



DLR

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Green Mobility Technology Roadmap

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SCCER-Mobility 1st Annual Conference at ETH Zürich
11th September 2014



DLR – Overview

DLR's mission:

- exploration of the Earth and the solar system
- research aimed at protecting the environment
- development of environmentally-friendly technologies to promote mobility, communication and security.

8.000 employee are working at 33 research institutes and facilities in ■ 9 locations and ● 7 branch offices.



DLR Transport – Goals and strategies

Superior Goals

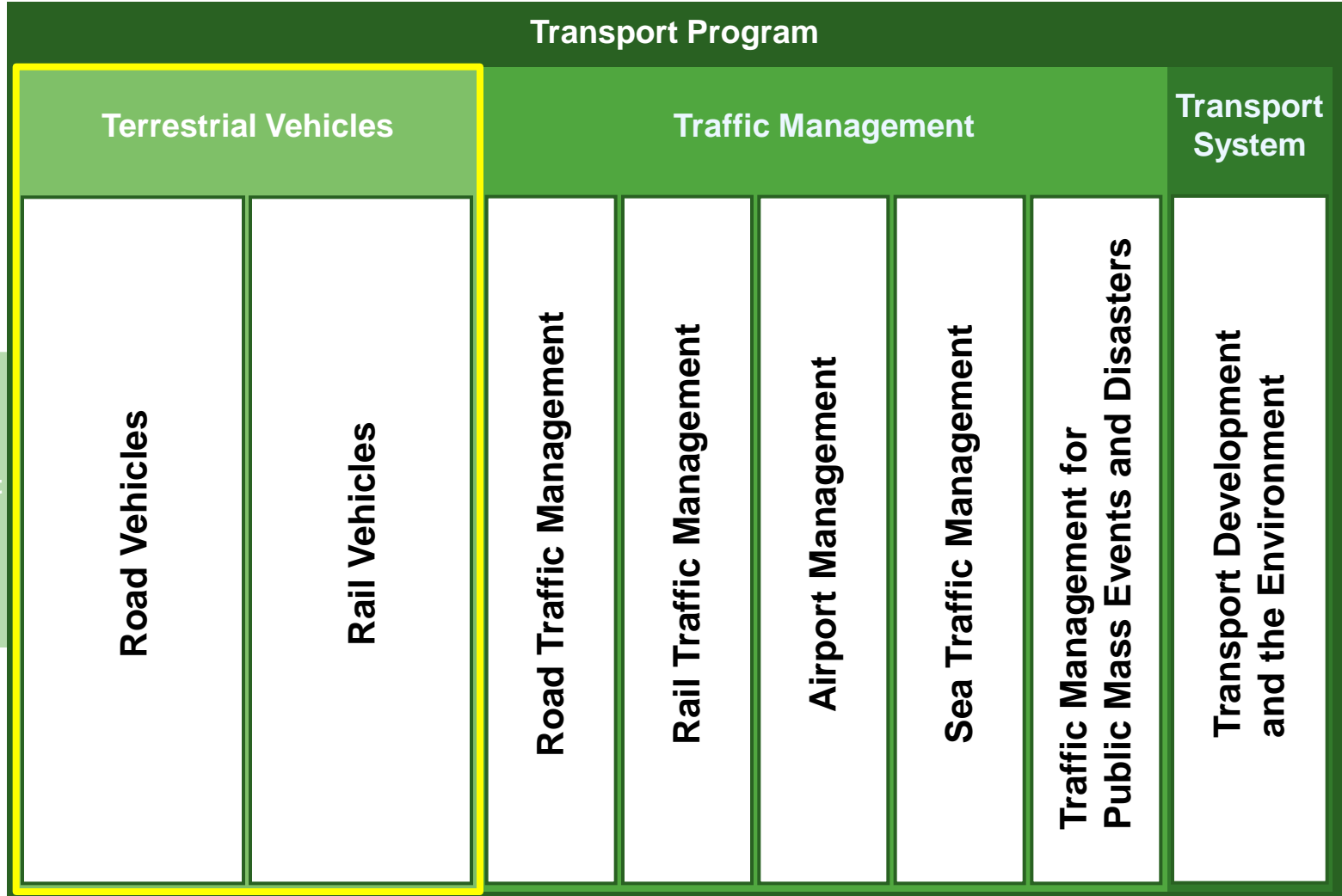
- Assurance of mobility
- Protection of environment and resources
- Improvement of safety

