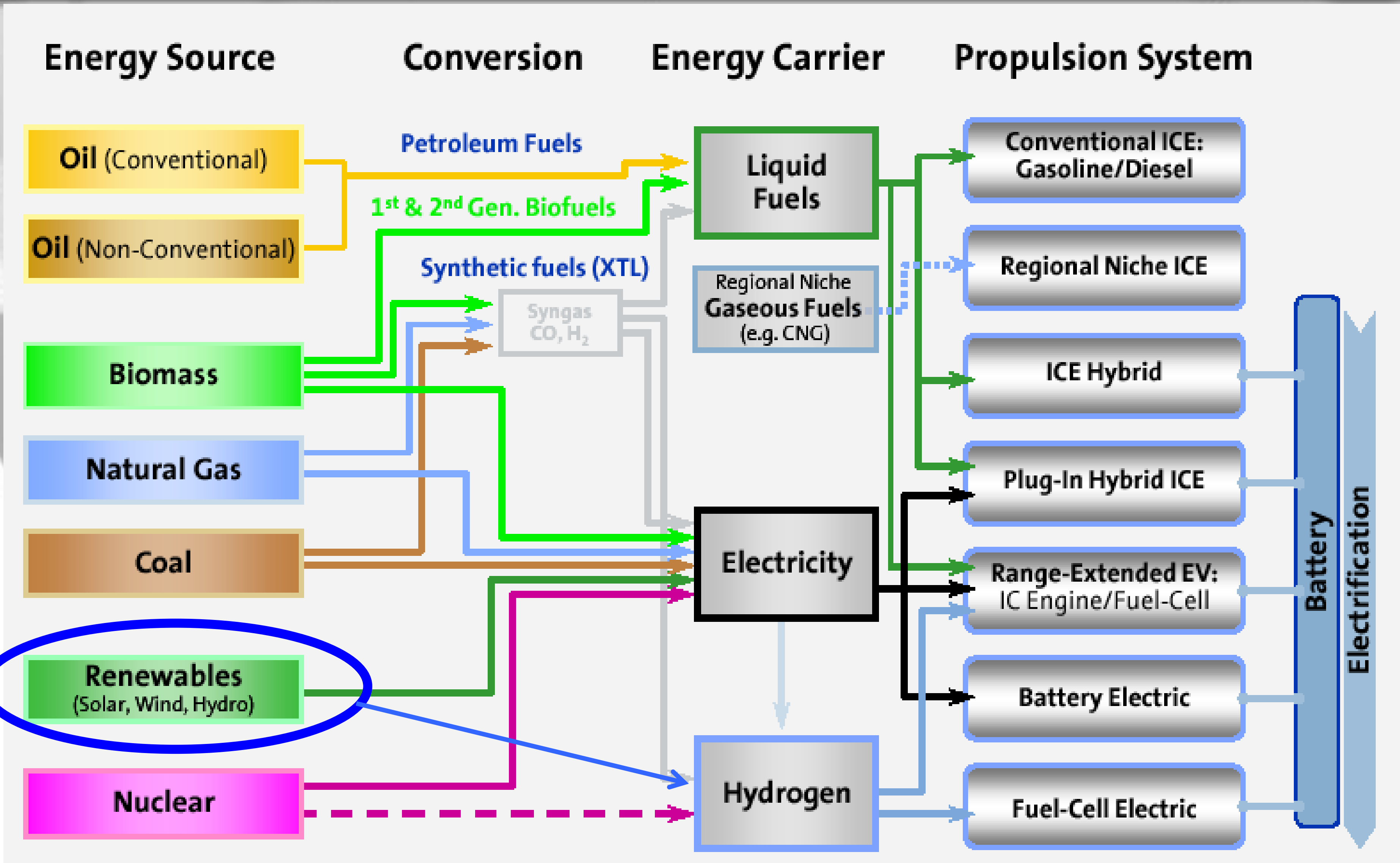


- **Safety & Emissions regulation**

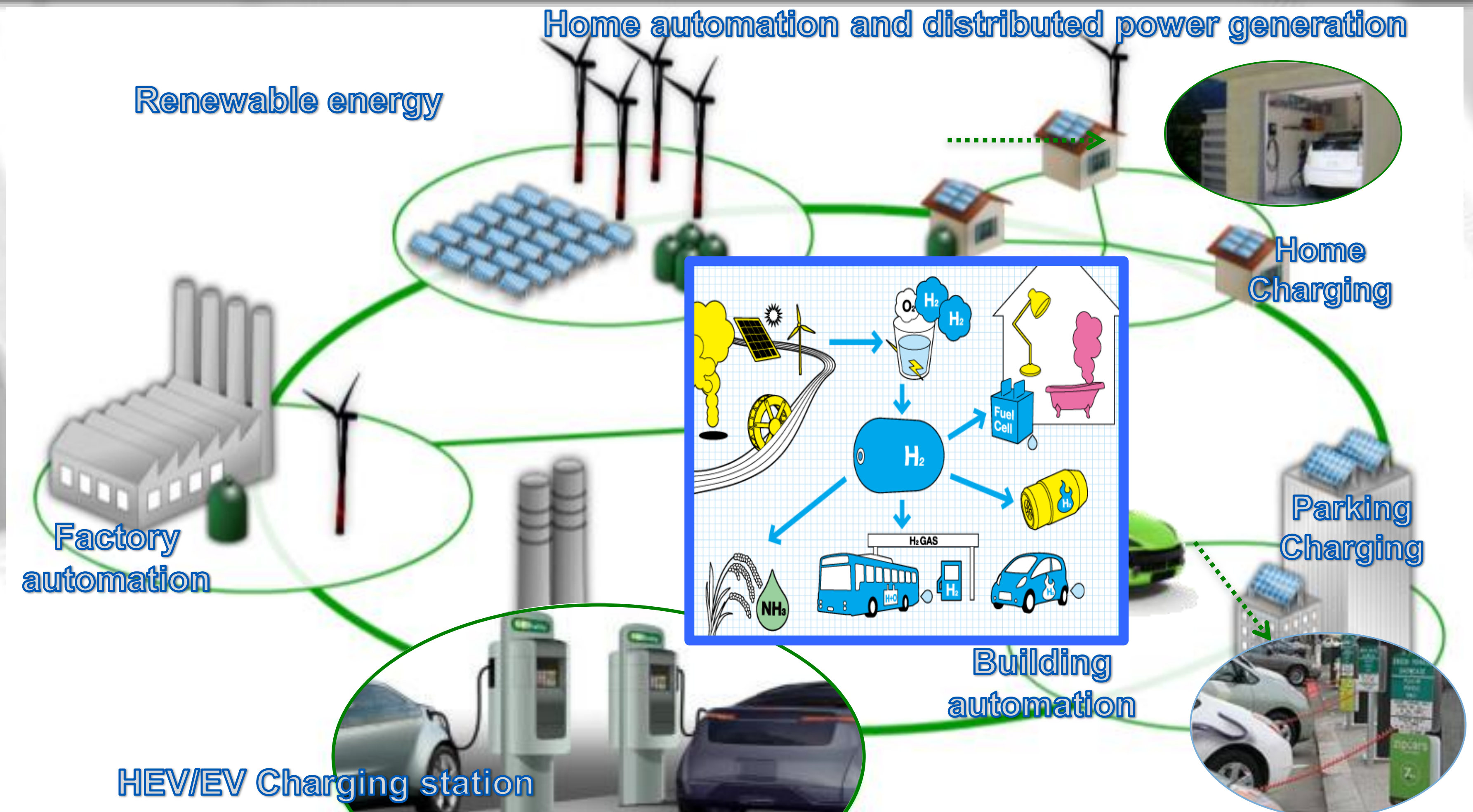
- **Energy supplying Strategy**

But CO2 legislation is a way to control Oil & Coal use

Hydrogen Energy Carrier

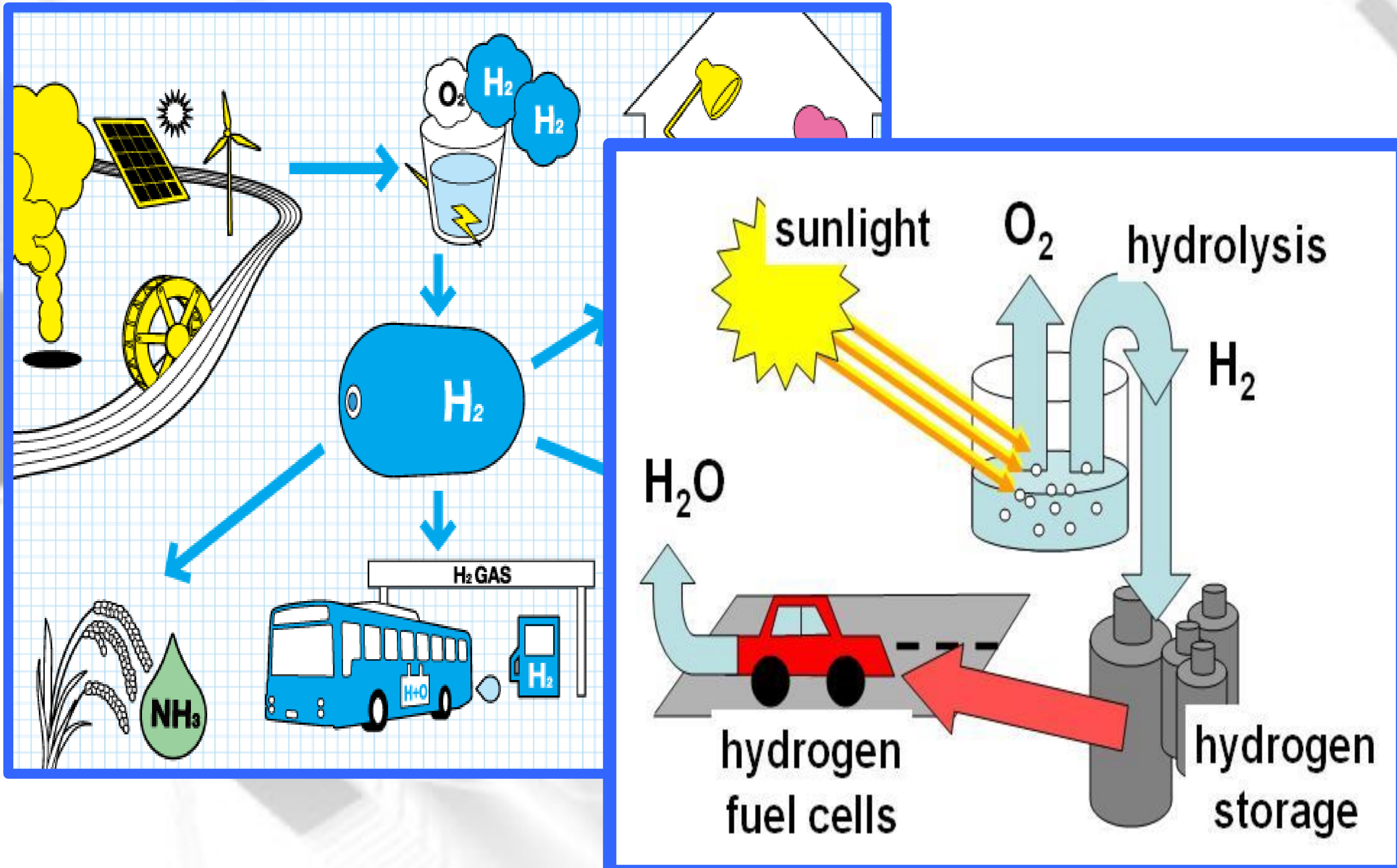


Hydrogen Energy Carrier



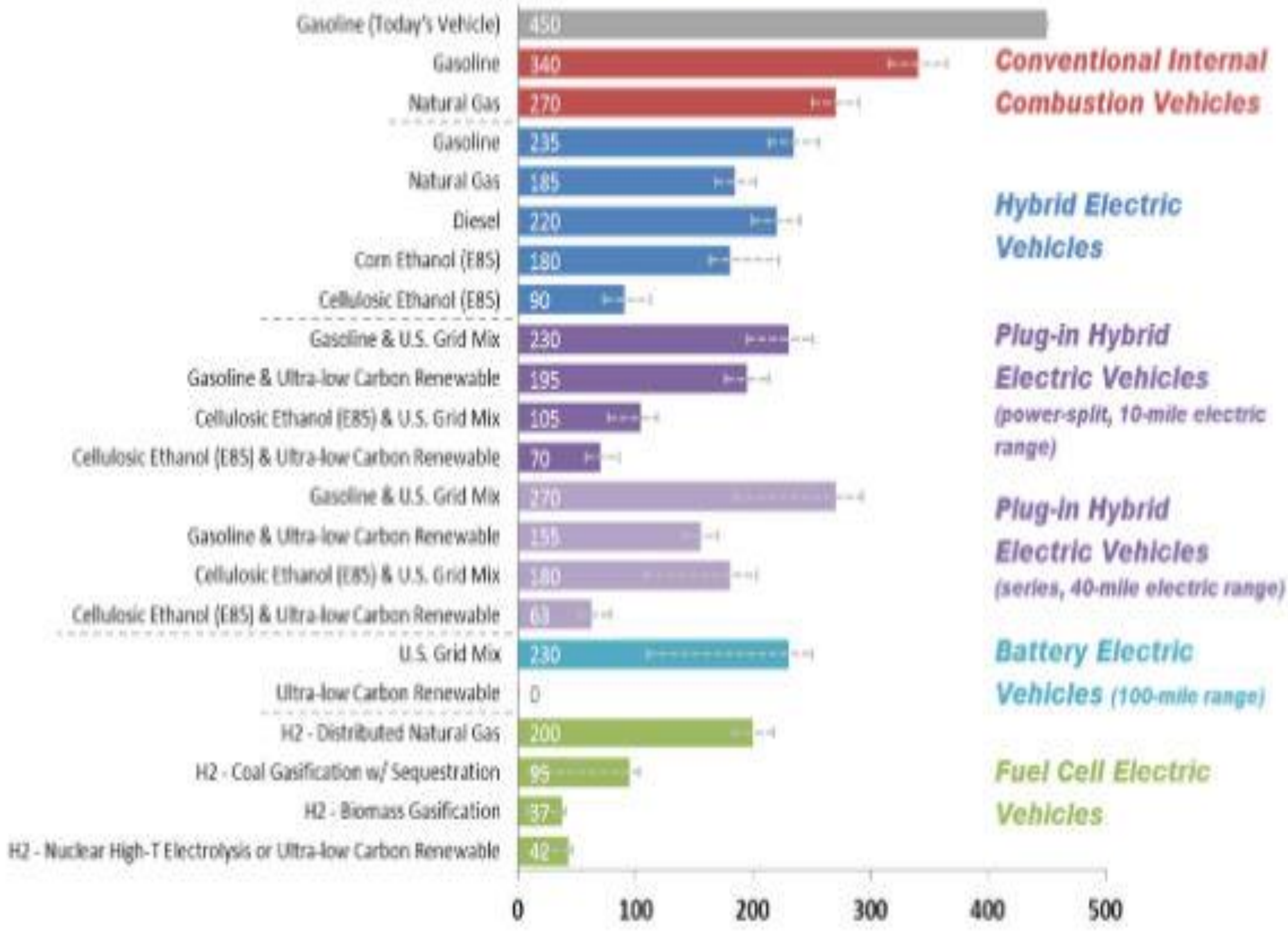
