

DAIMLER

7th Stakeholder Forum of the FCH JU, Brussels



Daimler's road to FCEV market introduction

Prof. Dr. Christian Mohrdieck, 12.11.2014

Daimler AG

Our Roadmap to a Sustainable Mobility

Highly Efficient Internal combustion engines

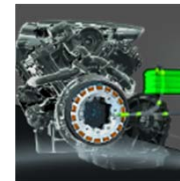


A 180 CDI BlueEFFICIENCY

3,6

l/100 km
92 g CO₂/km

Full and Plug-In Hybrids

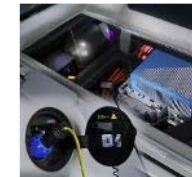


S 500 PLUG-IN HYBRID

2,8

l/100 km
65 g CO₂/km

Electric vehicles with battery and fuel cell



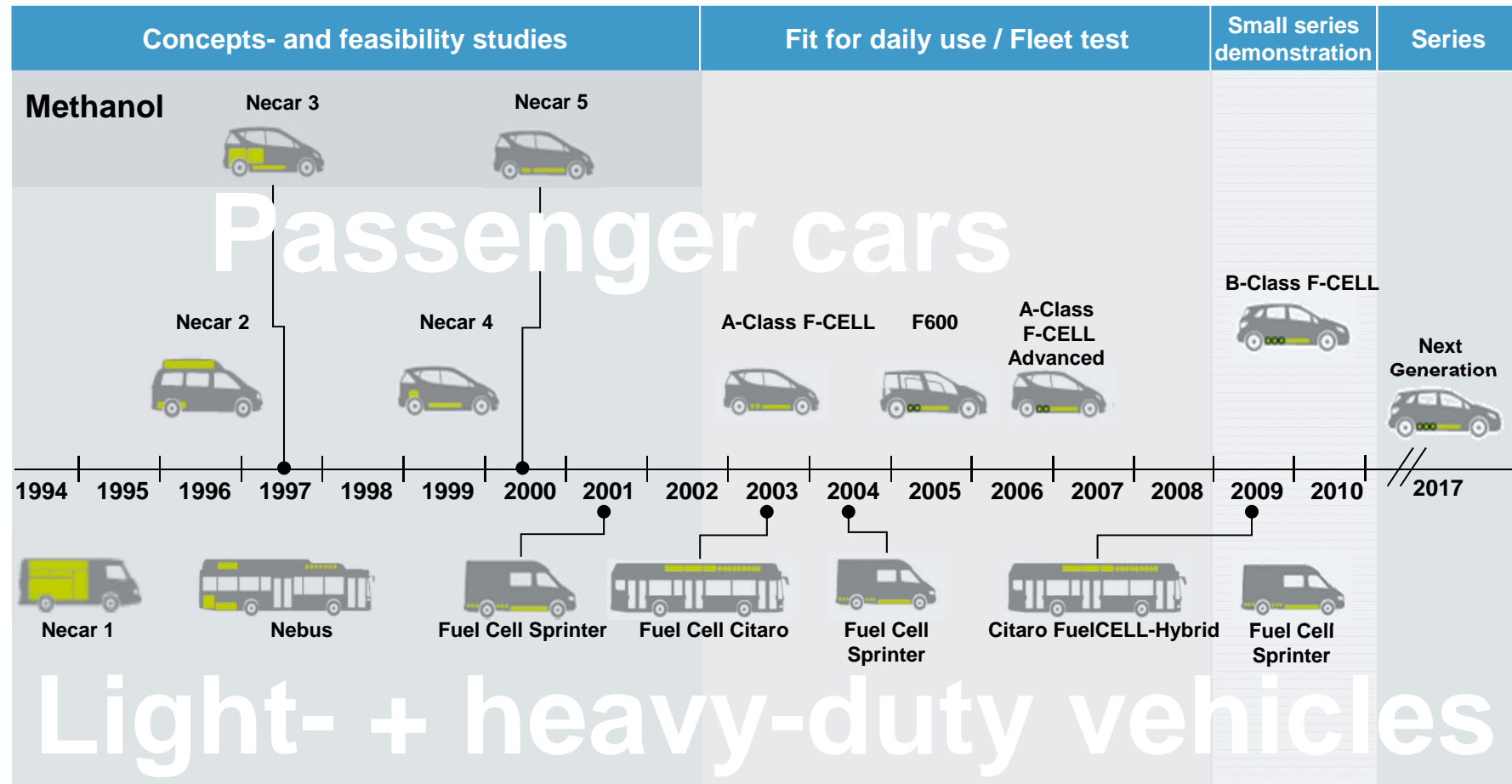
**B-Class Electric Drive
smart electric drive
B-Class F-CELL**