Strategic basis elements

- Independent transport strategy
- Extension of the transport-specific range of skills
- Use of DLR internal synergies
- Intensified focus on applications
- Complex systems research
- Design and use of large-scale plant
- Cooperation with excellent partners from industry and science on a strategic basis



Transport – Portfolio



Mobility

Environment

Safety and Security



Transport – Portfolio

Mobility

Environment

Safety and Security

Terrestrial Vehicles



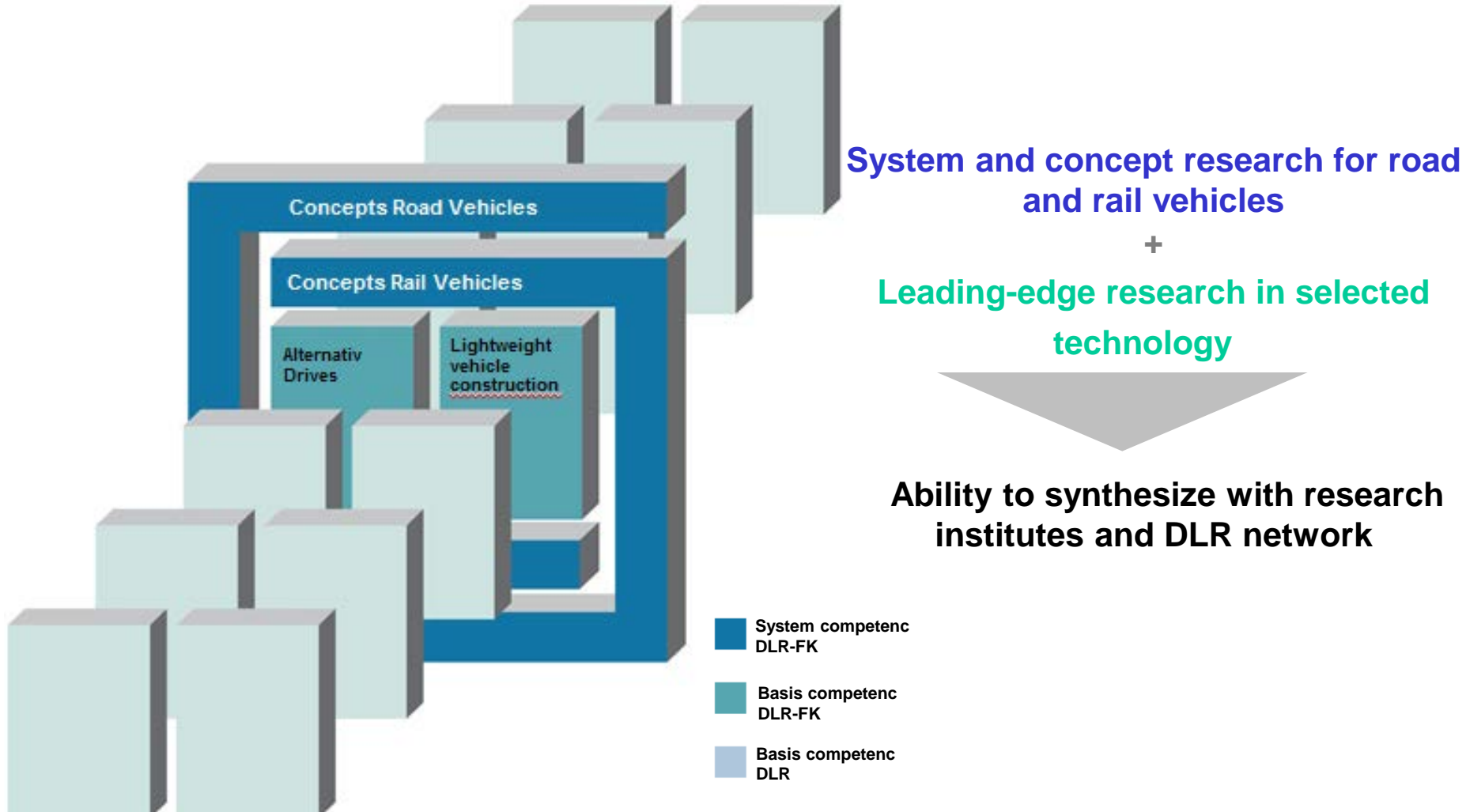
Transport Program

- Improvement of modeling for vehicle energy systems
- Reduction of driving resistance and vehicle weight
- Improvement of navigation support and driver Assistance
- Novel train concepts covering aerodynamics, material sciences and lightweight construction, optimized energy management

