Toyota Mirai

METROLOGY for HYDROGEN VEHICLES

未来

Introduction/Background

24/01/2018

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World Leaders Agreement – COP21 Paris

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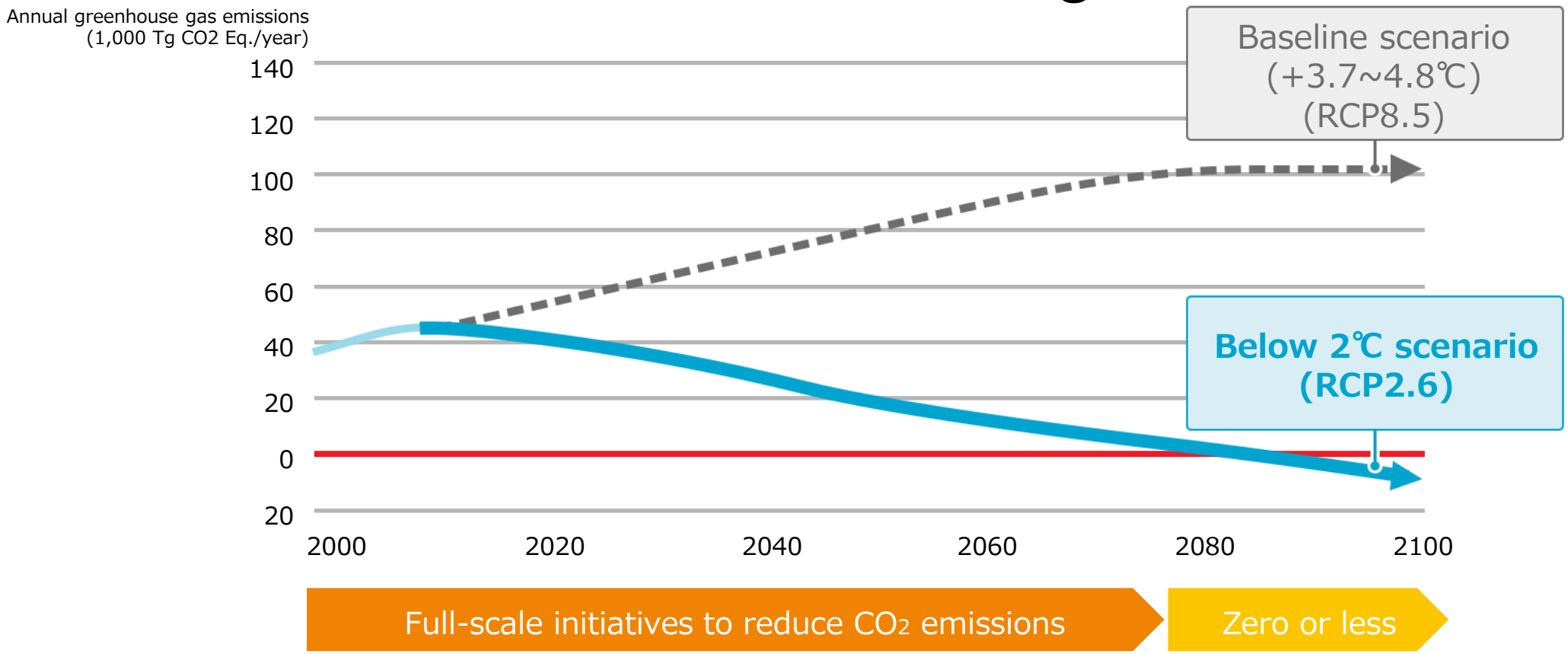
Forecast International Climate Change



Source: From the IPCC Working Group III 5th Assessment Report (2014)

Regarding GHG emissions, there is no time to lose

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Environmental Challenges

CLIMATE CHANGE

AIR QUALITY

ENERGY SECURITY

Energy Security

evs 27

1 billion EUR of oil expenses per day

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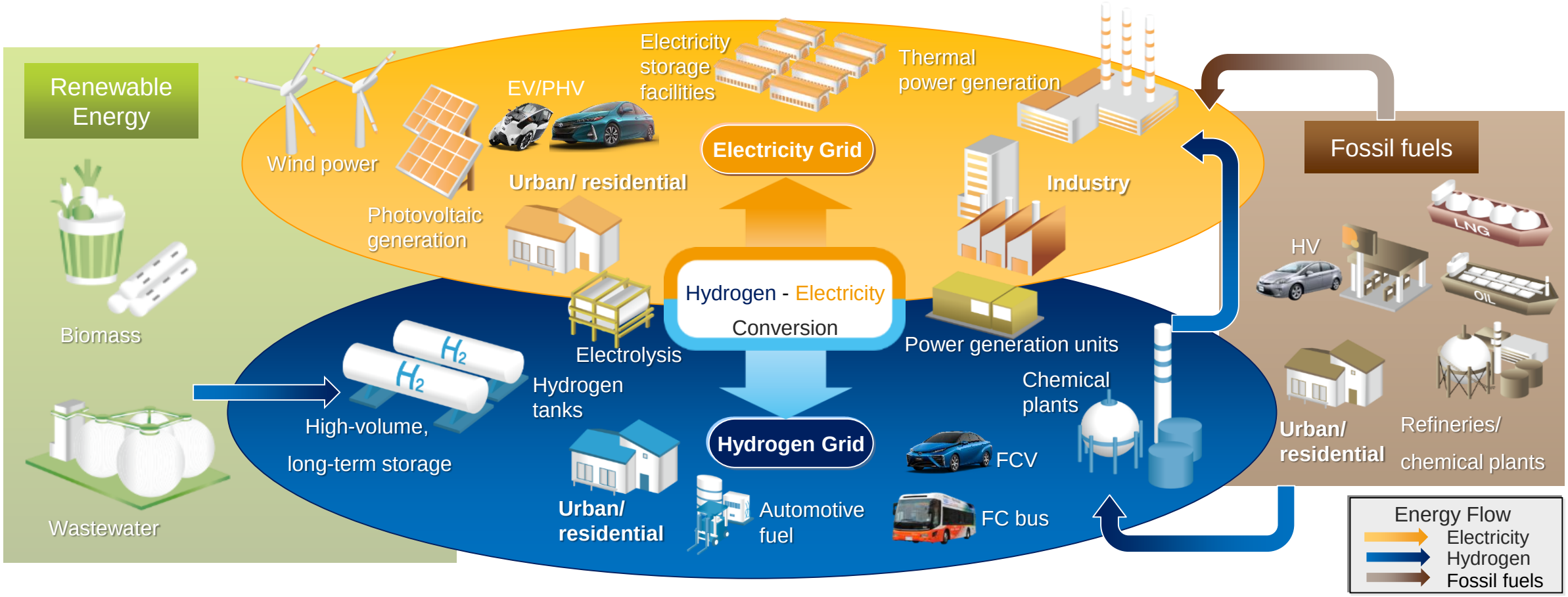
Future Vision: HyGrid (Hybrid Hydrogen – Electricity Grid)