0

l/100 km
0 g CO₂/km

Activities of DAIMLER AG within Fuel Cell Vehicles

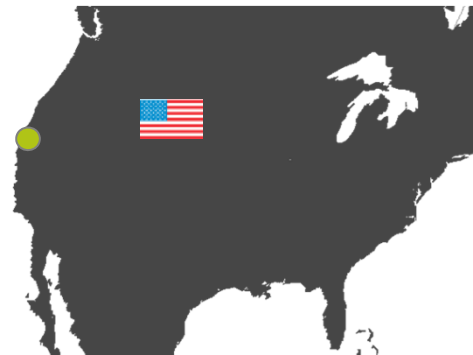
History of Fuel Cell Vehicles - almost 20 years of Experience



Market Preparation – Worldwide Fleet Operation

Fleet Demonstration with the Current Generation of Fuel Cell Vehicles

North America & Europe 200 B-Class F-CELL



Fleet Demonstration

▶ 70 F-CELL California



Fleet Demonstration

▶ 10 F-CELL Oslo



Fleet Demonstration

▶ 20 F-CELL Hamburg



▶ 40 F-CELL Berlin



▶ 10 F-CELL Frankfurt

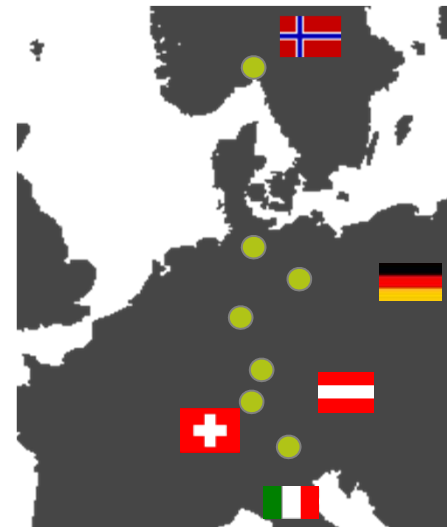


▶ 20 F-CELL Stuttgart
F-CELL Wien

ca. 30 F-CELL Internal Car Pool



Europe 23 Citaro FuelCELL Hybrid busses



Fleet Demonstration ¹⁾

▶ 4 Busses Hamburg



▶ 4 Busses Stuttgart & Fellbach



▶ 2 Busses Karlsruhe



▶ 5 Switzerland



▶ 8 Busses Italy (5 Bolzano, 3 Milano)



Small Series A-Class F-CELL (60 Units)
vehicle miles travelled > 2.230.000 km



Small Series B-Class F-CELL (200 Units)
vehicle miles travelled > 4.050.000 km



Small Series Citaro FuelCELL (36 Units)
vehicle miles travelled > 2.150.000 km



Small Series Citaro FuelCELL-Hybrid (23 Units)
vehicle miles travelled > 700.000 km