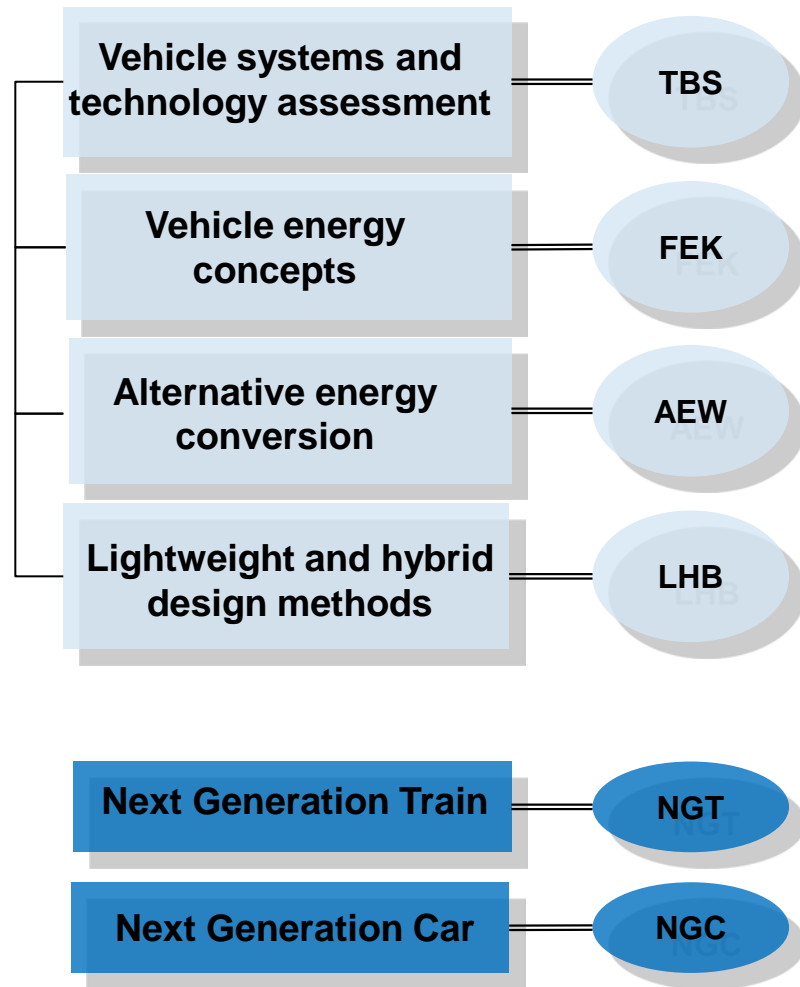


DLR's Research Network – “One DLR!”

