



Electrifying Hamburg's Public Fleets

EUSEW 2010, Brussels

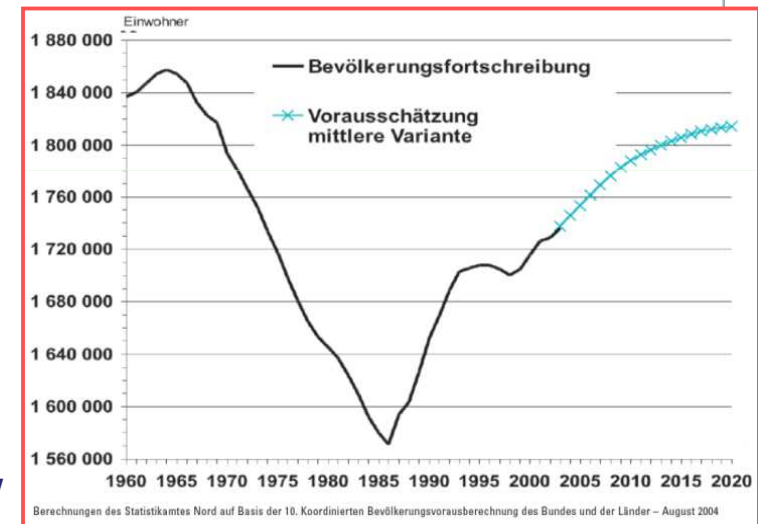
Heinrich Klingenberg

- European Green Capital of 2011- through promotion of energy efficient technologies – as for example fuel cells
- Decrease CO₂-emissions by 40% until 2020 through climate action plan based on values of 1990
- Transport as a major source of emissions (30%)
- City-owned companies as HOCHBAHN play important role with regard to the practical use of green technologies



Challenges

- Population in Hamburg will increase until 2020s
- The conditions for an economical development above-average are well
- Coeval the Hamburg Senat decided upon an ambitious climate action plan
- Additional on hand: concept for the inner city with sustainable space and resources development
- Discussions on congestion charge and inner city low emission zones
- Systematical enhancement of public transport



Focus-Region e-mobility

E-mobility



- ▶ Specialized city-cars
- ▶ Little footprint in terms of space
- ▶ Ideal for multi-modal mobility service

Fleet operation



- ▶ High operating grade
- ▶ Highly environmentally friendly
- ▶ Highly economic

H₂/FC-vehicles

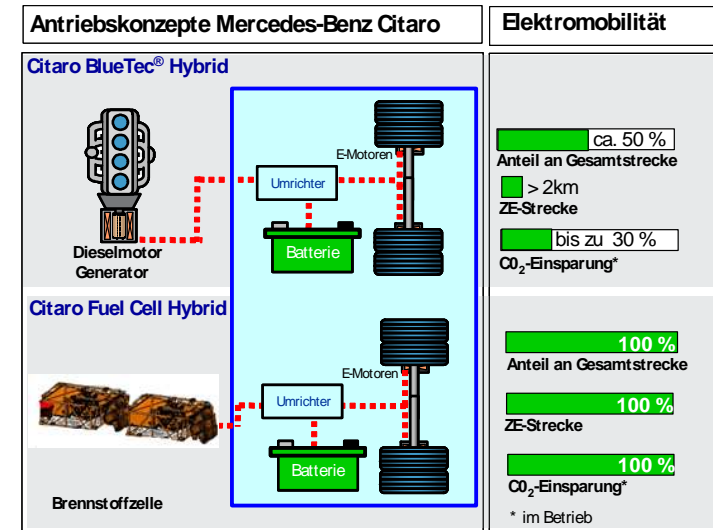


- ▶ Buses and Multi-purpose vehicles
- ▶ Low emissions for long range
- ▶ Public transport is a perfect match for the concept of e-mobility

- Fuel Cell and Battery vehicles are part of same technology pathway and have many synergies
- City-buses in short to mid term not able to run on battery systems only
- Hybridized buses (with fuel cells) as a viable technology solution
- **Most important:** the source of the primary energy has to be green!
- Unsteady energy sources need storage. Storing overload capacity via production of hydrogen or virtual e-car parks (V2G) are viable pathways

Fuel Cell & Diesel-Hybrid buses

- Strategy approach of HOCHBAHN:
Serial Hybrid (Diesel and Fuel Cell)
- **One technology platform for Fuel Cell Hydrogen Bus (FCHB) and Diesel Hybrid Bus (DHB)**
- **DHB** can operate in battery mode **partly allowing zero emissions** (low noise level & no pollution in sensitive areas)