Energy to be stored in Hydrogen

Hydrogen Energy Carrier



Well-to-Wheels Greenhouse Gases Emissions for Future Mid-Size Car

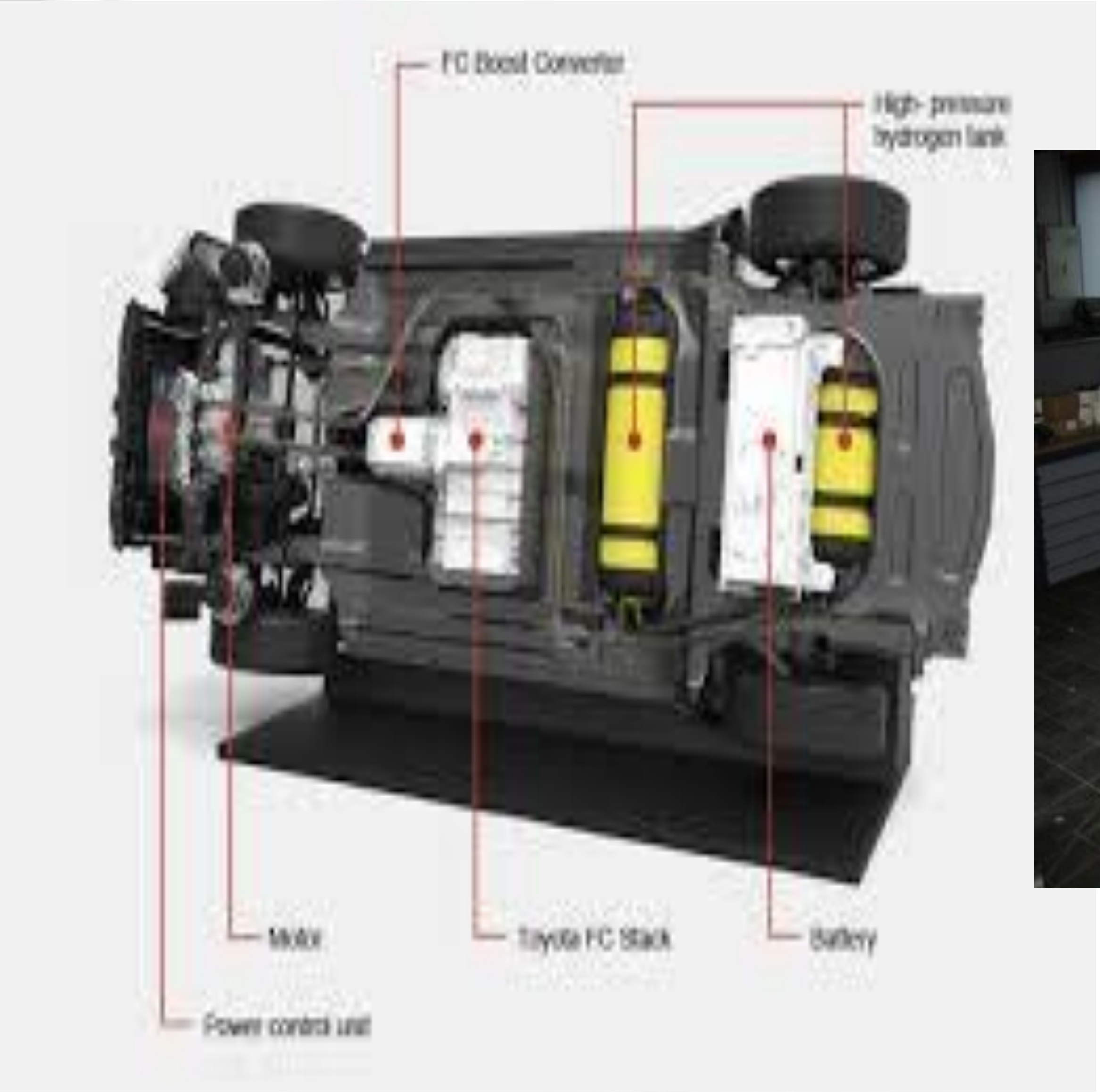
(Grams of CO_2-equivalent per mile)



Toyota Mirai ready to be in your garage : 66K€ price (6.500.000¥ in Japan)

Toyota Mirai ready to be in your garage

Toyota Mirai ready to be in your garage



History: TIME TO GO IN MASS PRODUCTION WITH REVOLUTIONARY TECHNOLOGY


1st Vw Calif


1st F1 MM


Fiat Chroma MM


Fiat Punto MM

1966 — **1984** — **1989** — **1991**

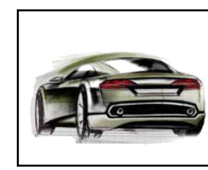
Euro 1

Electronic fuel injection cycle to mass production : 25 years


1st Toyota Prius


1st F1 MM

MB S Hybrid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1995 — **2009** — **2011** — **2013** — **2020**

US CAFÉ – EU CO_2

Hybrid Vehicle cycle to mass production : 25 years

EXPECTED TIME TO GO IN MASS PRODUCTION WITH HYDROGEN TECHNOLOGY

1st Toyota MIRAI

MB S Hydrogen

xxxx ??