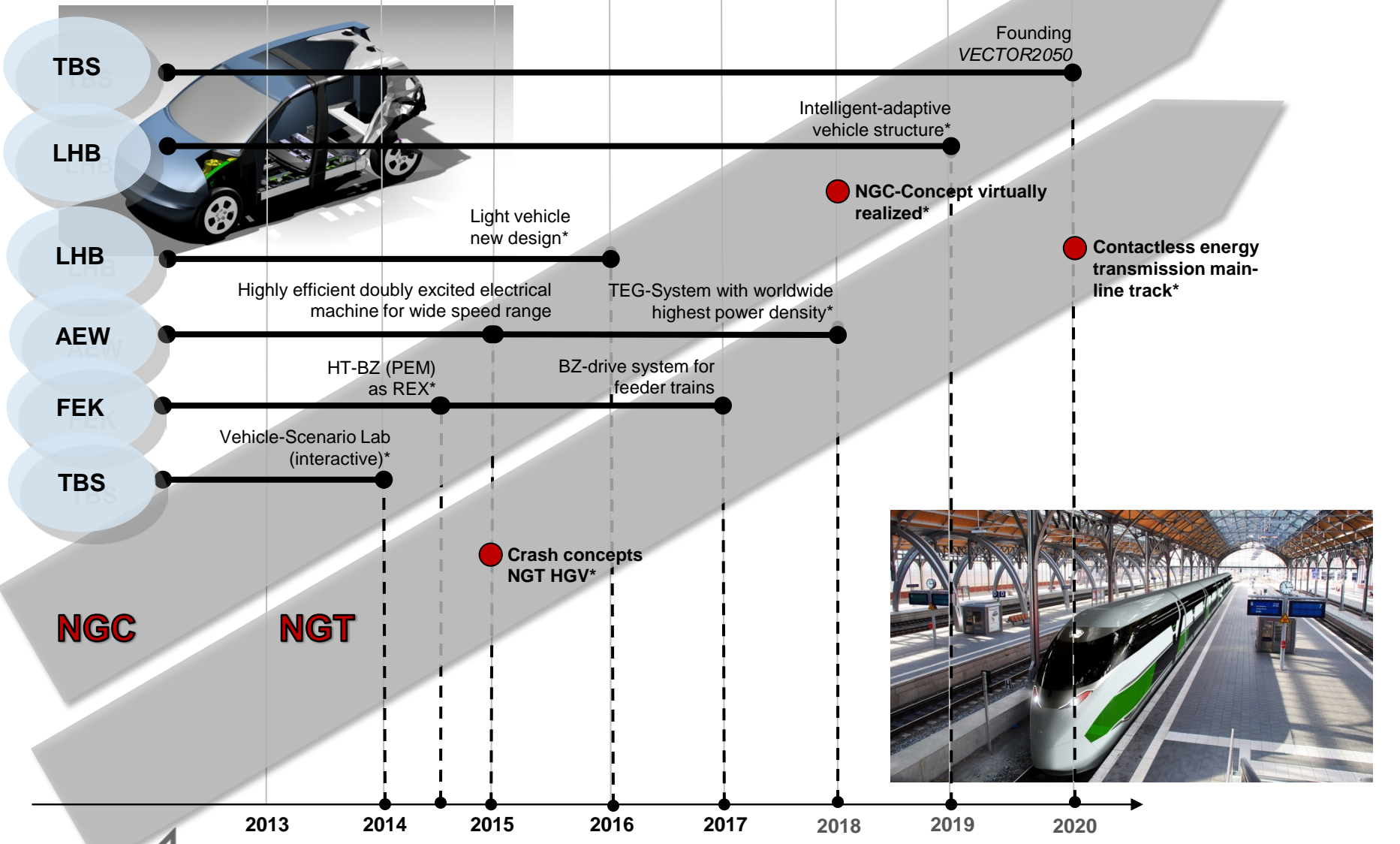
Institutes orientation and Researchfields



Institute of Vehicle Concepts



Roadmap FK 2020



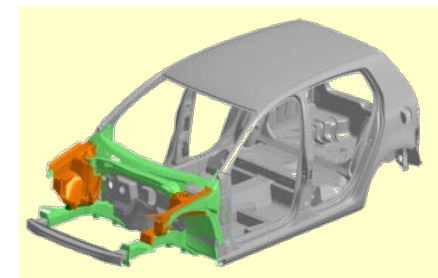
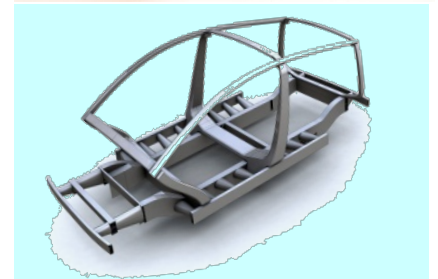
Novel Vehicle Structures

Challenges

- Reducing energy consumption and/or CO₂ emissions
- Improving passive safety

Solutions

- New vehicle concepts for urban mobility
- Lightweight design
- Reduced vehicle mass
- Improved crash safety through structural integrity and new materials
- Usage of cost-attractive technologies
- Increased flexibility and modularity