Highlights from Fleet Operation



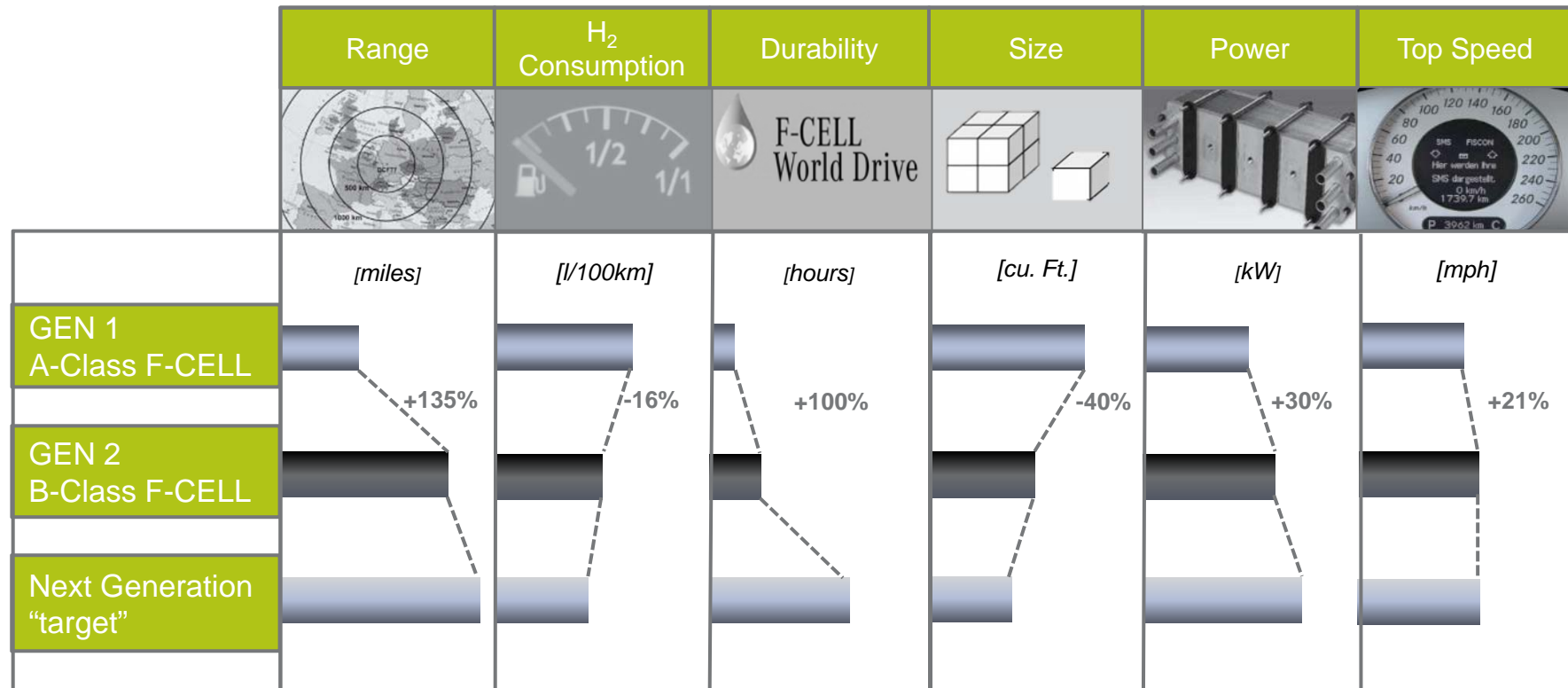
Accumulated mileage
more than 4 Mio. km.
Some vehicles run
up to 1.600 km per week.