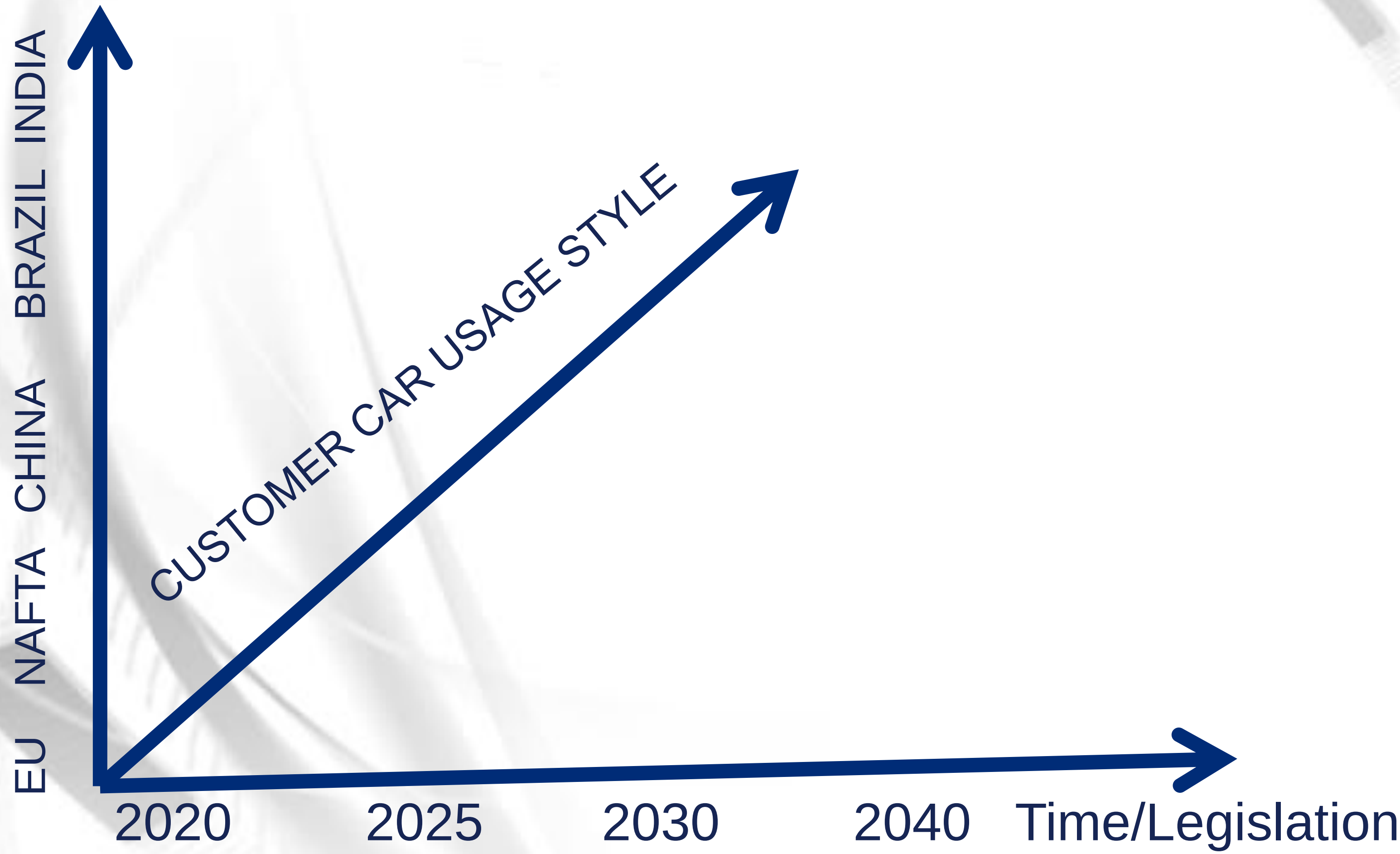
Mass Production components

XXX xxx

2015 — 2020 — 2025 — 2032 — **2040**

Hydrogen Vehicle cycle to mass production : 25 years

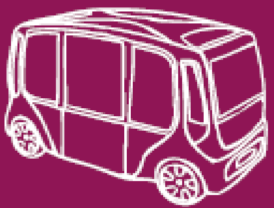
HEV – BEV – PHEV - FCEV three axiis Road Map