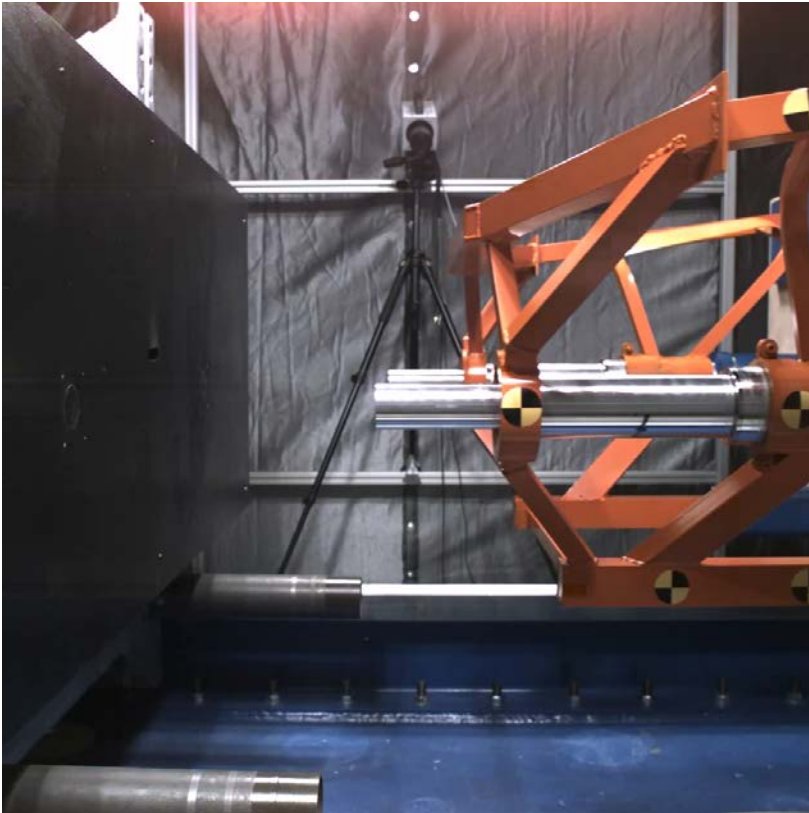
Front Structure

Challenges

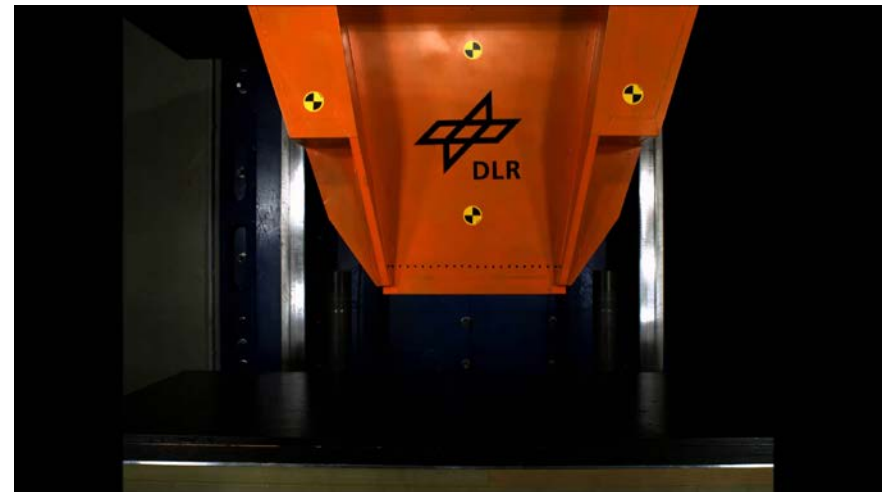
- Increase of passive safety

Solutions

- Energy absorption in frontal crash load cases



Crash of peeling tube front structure



Crash of sandwich front structure



Vehicle Energy Systems

Challenges

- Reducing energy consumption and/or CO₂ emissions
- Lowering of geo-political dependency