Feedback from customers

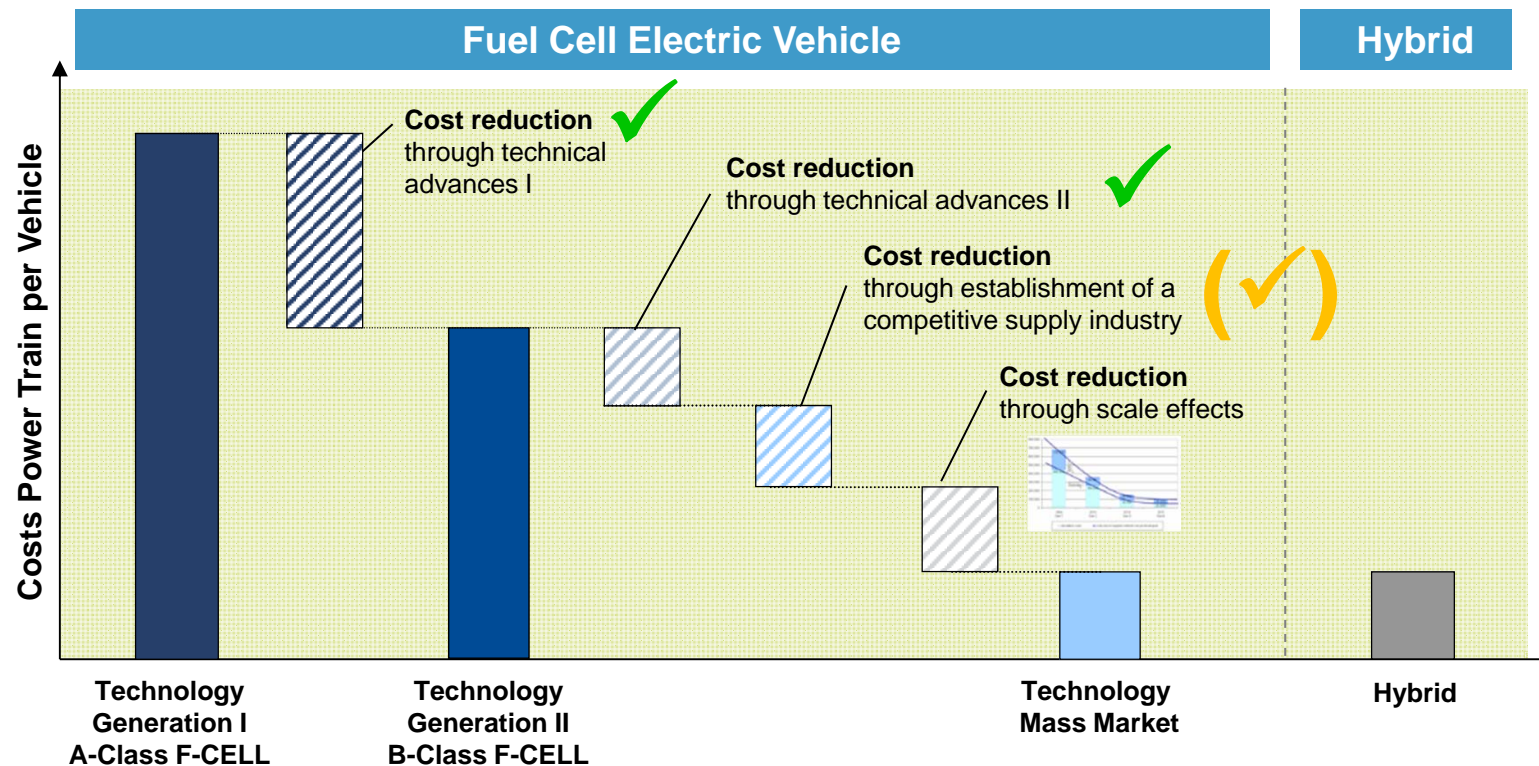


Technical Advancements of Daimler's Fuel Cell Vehicles



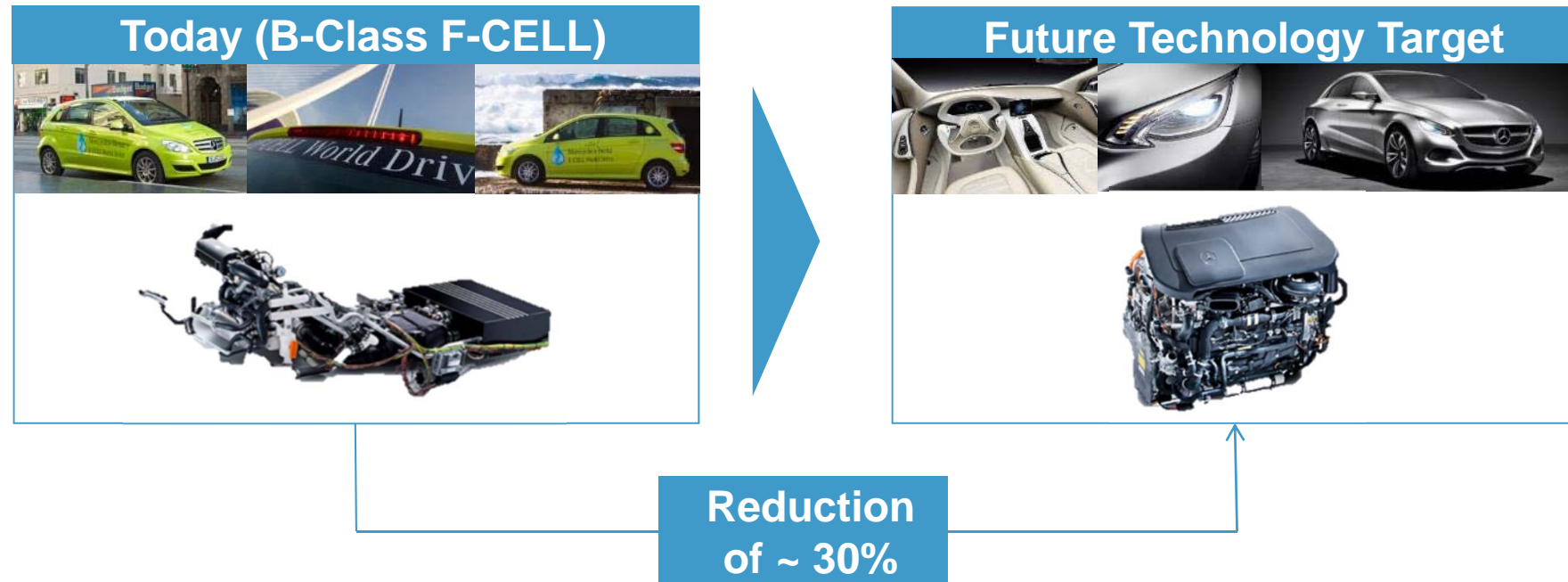
From generation to generation significant technical progress in all technical areas.

Cost Potentials of the Fuel Cell Technology



- The cost for the fuel cell power train are currently much higher than those from conventional drive systems. They can be reduced considerably through scale effects and technology advances.
- A reduction of the costs on the level of conventional drive trains is possible.
- Regarding the TCO¹ comparable values to conventional drive systems are reachable.

Packaging of Fuel Cell System



Through a further modularization of the fuel cell specific components, the packaging of future generations of FC vehicles will be simplified.

➔ The significantly more compact dimensions allow for an implementation in the engine compartment of a conventional vehicle.

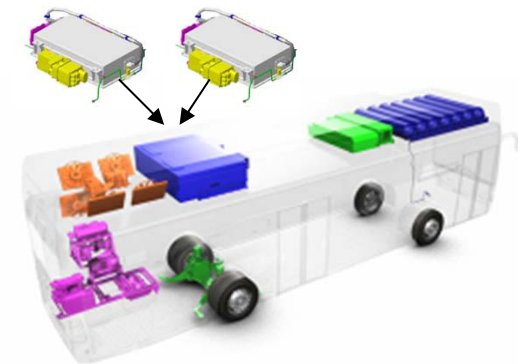
The Citaro FuelCELL-Hybrid is the next Generation of Fuel Cell Bus