Source: HyGrid Study Group HP

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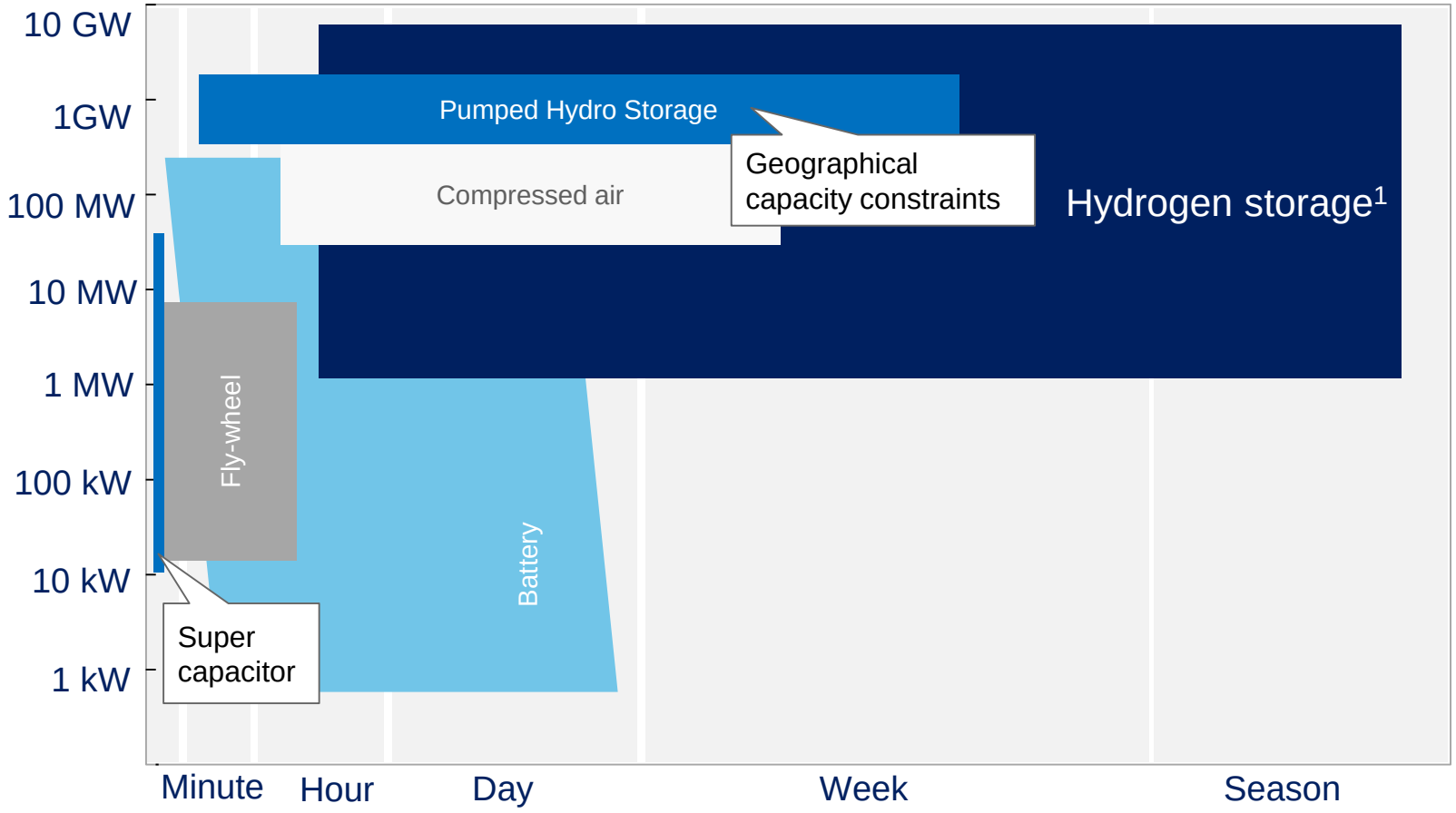
Using Hydrogen as a Storage for Renewables



Hydrogen is most promising for long-term and carbon-free seasonal storage

1 IEA data updated due to recent developments in building numerous 1MW hydrogen storage tanks

Source: IEA Energy Technology Roadmap Hydrogen and Fuel Cells, JRC Scientific and Policy report 2013

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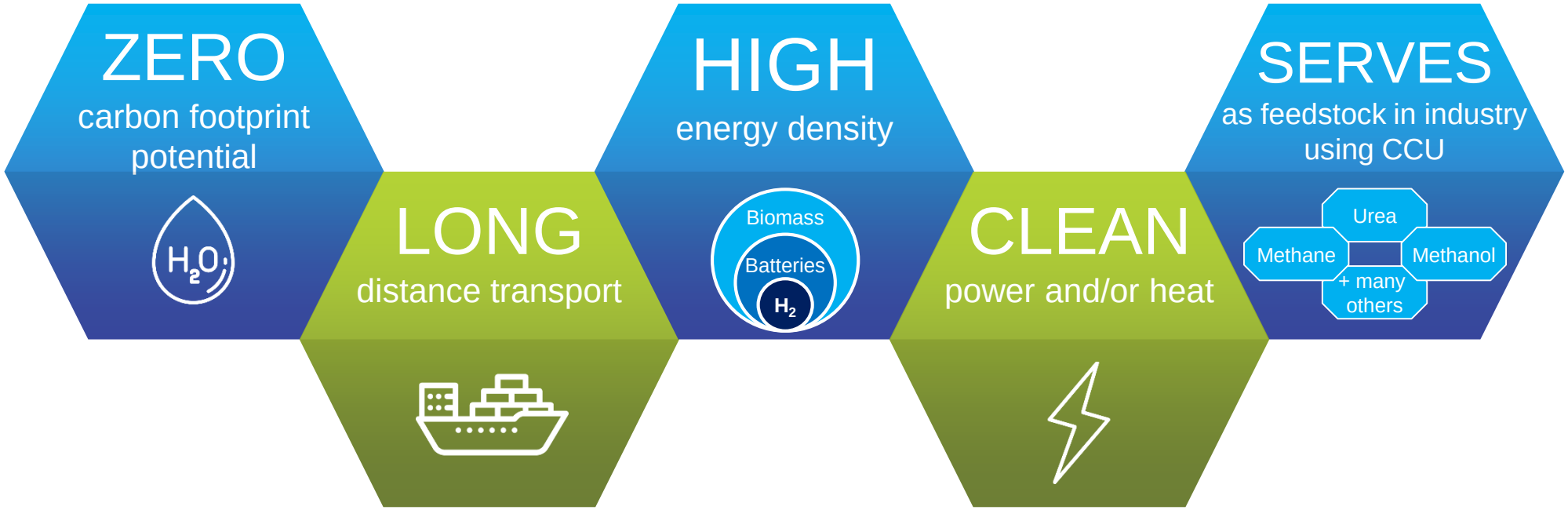
Hydrogen: Versatile, 0-Emission Energy Carrier