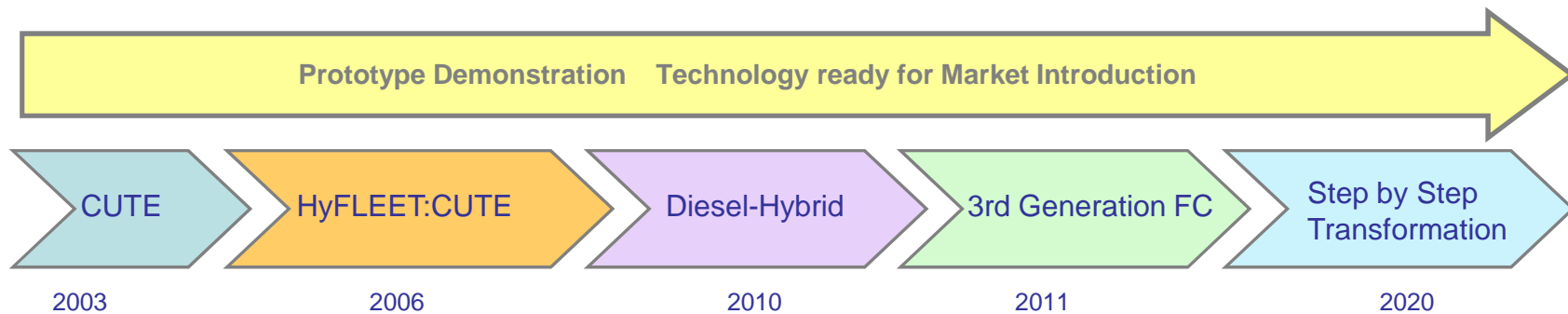
Source: Daimler

- Growing production numbers of DHB allow for substantial Economies of Scale effects, also benefiting cost reduction for FCHB in the mid to long term
- As long as fossil fuels can be purchased on the market at a „reasonable“ price DHB functions as bridge technology to prepare for FCHB
- In midterm set new standards in Public Transport by decreasing emissions of buses to zero using FCHB and preparing in due time for the post fossil age

New Citaro FuelCELL-Hybrid

Next generation fuel cell buses are characterized by:

- Optimized fuel cell system and fuel cell operation strategy
- Use of passenger car modules
- Optimized drive train concept
- Integrated energy accumulator - lithium-ion high voltage battery
- Electrified auxiliary system components
- Reduced weight of the bus (e.g. by reducing the number of gas cylinders due to better efficiencies - 350 bar Tank system)



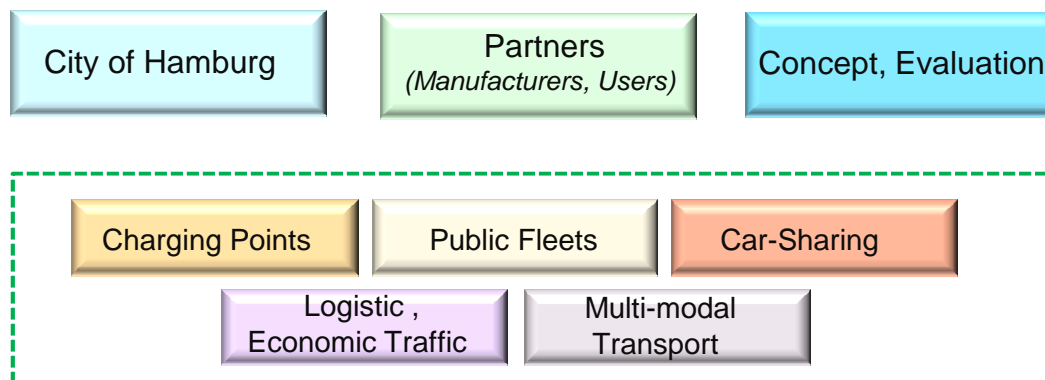
Clean City Cars

- Introduction of 500 Daimler fuel cell cars intended until 2015
- Co-operation of the City of Hamburg, Daimler AG, Total, Shell and Vattenfall
- Base for future infrastructure – starting in 2010
- 5 publicly accessible refuelling stations planned until 2011



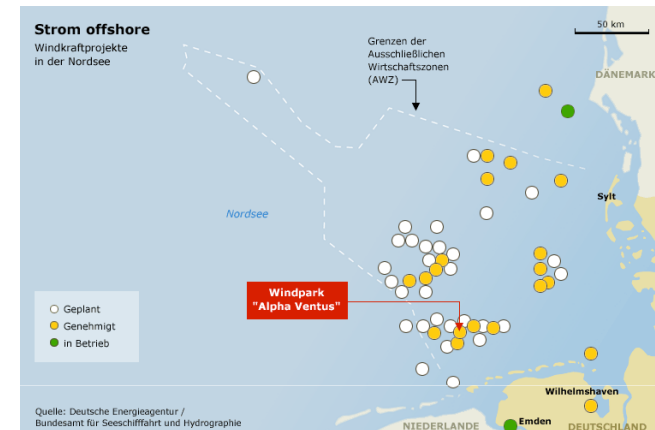
Electric Vehicles

- Regional Masterplan and Ramp Up of Charging points under way
- Initial phase supported with funds from National E-Mobility program
- Variety of vehicles according to purpose of utilization
- In phase 1 mostly fleet applications including car-sharing
- Multi-modal concept matched with public transport



Wind: source of clean power

- Actual capacity of wind-farms ca. 20 GW (mostly onshore) in Northern Germany
- Another 25 GW currently under planning (mostly offshore until 2030)
- Losses in peak load due to insufficient grid min. 10 % today and even higher in the future
- Research project for wind/hydrogen network in preparation



Long term strategy: Full electrification of Public Transport in Hamburg

- Introduction of new DT5 Underground train in late 2010
(Up to 95% of train components recyclable as already with first generation DT4 vehicle)
- Introduction of new Light-Rail-System in 2014
- Constant build up of newest electric Diesel- and Fuel Cell Serial-Hybrid buses from 2015



**THANK YOU
FOR YOUR
ATTENTION!**