Next Generation Fuel Cell Hybrid Bus Power Train

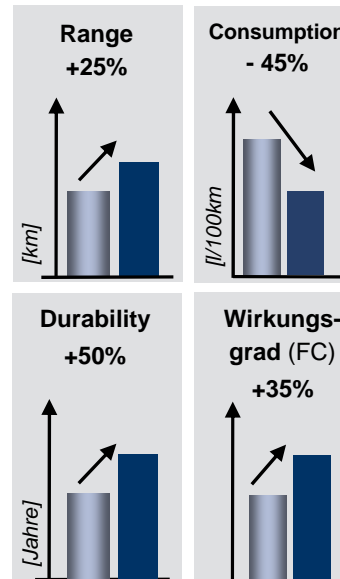
- Energy retrieving through hybridization (recuperation)
- Higher efficiency
- Passenger comfort through noise reduction and steady acceleration
- Optimum availability – improved
- Higher lifetime

2 Fuel Cell Systems also used in B-Class F-CELL



BZ-Bus (CUTE)












Technical Data	
Power FC-System	250 kW
Durability (FC)	4 years
Drive power	205 kW, for < 15-20 sec
Hydrogen Storage	40 – 42 kg Hydrogen (350 bar)
Range	180 - 220 km
HV-Battery	--
Efficiency FC-System	43 - 38 %
H ₂ -Consumption	20 – 24 kg / 100 km



Citaro FuelCELL-Hybrid

Technical Data	
Power FC-System	120 kW (const.) / 140 kW (max.)
Durability (FC)	6 years
Drive power	Output (const. / max.): 2 x 80 kW / 2 x 120 kW
Hydrogen Storage	35 kg Hydrogen (350 bar)
Range	> 250 km
HV-Battery	26,9 kWh, Output 250 kW
Efficiency FC-System	58 - 51 %
H ₂ -Consumption	10 – 14 kg / 100 km

FCEV Market Overview

Coupé	Compact Class	SUV	
<div>Honda FCX Clarity</div> <div></div> <div>Toyota FCV</div> <div></div>	<div>Ford Focus FCV Hybrid</div> <div></div> <div>Compact MPV*</div> <div>MB B-Class F-CELL</div> <div></div> <div>Renault Scenic ZEV H2</div> <div></div>	<div>Hyundai ix35 Fuel Cell</div> <div></div> <div>GM HydroGen 4</div> <div></div> <div>Toyota FCHV</div> <div></div>	<div>Kia Borrego FCEV</div> <div></div> <div>Nissan X-Trail FCV</div> <div></div> <div>VW Tiguan HyMotion</div> <div></div>
City Car			
<div>Fiat Panda Hydrogen</div> <div></div>			

Many of the biggest and most important automobile manufacturers are committed to develop and commercialize fuel cell electric vehicles

Daimler Commitment: 20 H₂-refuelling stations as a catalyst for the market introduction of fuel cell technology

Key Facts

- 20 new H₂ refuelling stations (FS) will be built from 2013 jointly by Daimler and Linde with support of federal government
- Refuelling stations primarily in „high-density“ regions (e.g. Baden-Württemberg), metropolis and corridors
- Germany as first country, which will get an area-wide H₂-infrastructure