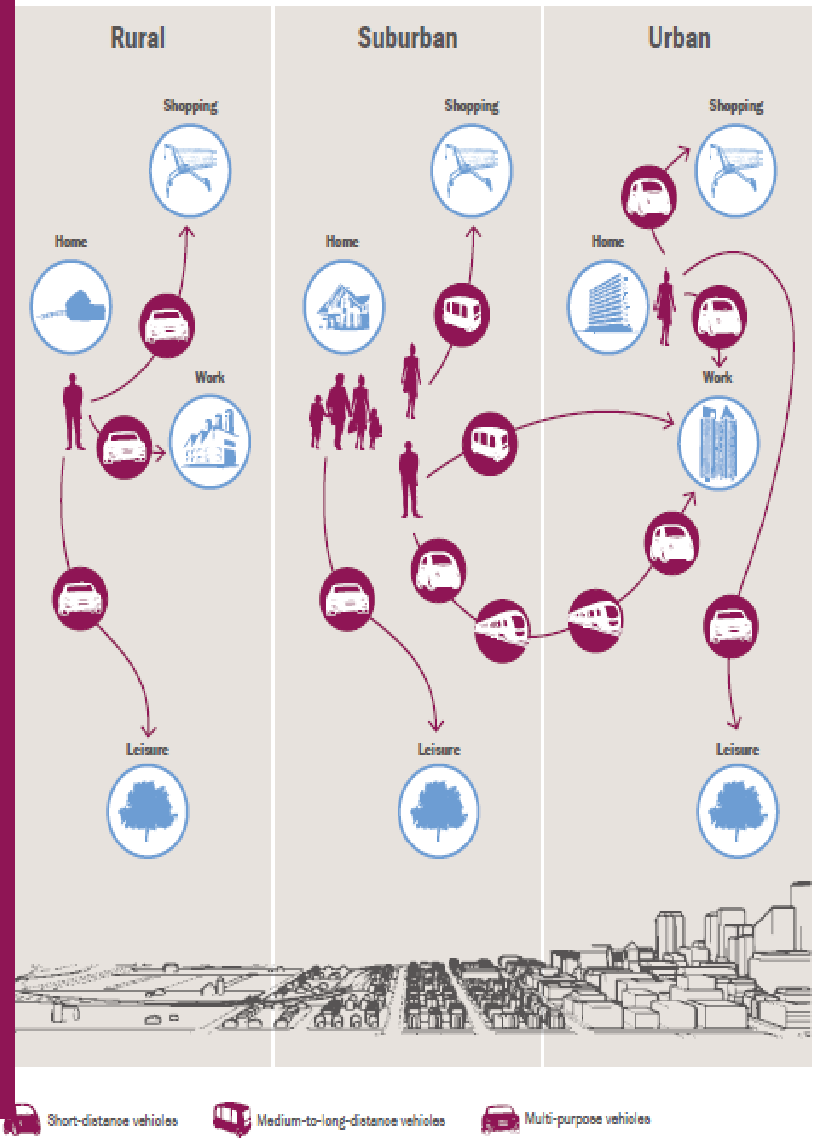
APPLICATION BASED DESIGNS

EXAMPLES OF POSSIBLE VEHICLE DESIGNS

CUSTOMER CAR USAGE STYLE


	SHORT-DISTANCE VEHICLE	MEDIUM-TO-LONG-DISTANCE VEHICLE	MULTI-PURPOSE VEHICLE
Primary uses	> Short trips within cities, suburbs or for last mile transportation to/from public transit such as the nearest subway station	> Medium-to-long-distance trips in suburbs and cities	> Personalized and/or leisure travel for multiple passengers
Primary focus	> Easy maneuverability and low cost	> Higher comfort for longer trips	> Personalized travel experience and comfort
Average trip distance	> Mostly under 10-15 miles	> Mostly over 10-15 miles	> Any range
Design	> Mini-vehicle	> Medium to large vehicle	> Medium to large vehicle
Capacity	> 1-2 passengers > Limited cargo space	> 4+ passengers > Large cargo space	> 1-4+ passengers > Limited/large cargo space
Ownership	> Shared mobility	> Shared mobility	> Personal ownership
Areas of use	> Cities and suburbs	> Cities and suburbs	> Cities, suburbs and rural
Important attributes	> Fuel efficiency > Low emissions > Low maintenance > Reliability	> Comfort > Fuel efficiency > Low emissions > Low maintenance > Reliability > Infotainment	> Individualization > Comfort > Online services > Infotainment > Fuel efficiency > Low emissions > Low maintenance



Source: Roland Berger

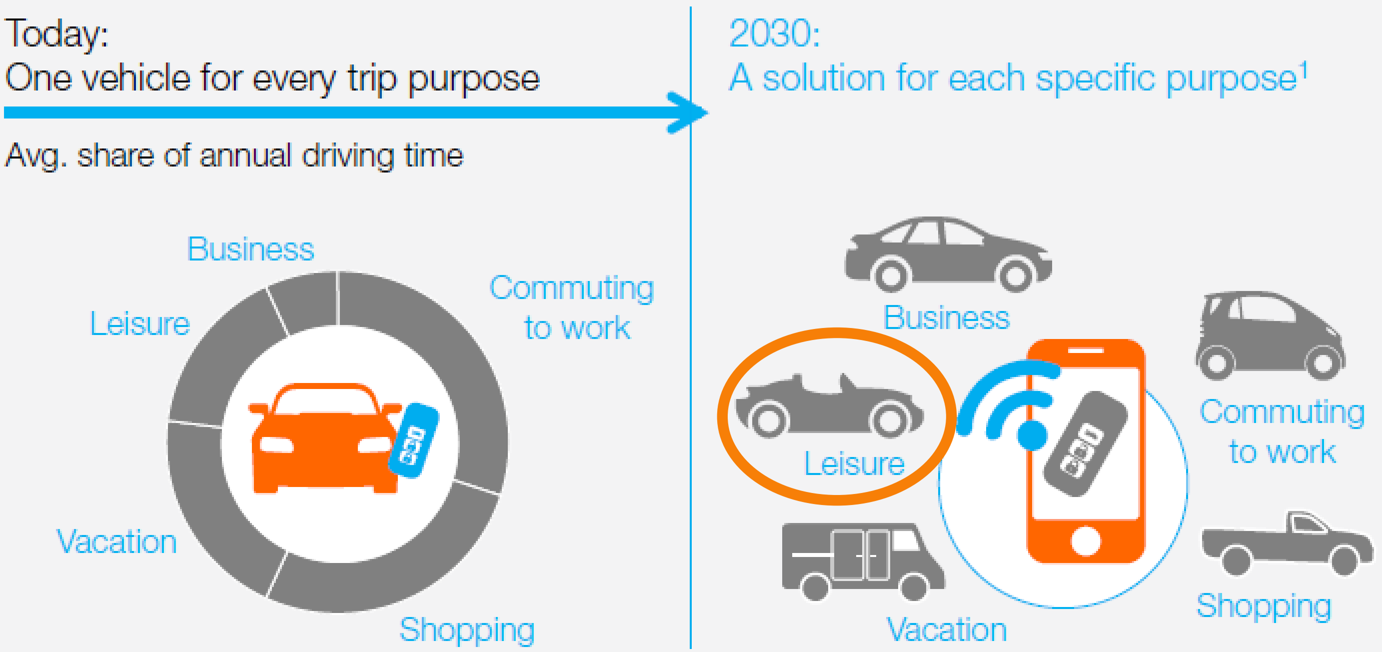
Changes in mobility behavior

New segments of specialized vehicles designed for very specific needs → optimal mobility solution