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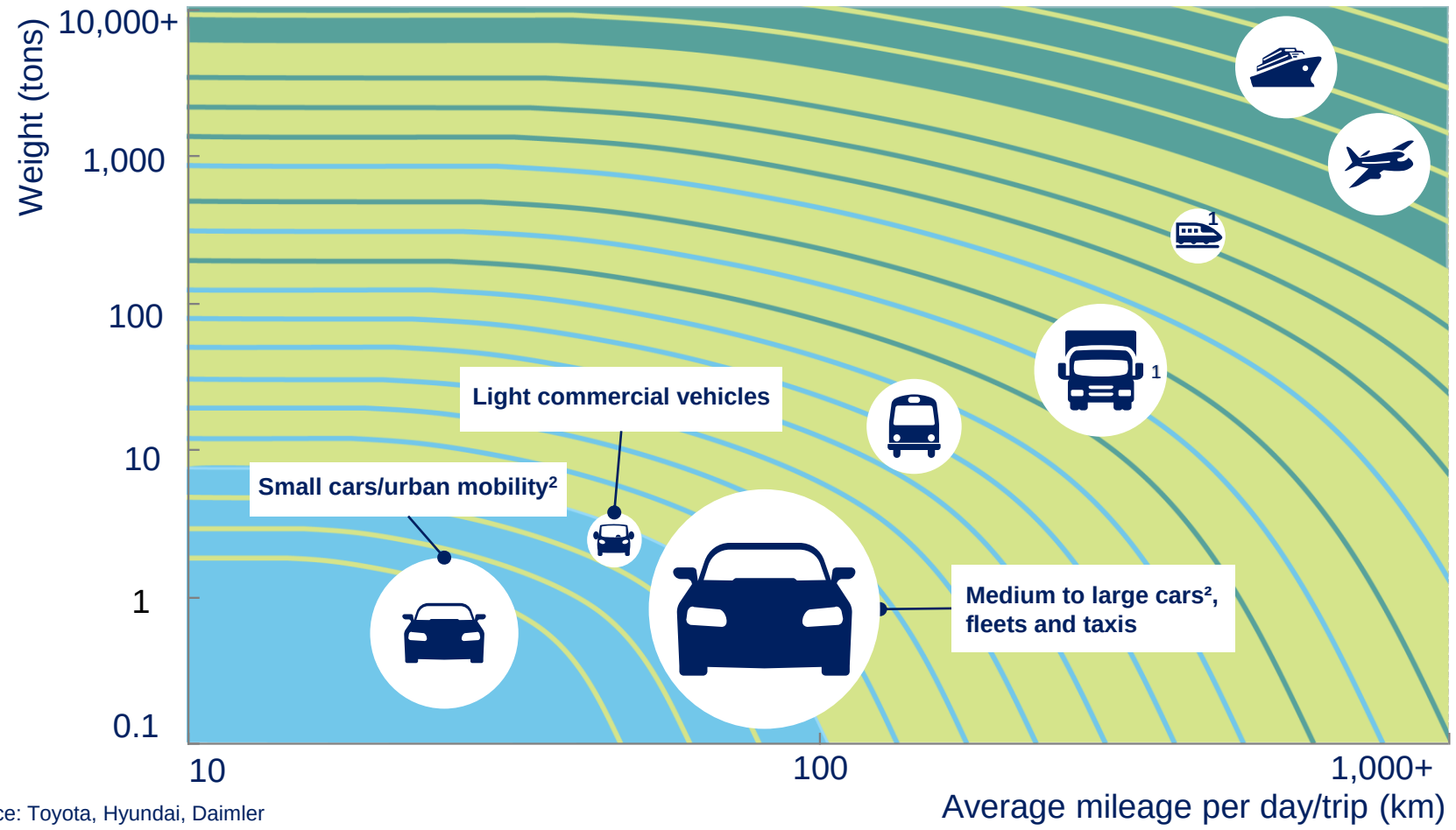
FCVs are essential for decarbonising transport



BEV

FCV

Bio- and (H_2-based) synthetic fuels

Bubble size represents relative annual energy consumption of this type in 2013

1 Battery-hydrogen hybrid to ensure sufficient power

2 Split in A- and B-segment LDVs (small cars) and C+-segment LDVs (medium to large cars) based on a 30% market share of A/B-segment cars and a 50% less energy demand

Source: Toyota, Hyundai, Daimler

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Mirai is not a car, it’s a symbol

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Developing Hydrogen FCV for 20 years

FCEV Fuel
H_2 Stored in adsorbing alloy

1992 → 1996

FCHV-4 Fuel
Hydrogen stored in high-pressure tanks

1999 → 2001

FCHV
Toyota-made tanks, 1st FCV homologated

2002 → 2005

FCV-R Fuel
Mirai precursor

2009 → 2011 → 2015

FCHV-3 Fuel
Hydrogen

(adsorbing alloy)

FCHV-5 Fuel
Hydrogen generated on-board by reforming on gasoline

FCHV-adv Fuel
New stack, stainless steel cells

Mirai
Revolutionary Titanium stack, 3.1 kW/L world record

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Toyota 2050 Challenge

TOYOTA ENVIRONMENTAL CHALLENGE 2050

To go beyond zero environmental impact and achieve a net positive impact, Toyota has set itself six challenges. All these challenges, whether in climate change or resource and water recycling, are beset with difficulties, however we are committed to continuing toward the year 2050 with steady initiatives in order to realize sustainable development together with society.