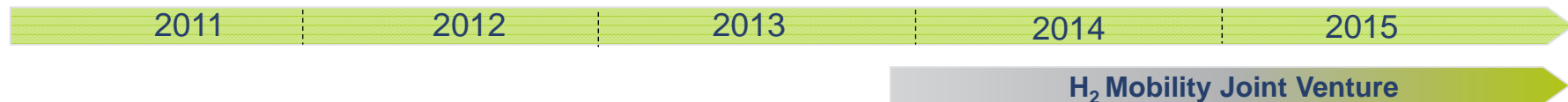


Approximate allocation of 20 FS



Discussions with retail partners and location agreements

20 H₂-refuelling stations until 2015



H2-Mobility Initiative in Germany

Build-up of a HRS-Network until 2023

Partners of Initiative



Development-Plan

Build-up of a hydrogen refueling station network in Germany until 2023

Unitl 2023

~ 400

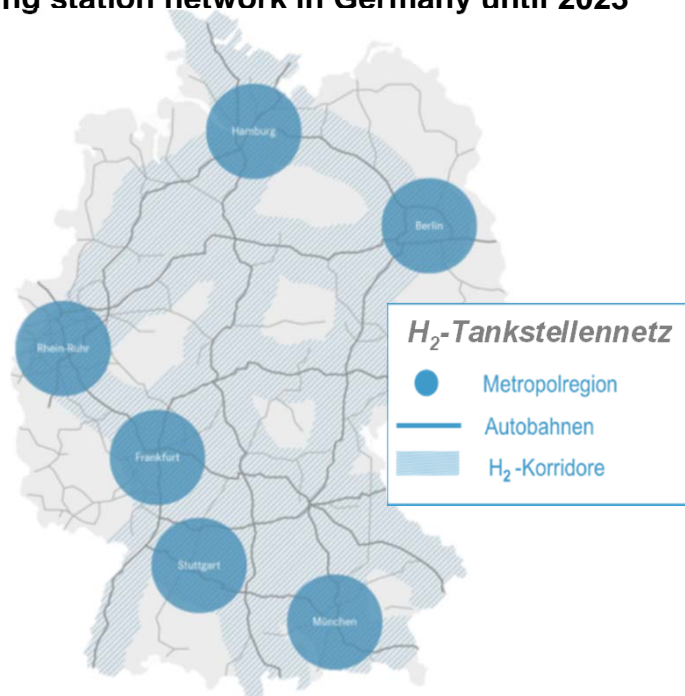
public accessible HRS to be build-up in Germany

~ 90

km distance between HRS on the Highways and around the Lighthouse-Regions

> 10

HRS available in Metropolitan areas



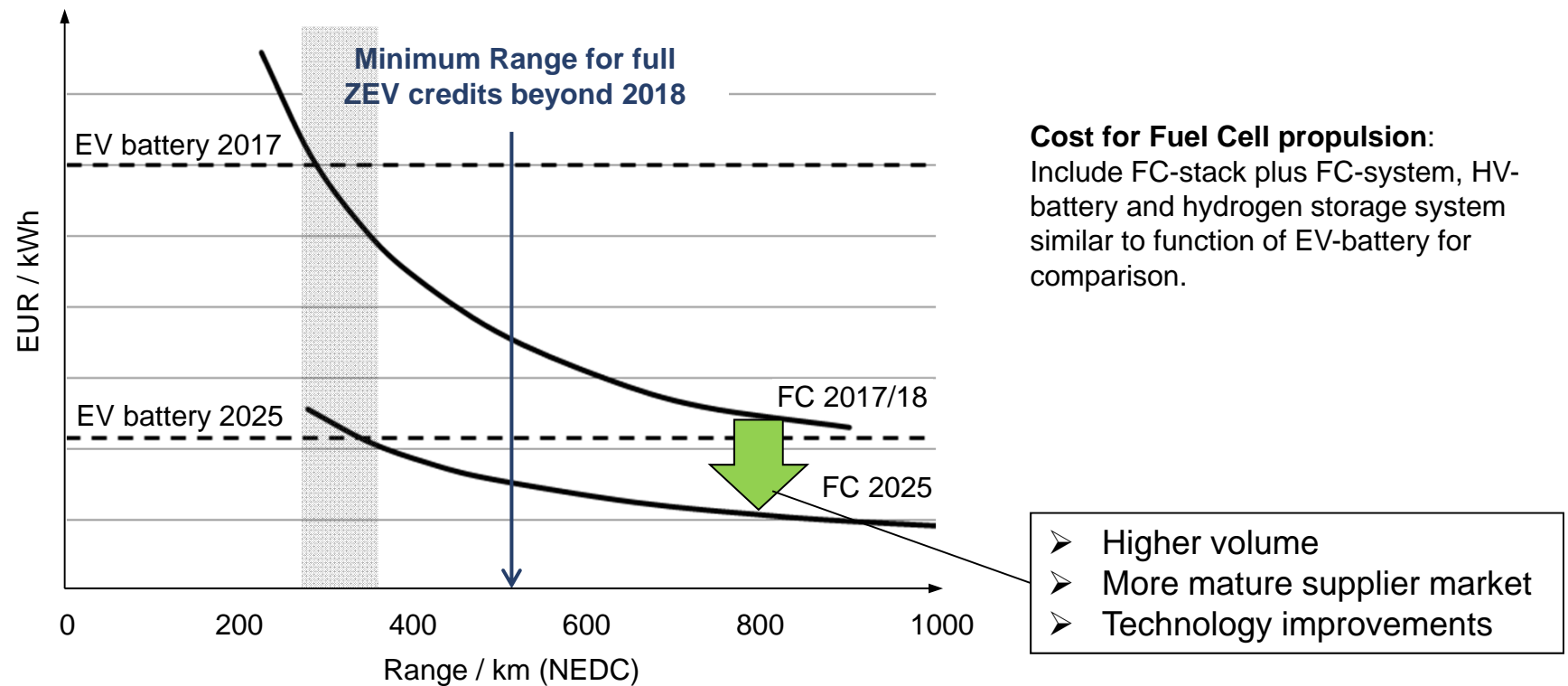
Joint Initiative of Oil-Industry, Gas-Industry and OEMs with governmental support to build a Joint Entity that owns (built-up and operate) H2-Infrastruktur