Solutions

- Range-Extenders
- Efficient energy converters (i.a. free-piston linear generator, micro gas turbine)
- Aggregates for use of waste energy (i.a. thermoelectric generator)
- Optimized energy management
- Fuel cell systems for in-vehicle application
- Powerful hydrogen tanks



Hydrogen range extender

Challenges

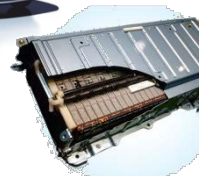
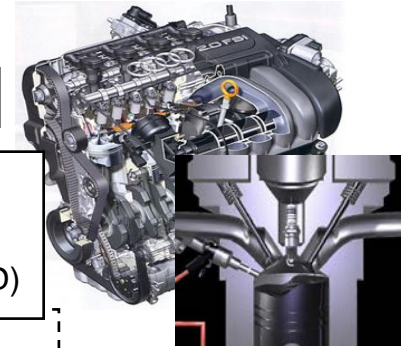
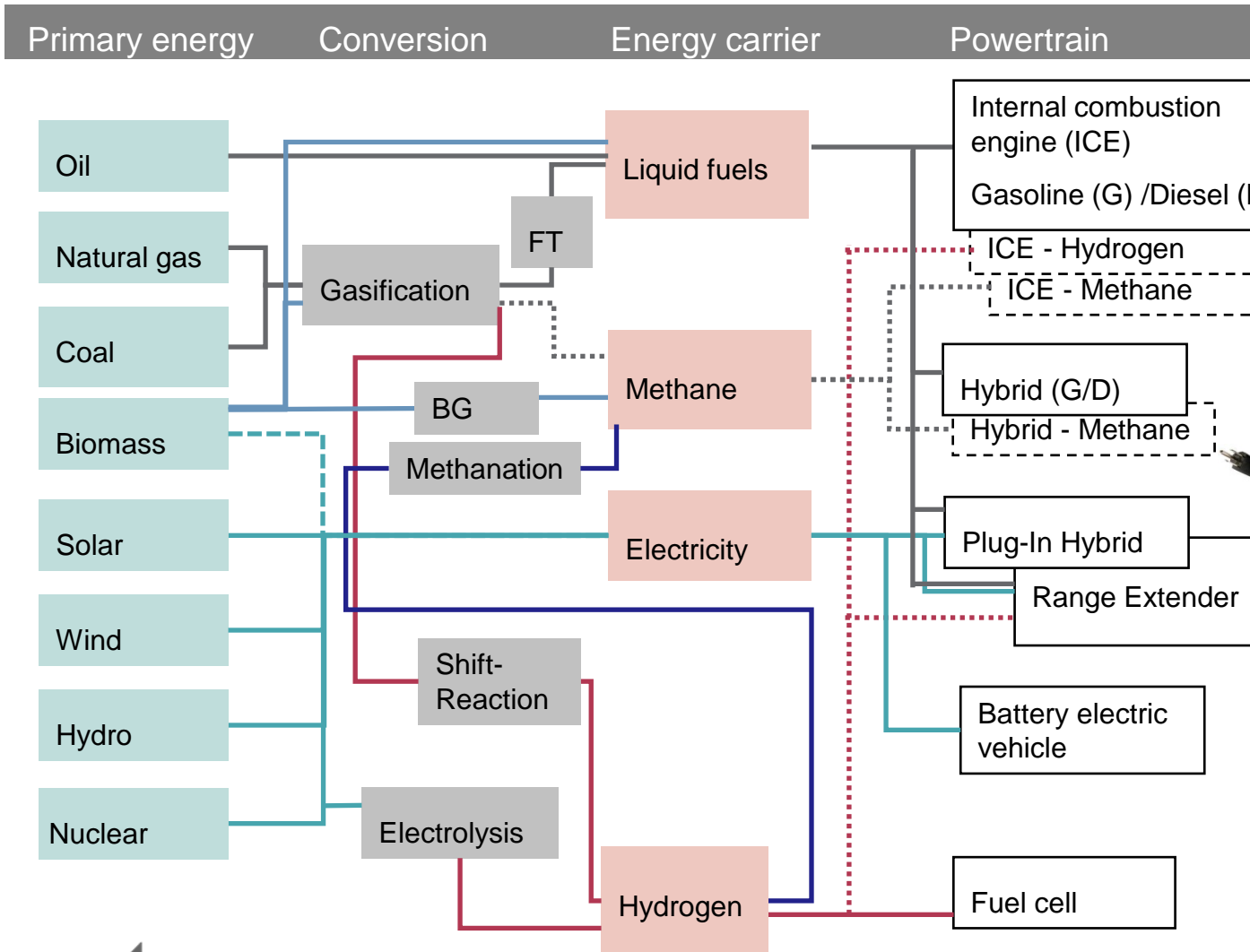
- Doubling the range of battery electric vehicle, which has extreme low available space