Toyota 2050 Challenge

Challenge 1: New Vehicle Zero CO_2 Emissions Challenge

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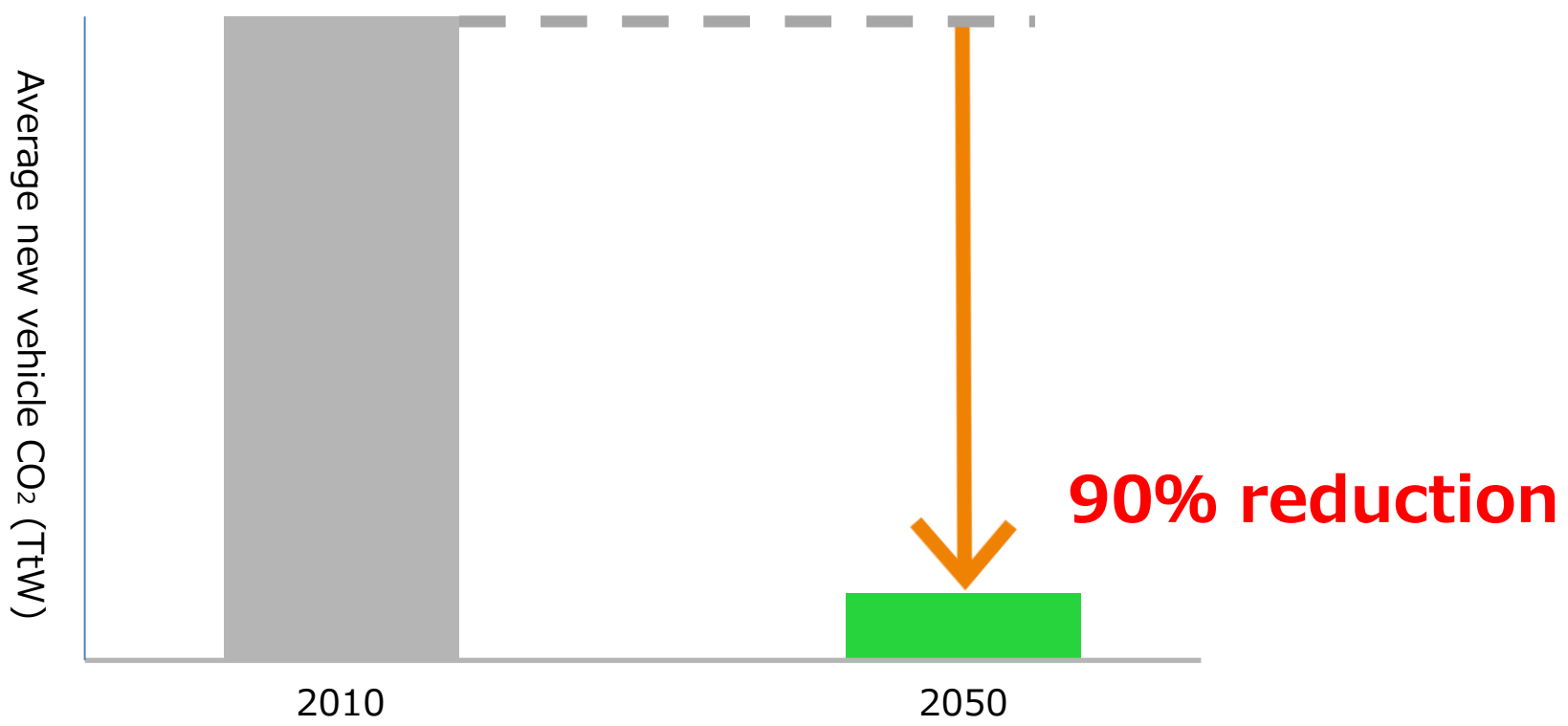
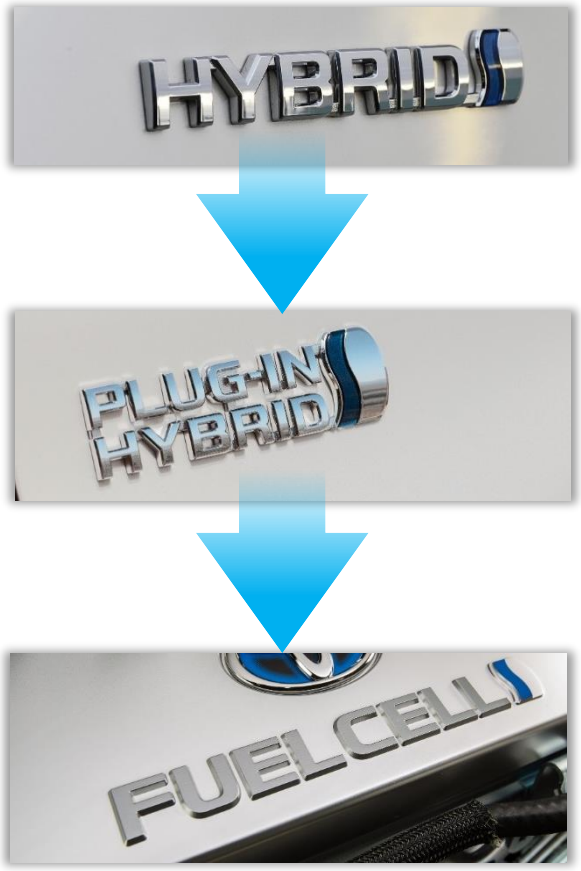
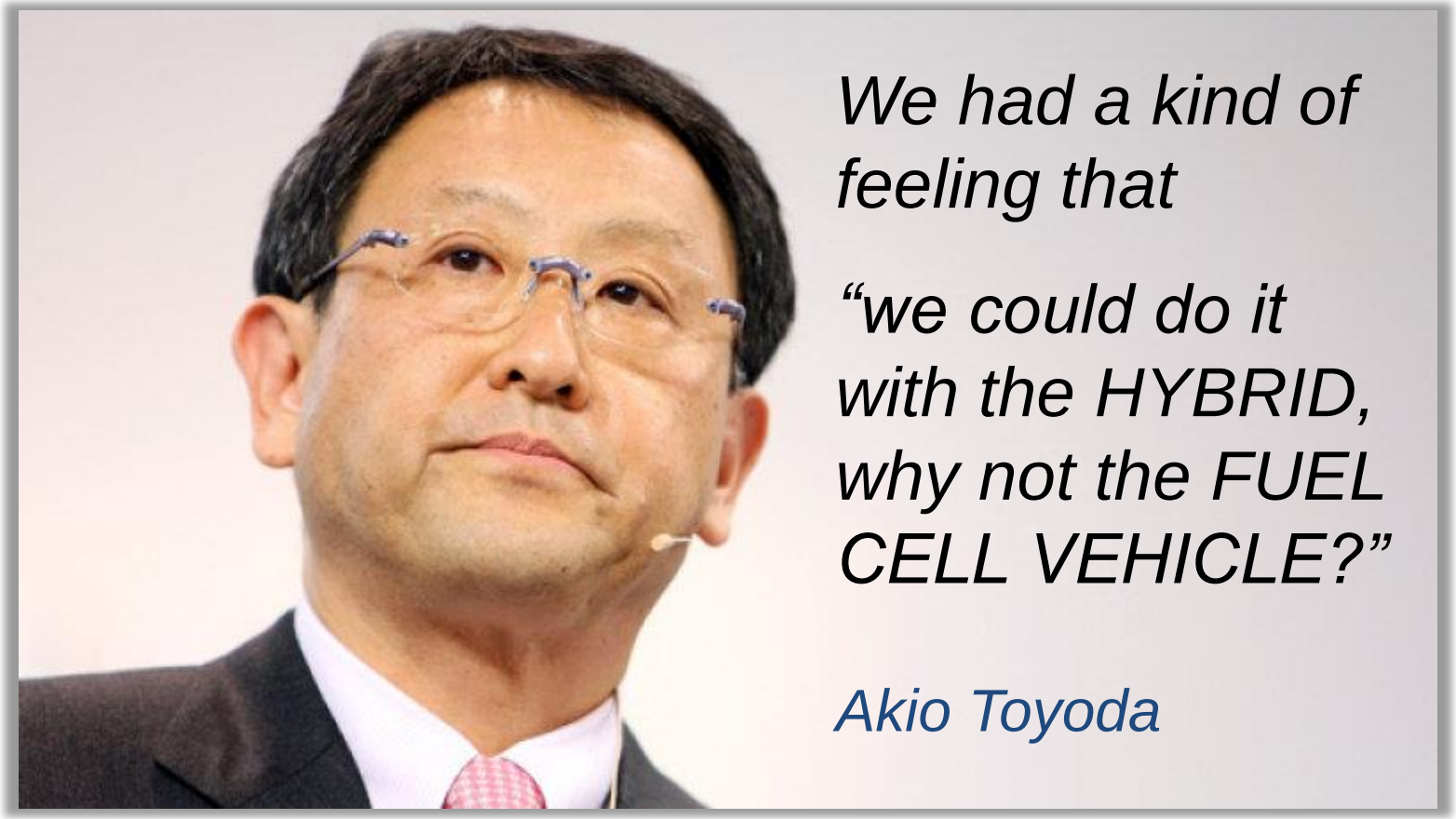