The Joint Entity is an independent alliance that imposes clear commitments to its partners

The objective is the market development to overcome the initially negative business case and launch to an independent and functioning Hydrogen-Market

FCEV and BEV

Comparison of cost per kWh electrical energy source



- Beyond a range of approx. 350 km Fuel Cell propulsion is less expensive than EV-battery propulsion

Daimler's commitment to FCH- JU

- Daimler is highly committed to FCEV technology and its commercialization
- The FCH JU is a very important institution for our research and demonstration activities and the build up of the necessary H₂ Infrastructure network in the European Union
- Daimler is one of the founders of the FCH JU and has been involved in the NEW-IG and FCH JU from the very beginning on. We will continue our strong support and engagement.
- Continued strong support by European Commission, open discussion and cooperation among the stakeholders will open the door to the hydrogen based sustainable mobility and competitive economy
- Daimler has been involved in a number of FCH JU demonstration projects and will continue to contribute further to FCEV demo projects



10 Mercedes B-Class F-Cell in Oslo region, FCEV demo tour through Europe



17 Citaro FuelCELL-Hybrid Buses in Aargau, Bolzano, Hamburg and Milano



4 Mercedes B-Class F-Cell and 2 Mercedes New Generation FCEV prototypes in Stuttgart region

CHIC – Clean Hydrogen In European Cities

CHIC Background:

CUTE/ECTOS: 2001 – 2005

- Demonstration of a fleet of 30 fuel cell buses in regular public transport

HyFLEET:CUTE: 2006-2009

- 47 hydrogen powered buses in public transport
- 2.600.000 km* in public service, 555 tons* of H₂ refuelled and more than 1 million liters of Diesel replaced
- Fuel cell buses are suitable for operation in public transport
- Development of a new, fuel efficient fuel cell hybrid bus concept



Key Facts:

- 25 partners from 9 countries worldwide
- 26 fuel cell buses operated in 5 Phase 1 cities
- **London, Milan, Oslo, Bolzano and Aargau** -
- At least 3 different bus manufacturers in the Phase 1 cities
- 2 filling stations per Phase 1 city
- Demonstration phase 2010-2016
- 25.88 Mio. EUR funding, 81.8 Mio EUR costs



Examples - Hamburg and London

Hamburg

- 4 Citaro Mercedes-Benz Citaro FuelCELL handed over in August 2011
- First international fuel cell bus technology exchange in Hamburg in October 16 - 17, 2013
- 3 Hydrogen Refueling Stations in operation (Total Cuxhavener Str. , Vattenfall HafenCity and Vattenfall Hummelsbüttel)



London

- Official launch of London project on December 10, 2010
- First vehicles entered into service January 2011
- 1 Hydrogen Refueling Station





Thanks for your attention!