DAIMLER

IEA H2 Roadmap Workshop

Progress on FCEV development

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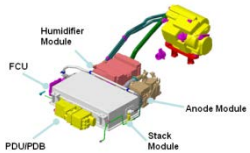
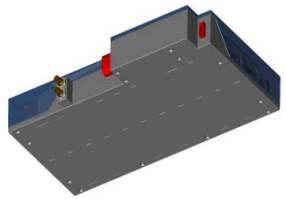
Daimler AG

Technical data Mercedes-Benz B-Class F-CELL

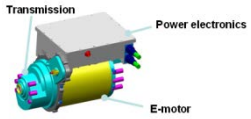
Fuel Cell System	
Air module	Screw w/o expander
Humidifier	Gas-to-gas humidifier
Power	80 kW
# Cell rows	2
# Cells	396
Cold start ability	- 25 °C



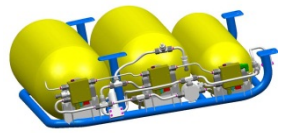
Battery System	
Technology	Li-Ion-Battery, 60 Cells
Power (18 s./ 5 s.)	30/34 kW
Nominal voltage	212 V (3,54 V/cell)
Nominal capacity	6.8 Ah
Energy content	1.4 kWh
Volume	44 l



Electric Drive Train	
Technology	PM (permanent magnet motor)
Transmission	compound-planetary + bevel gear differential
Power (c/p*)	70/100 kW
Torque	290 Nm
Efficiency	> 88 %

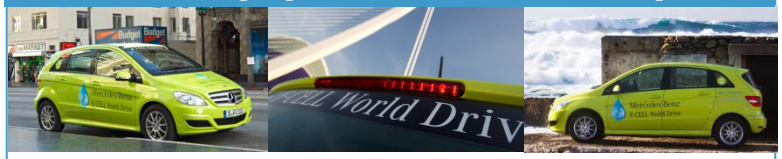


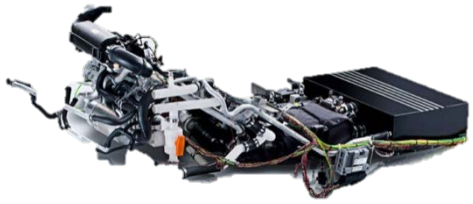
H2-Tank System	
Pressure	700 bar
Volume	106 l
Weight	114.4 kg
Capacity	3.7 kg H2
Refuelling time	~ 3min (H2 precooled)



Packaging of Fuel Cell System

Today (B-Class F-CELL)





Future Technology Target

Reduction of ~ 30%

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 would allow a accommodation in the engine compartment of a conventional vehicle.**

Market Preparation – Worldwide Fleet Operation

Fleet demonstration with the current generation of Fuel Cell vehicles

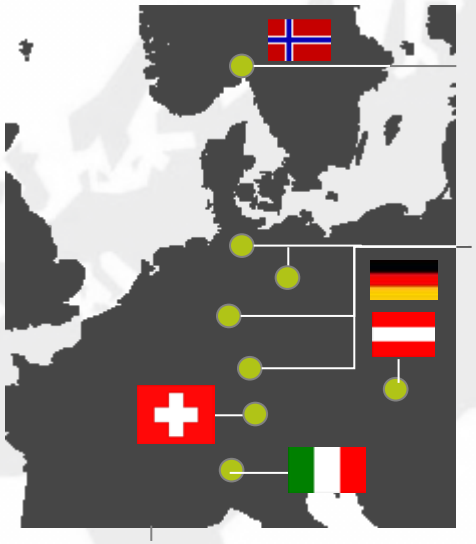
Fleet demonstration of the current generation of electric vehicles with fuel cell (B-Class F-CELL, Citaro FuelCELL-Hybrid) since the end of 2010 in Germany, Europe and the USA.

North America

Fleet Demonstration
▶ **California**

Fleet Demonstration:
More than 6,8 Mio. km

Europe



Fleet Demonstration
▶ **Oslo**

Fleet Demonstration
▶ **Hamburg**

▶ **Berlin, Frankfurt, Stuttgart**

▶ **Karlsruhe**

Fleet Demonstration
▶ **Wien**

Fleet Demonstration
▶ **Mailand, Bozen, Brugg**

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 > 2.100.000 km

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

Small Series Citaro FuelCELL-Hybrid (~ 30 Units)
vehicle miles travelled > 320.000 km