90% reduction of new vehicle CO_2 emissions by 2050 compared to 2010

Toyota's Answer – Mirai, the obvious next step

未来



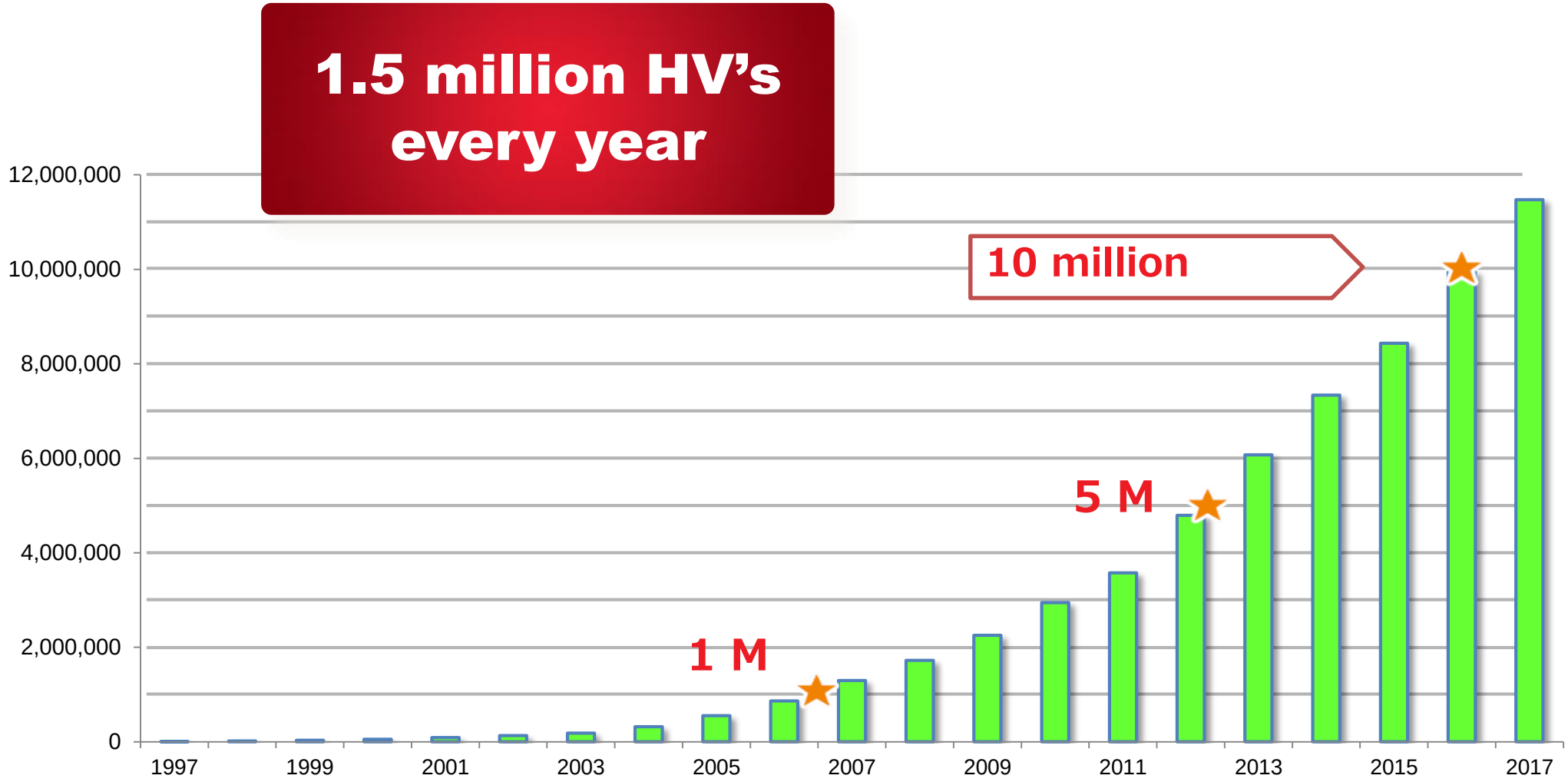


We had a kind of feeling that

"we could do it with the HYBRID, why not the FUEL CELL VEHICLE?"

Akio Toyoda

Hybrid Global Sales



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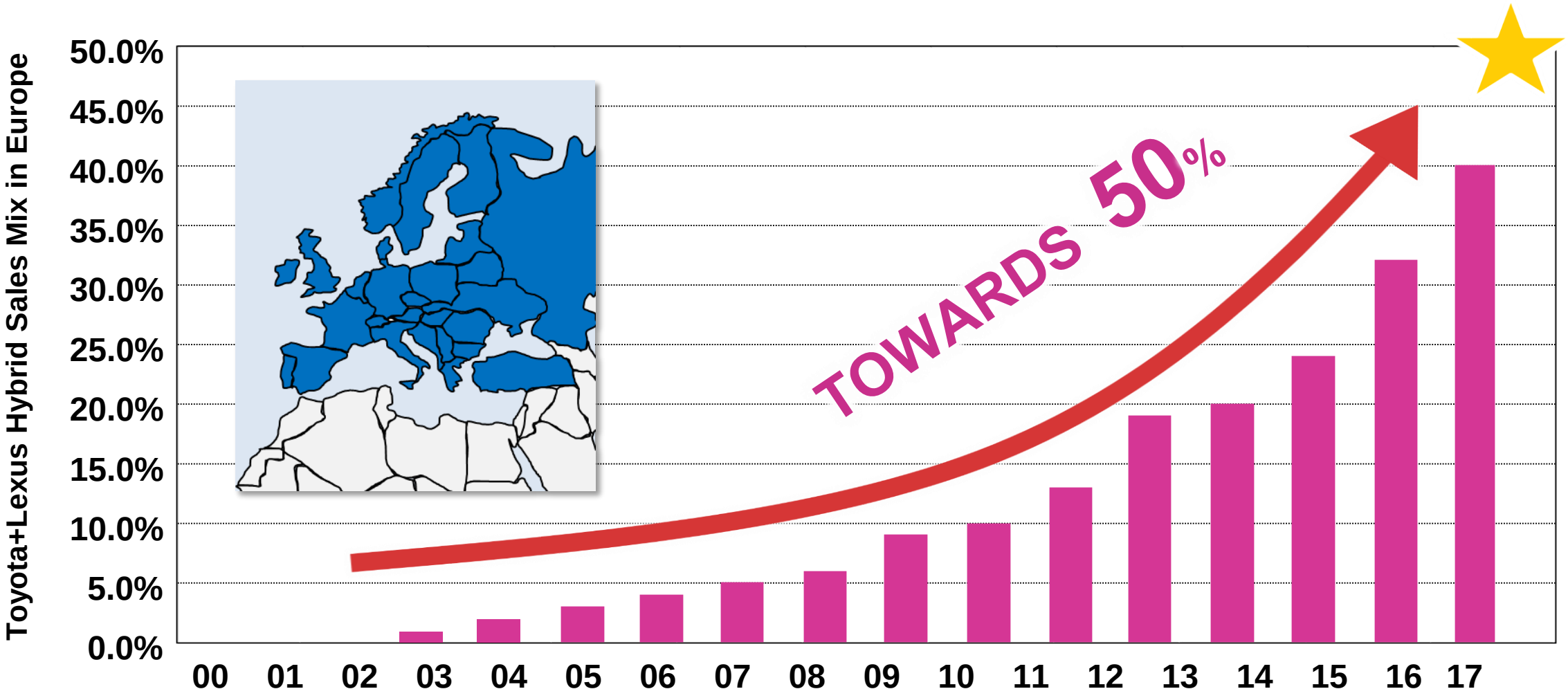
Growth of HV in Europe



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Toyota FCV sales plan in 2020