Solutions

- Integration of a high temperature fuel cell as on-board charger
- Innovative thermo-management for HVAC and range extension

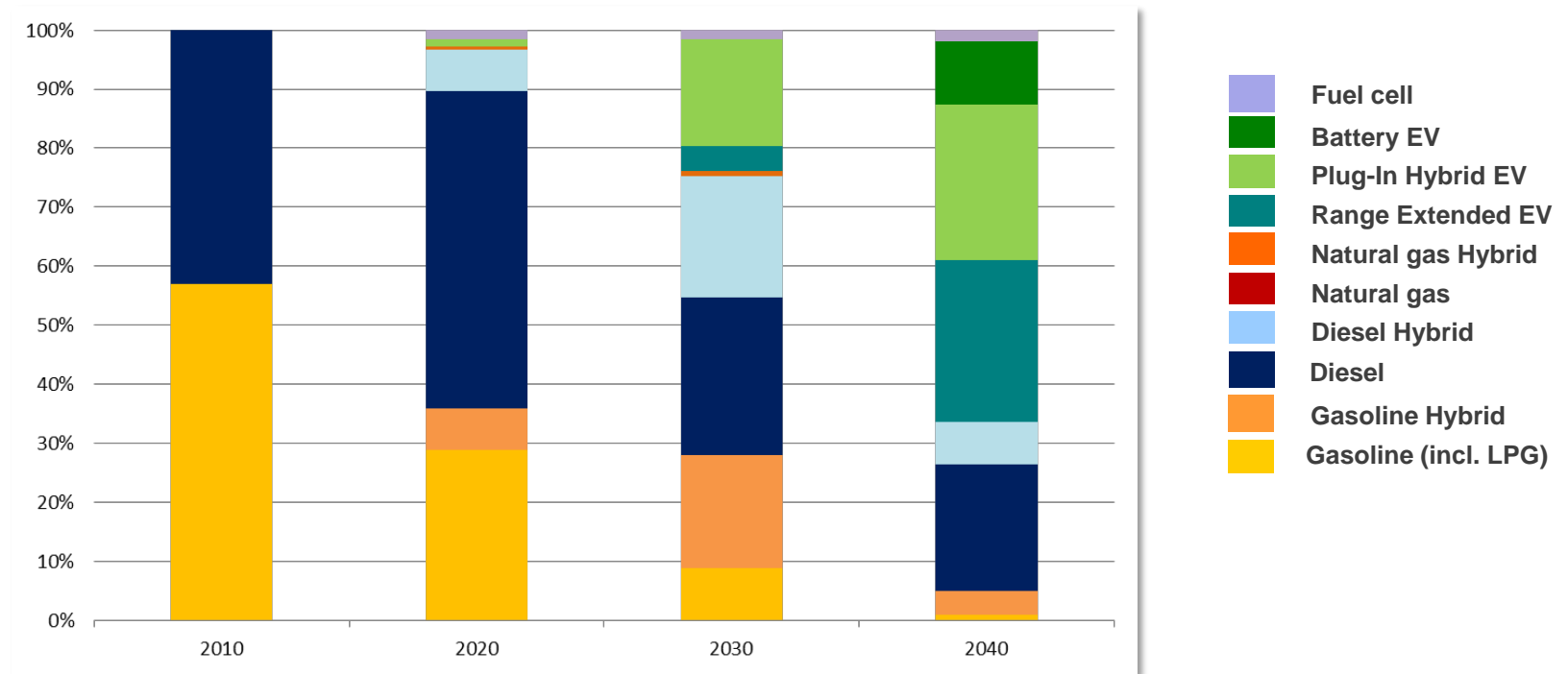


Alternative fuels and powertrains



Vector 21

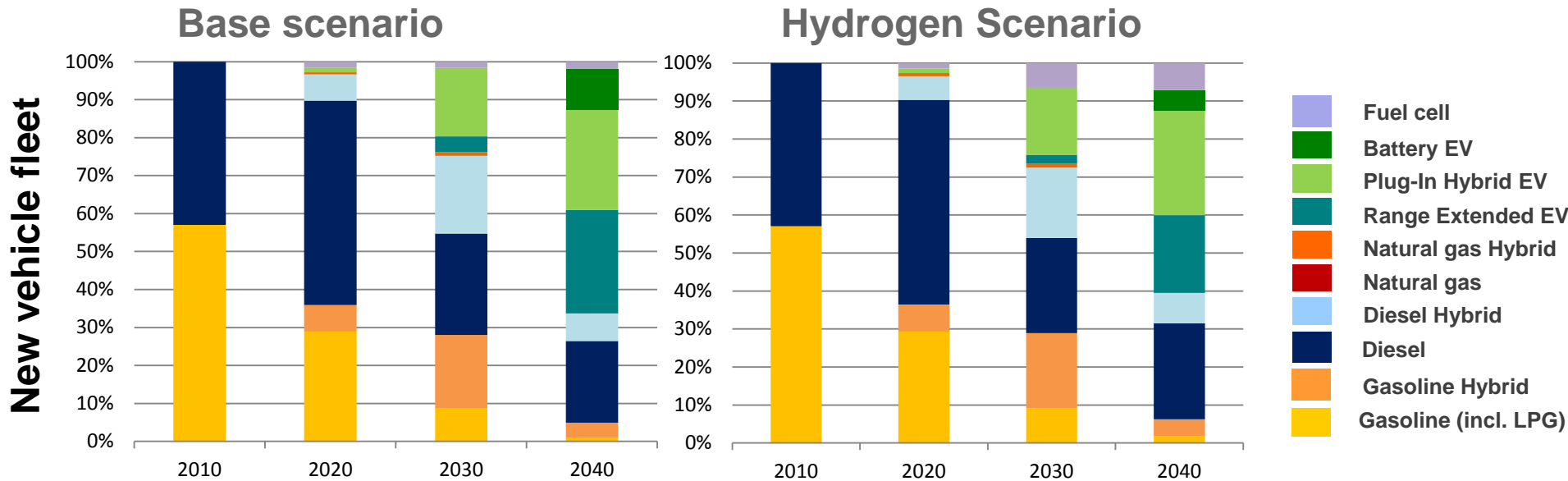
Base scenario, new vehicle fleet in Germany



- CO₂-targets lead to efficiency increase in ICE and increasing share of electrified powertrains
- Conventional powertrains are substituted by electrified ones (2040: 85% with ICE, 80% with battery)
- In the long run, no powertrain is expected to dominate the market



Alternative scenario: Best hydrogen availability



Changes compared to base scenario: → 100% H₂ availability (no restrictions for infrastructure)

Impact on the new vehicle fleet:

- Cumulative about 2.3 million more fuel cell vehicles between 2010 and 2040 compared to base scenario



What may be important for the future?

Question to be addressed

- What chance has e-mobility?
- Options for hydrogen?
- Is there a potential for e-gas?
- ...



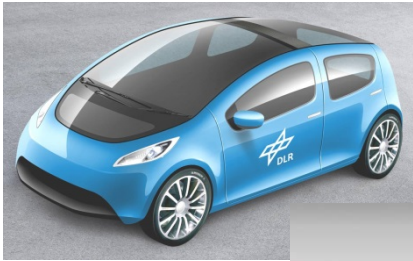
Research platform

Some answers

- Differentiation of fuels and vehicle concepts
- Hydrogen and electricity
- Urban vehicle concepts for urban mobility
- Assisted and autonomous driving
- Alternative vehicle concepts, e.g. new people mover, SkyTrains
- ...



“Future mobility has to be energy efficient, sustainable and economically attractive”



Thank you for your attention!

Knowledge for Tomorrow