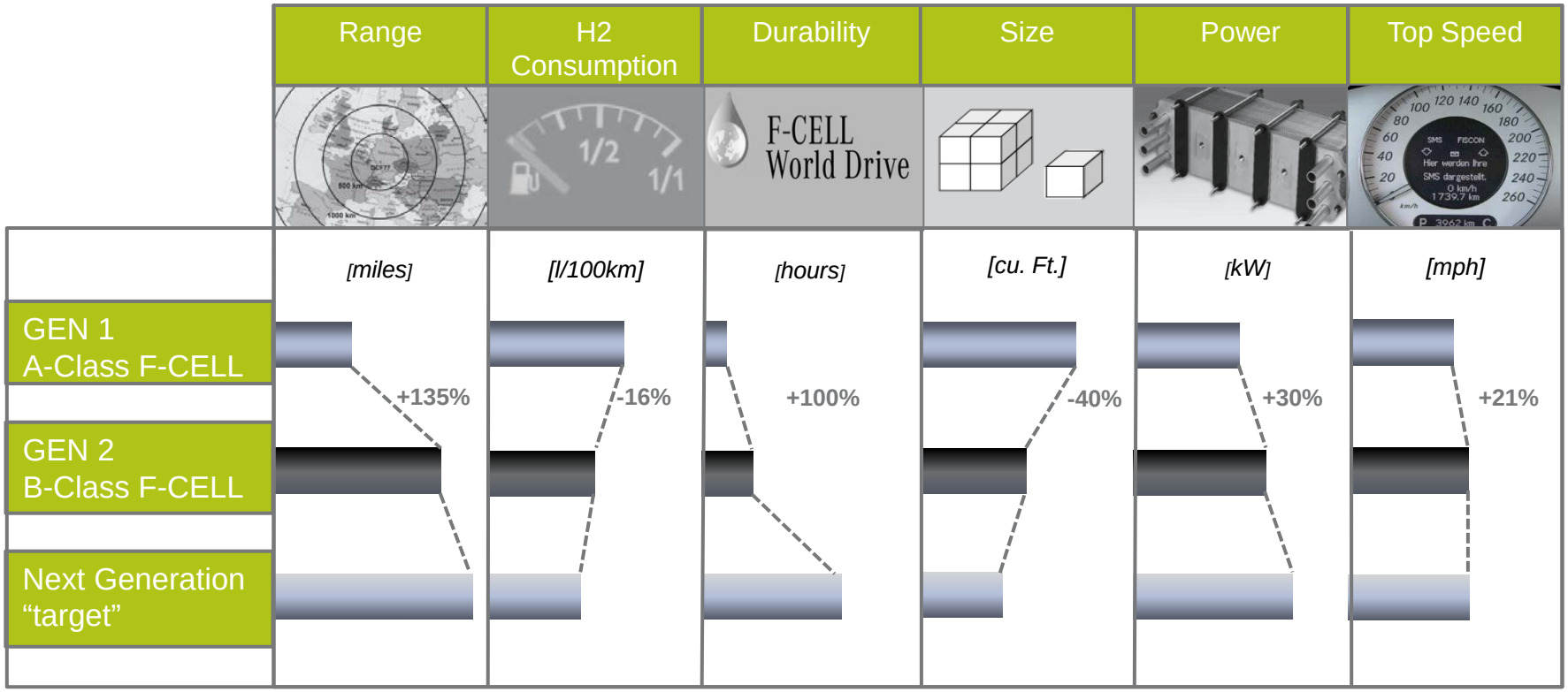
Technology: Demonstration of technical maturity

Mercedes-Benz F-CELL World Drive 2011!

- 125 days
- 14 countries
- 3 B-Class F-CELL
- Appr. 30,000 km per vehicle
- 29 Legs
- 2 refuellings per day
- Up to 1,000 km per day

DAIMLER AG demonstrated the reliability and technical maturity of their B-Classes F-CELL and their leadership in this technology.

Technical Advancements of Daimler's Fuel Cell Vehicles



From generation to generation great technical improvements in numerous technical areas.

Technical Configuration of a Hydrogen Fueling Station

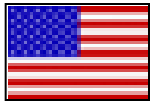
Status quo of hydrogen filling stations:

- Pre-cooling down to -40° Celsius
- Pressure of hydrogen: 350 and 700 bar
- Standardized refueling process (SAE TIR J2601, ISO/TS 20100) using infrared data interface for communication vehicle <> filling station (SAE J2799)
- Refueling time: approx. 3 minutes for the B-Class F-CELL (ca. 4 kg hydrogen)
- Standardized hydrogen filling connector (SAE J2600, ISO/FDIS 17268)
- Hydrogen fuel quality (SAE J2719, ISO/FDIS 14687)
- Unitized construction / scalable

Currently there is a significant momentum in several markets to push for the commercialization of H2-infrastructure

- H2-Mobility ensures highly covering in all appreciable regions including Autobahn
- Parallel build-up up to **85 HRS** (including 20 Daimler/Linde stations) focussing on expansion of H2-regions plus covering corridors (→ **sufficient HRS in the middle-term**

- Activities in England, France and Switzerland have been started in parallel. Encouragement of the EU is necessary.