McKinsey&Company

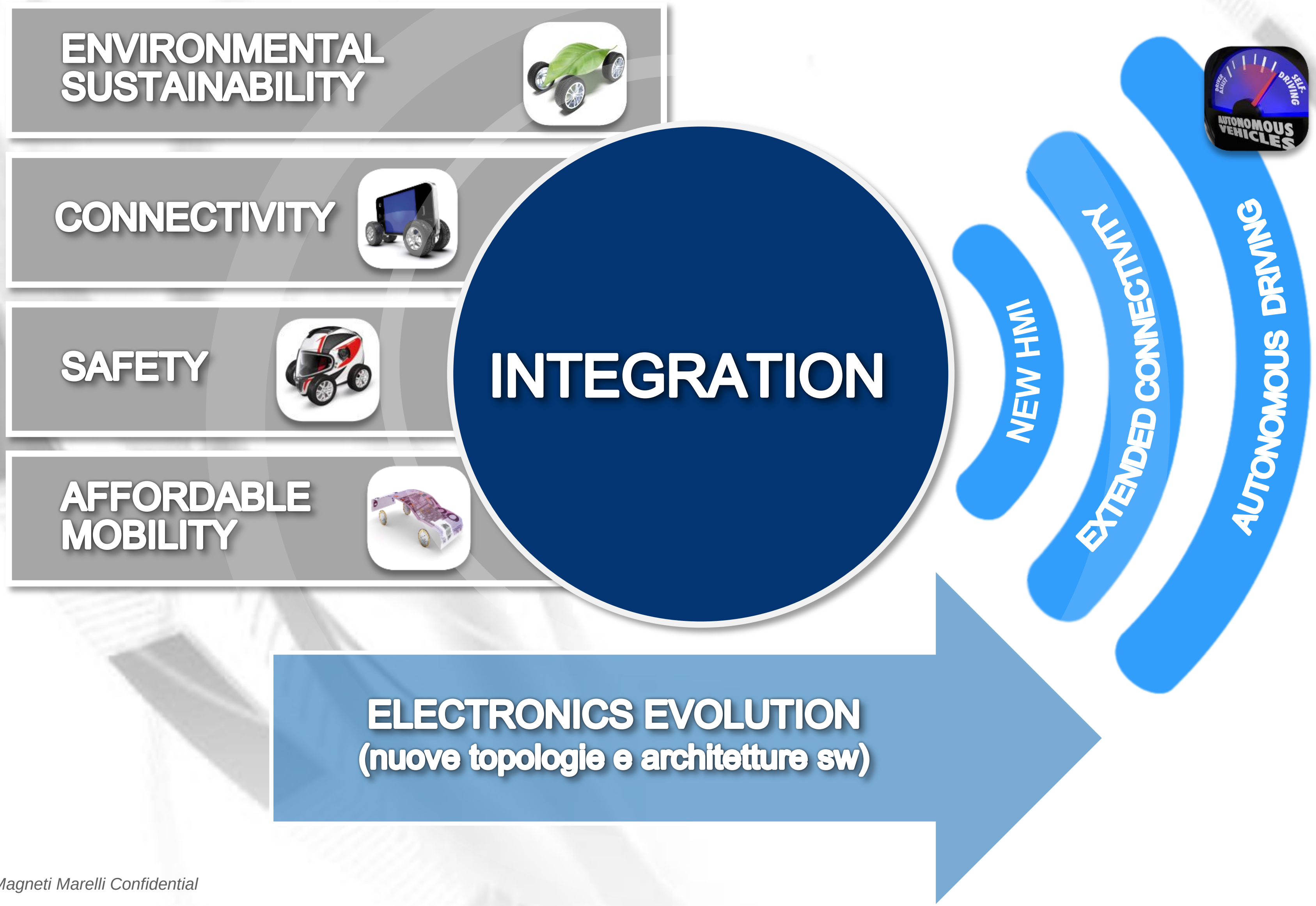
Exhibit 3

Today consumers use their vehicles for all purposes; in the future, they will choose an optimal mobility solution for each specific purpose



1 Only showing automobile based mobility, alternative options like walking, biking, and public transportation are also included in optimal mobility solutions
SOURCE: McKinsey