GLOBALTARGET: More than 30,000/year around 2020

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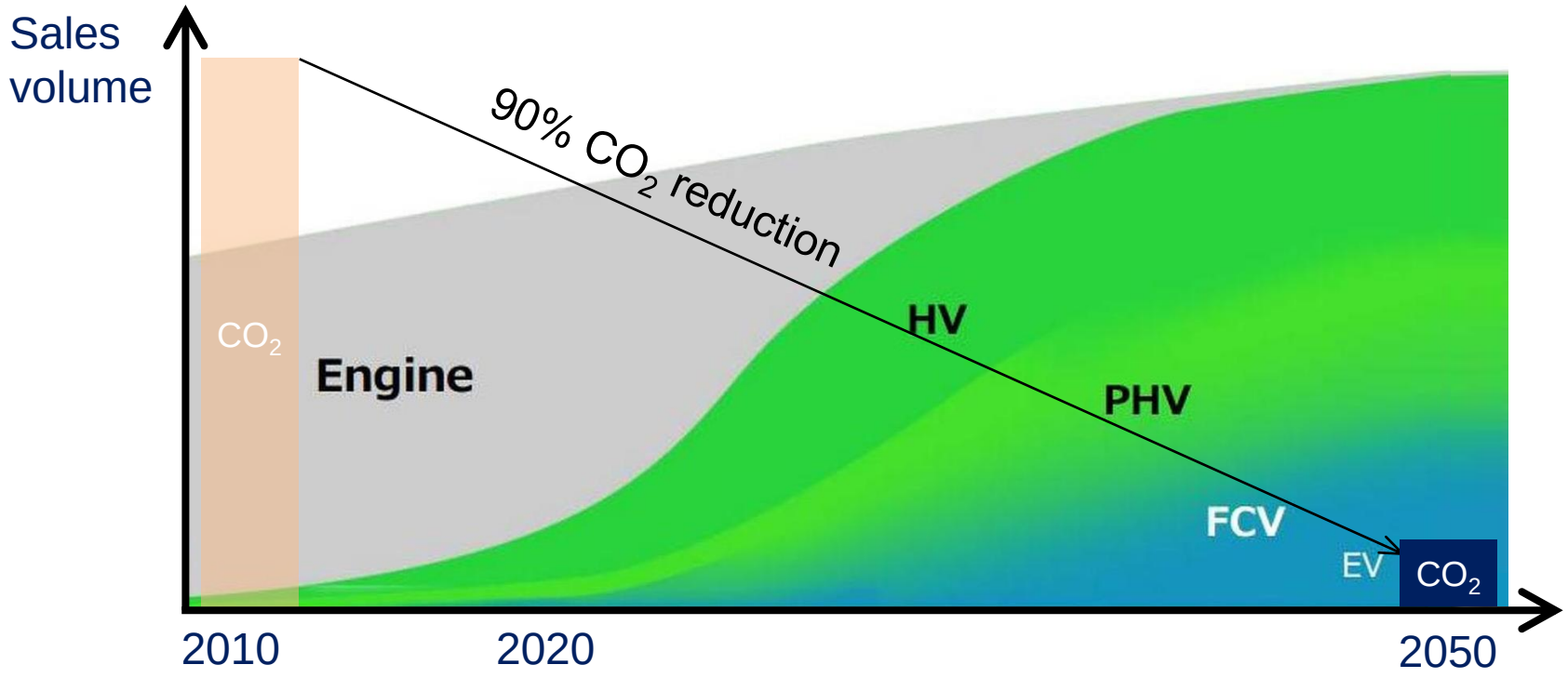
Mirai

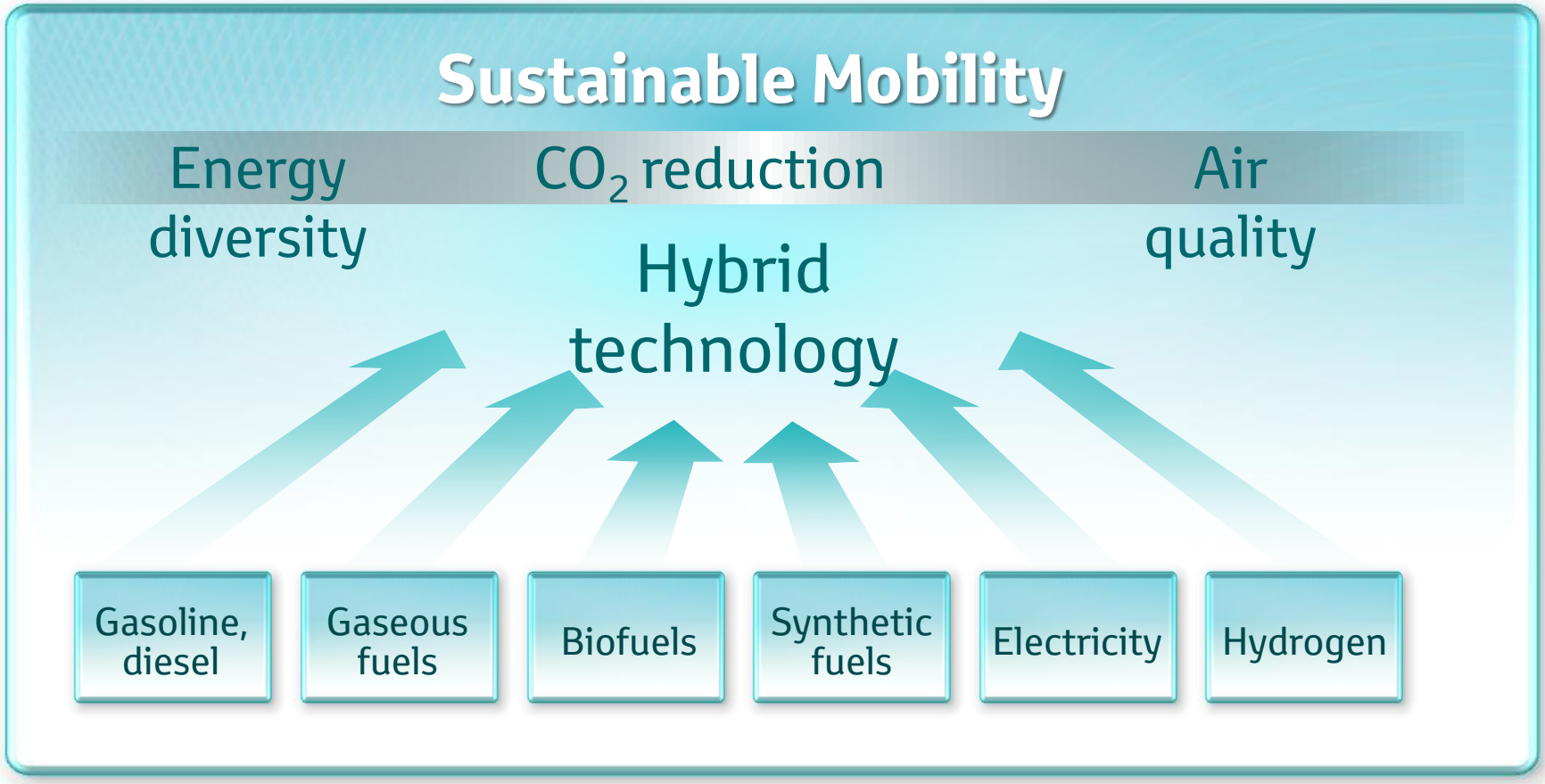
Mix of powertrains required to achieve 90% CO2 reduction.