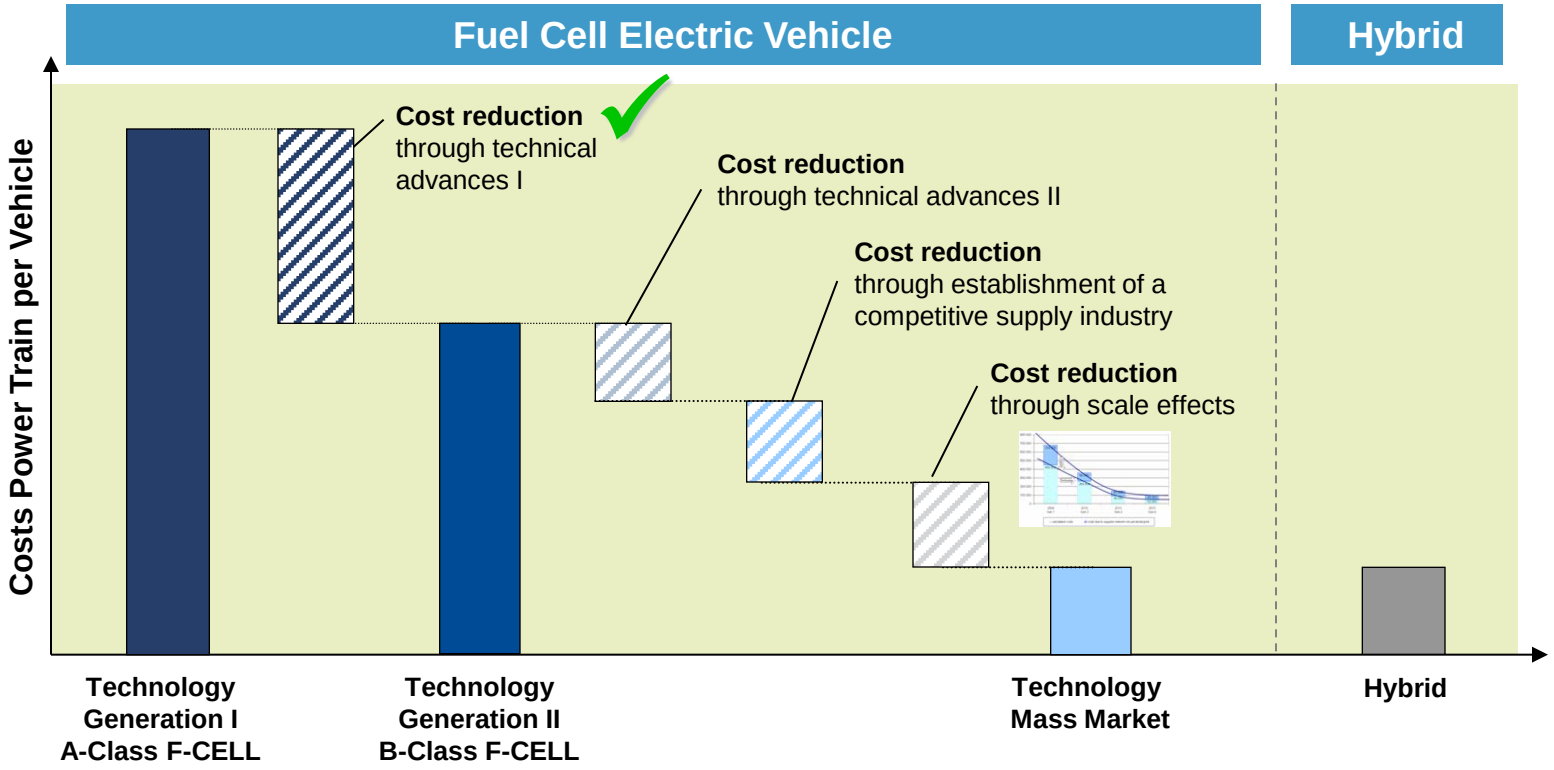


- Demonstration-Projects established in California and US East-Coast.
- From **2015** on **obligation of gas suppliers** for build-up and operation of HRS in California (clean fuels outlet). This leads to a comprehensive and sustainable infrastructure build-up. At the moment there are lawsuits against this act pending.

Los Angeles Area

- Signing of a MoU by 3 ministries and 13 enterprises (Private-public-partnership) to develop a timetable for H2 infrastructure and FCEV.
- **Sufficient HRS covering until 2015** in the four importanst metropolian areas Tokio, Aichi, Osaka and Fukuoka is assured. Further build-up in process of planning.