AUTOMOTIVE AND MAGNETI MARELLI FUTURE CHALLENGES



Autonomous Drive

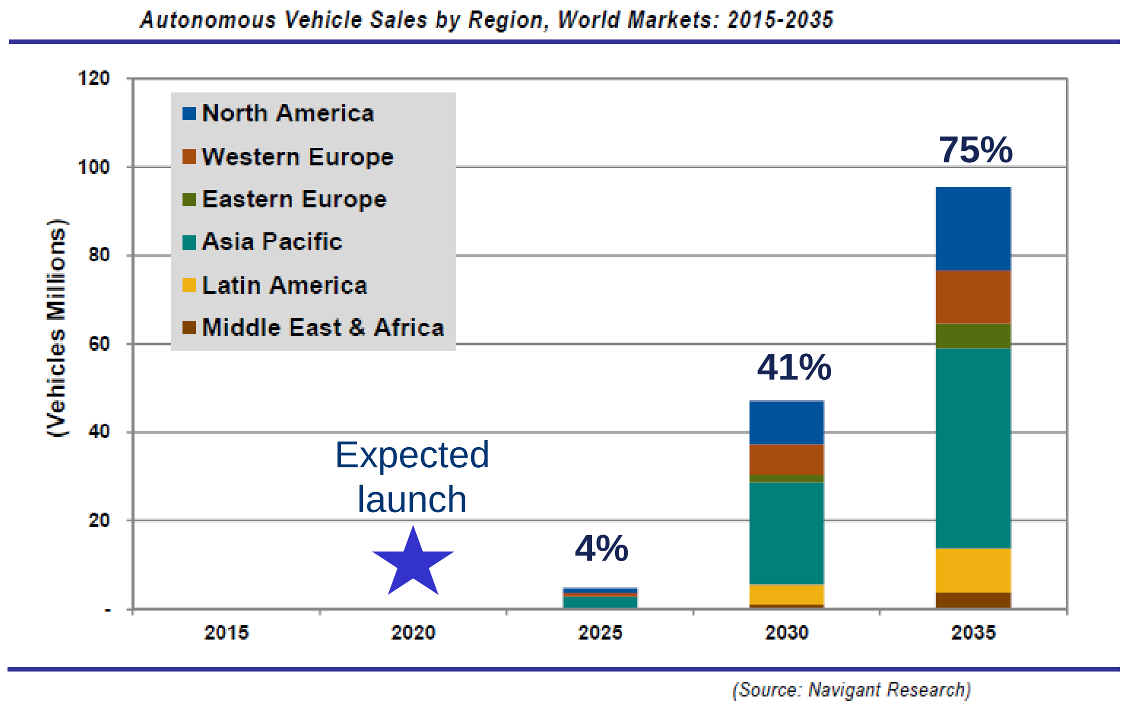
The unique way to make a quantum lap in safety & consumption

Over 90% of accidents are due to driver distraction or insufficient driving skills.

The driving approach "passionate" is not the best way to reduce fuel consumption.

To optimize the mobility system driver is required to be **very rational**, able to manage in advance the **driving strategies.**

It's best to use a **robot** !

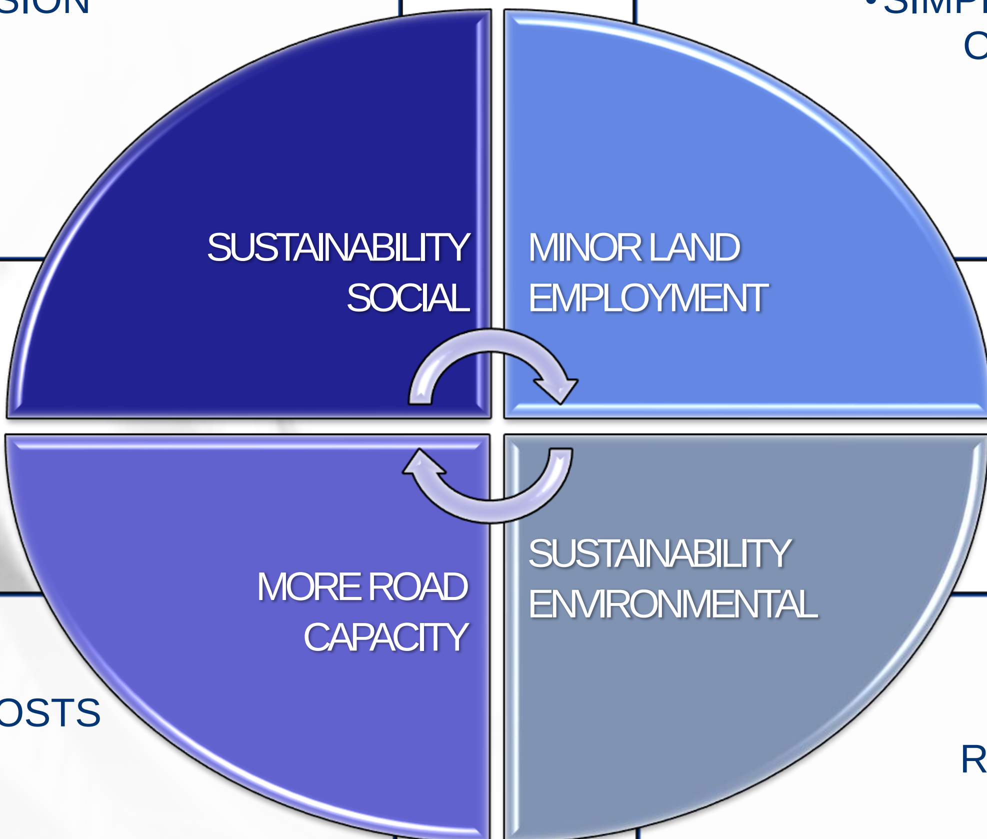


- **Perception technology** is growing rapidly; data fusion is the key word
- **V2X connectivity** will become dominant for many autonomous functions
- **The cost of the sensors** will decrease with the increase of the volumes
- **There is no legislation**, "each car must have a driver" (Vienna Convention), is a major obstacle
- **Liability** issues arise: « The OEM will sell both the vehicle and the driver »

VEHICLES AUTONOMOUS
An opportunity for the "virtuous circle"

The Autonomous Vehicle is driven by **Security**, but it can give more opportunities addressed to both the **Environmental** and **Social Sustainability**

- NO COLLISION
- SIMPLIFICATION OF PASSIVE SAFETY



- LOWER COSTS
- WEIGHT REDUCTION

- Thank You