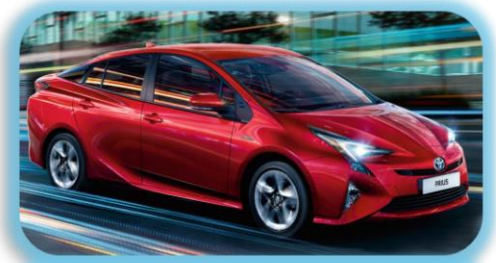
Electrification will increase dramatically after 2020

The Journey to Sustainable Mobility

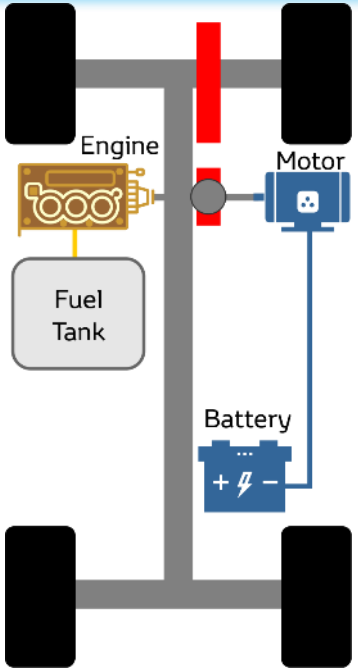
- The right car, at the right place, at the right time, using the right source of energy: A mix of sources.



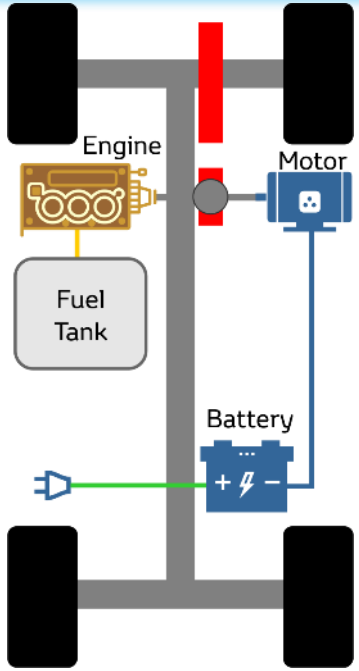
Using hybrid technology for Plug-In, EV and Fuel Cell



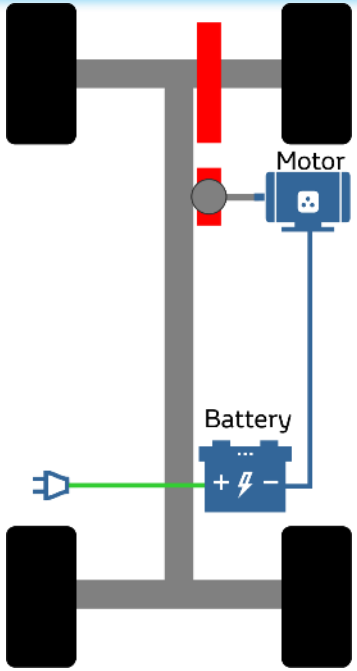
HYBRID



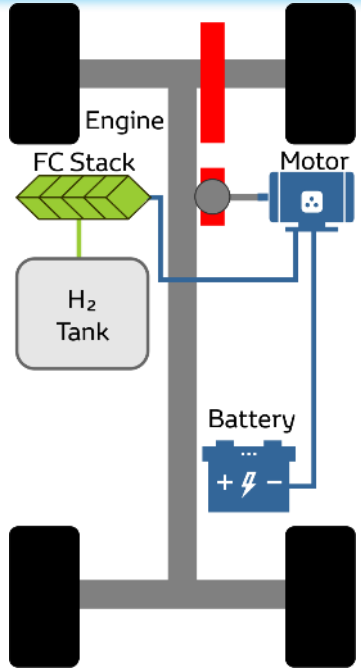
PLUG-IN HYBRID



ELECTRIC



FUEL CELL



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Fuel Cell Components

★FC stack

- Innovative flow channel structure and Electrodes of cells for higher output

Output/volume; 3.1kW/L

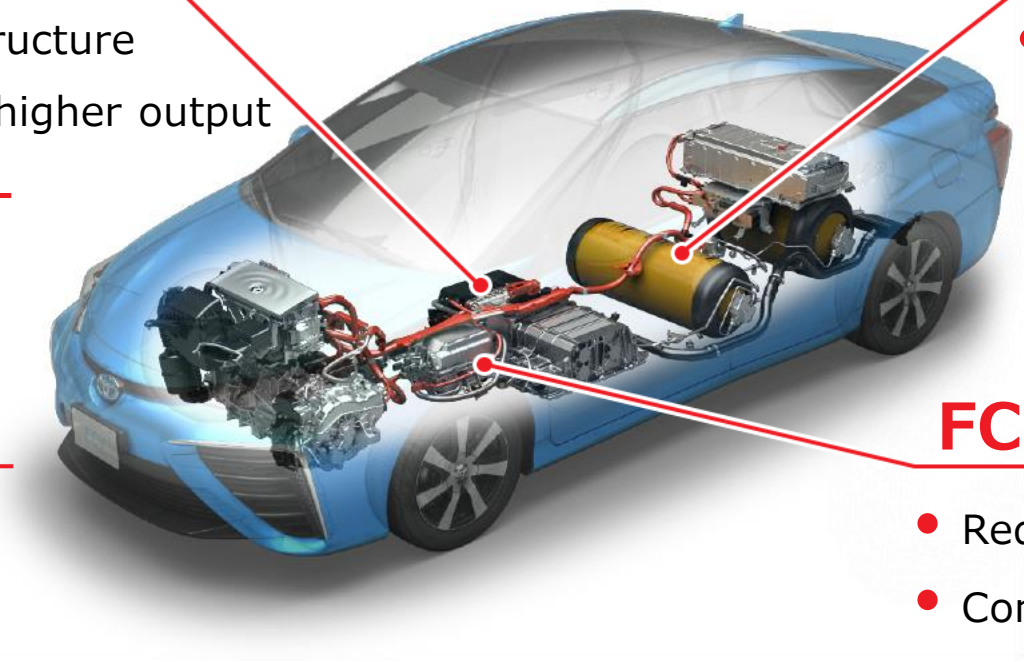
world top level

★High pressure hydrogen tank

- The light weight structure of carbon fiber reinforced plastic enabled

Storage; 5.7 wt%*

world top level



Humidifier less

- Internal circulation

FC boost converter

- Reduced number of cells in FC stack
- Common use of hybrid units

*Hydrogen mass/Tank mass

FC main components developed in-house to achieve world leading performance

Warranty Period like any other Toyota hybrid

3 years / 100,000 km

Standard warranty for all general parts and components

5 years / 100,000 km

Extended warranty for all hydrogen and high voltage parts

- Fuel tank
- FC stack
- HV battery
- Drive motor
- HV Inverter
- HV booster

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Thank You

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