Cost Potentials of the Fuel Cell Technology

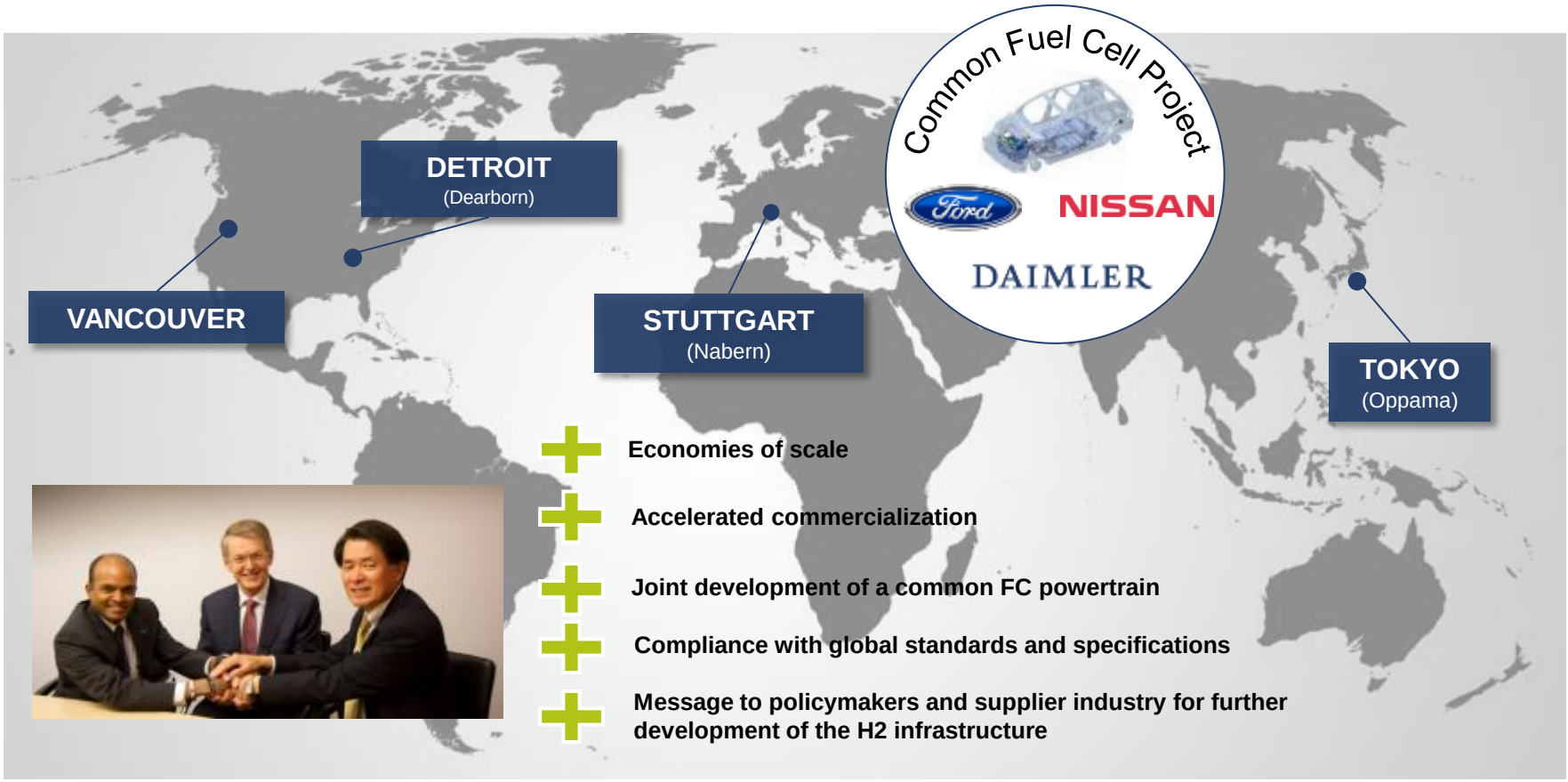


- **The cost for the fuel cell power train are currently much higher than those from conventional drive systems. They can be reduced considerably through scale effects and technology advances.**
- **A reduction of the costs on the level of conventional drive trains is possible.**
- **Regarding the TCO[1] comparable values to conventional drive systems are reachable.**

1) Total Cost of Ownership

Cooperation Nissan/Ford/Daimler

Asia, Europe and US – Unique collaboration across three continents



In 2017, the partners begin the production of more than 100,000 fuel cell vehicles, because the infrastructure and the framework will then be given.

Thanks for your attention!