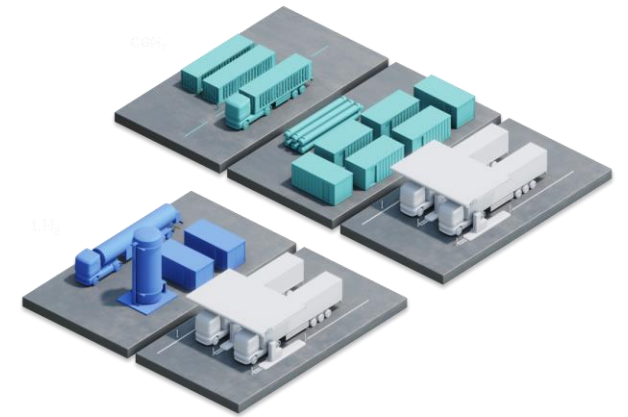


H₂ refuelling infrastructure for long-distance road haulage

Tight timeline for the roll-out

Speaker: Dipl.-Ing. Jan Zerhusen (LBST)



- H₂ road transport is gaining momentum, first small fleets and prototypes are put into operation
- H₂ fuel supply infrastructure is key to successful market ramp-up, but virtually not existing yet
- Study launched to provide an overview of the current state of play regarding refuelling infrastructure

Focus: H₂-Infrastructure for heavy-duty long-distance road haulage

Study topics:

- Hydrogen fuel options for heavy-duty vehicles (HDV)
- Status of refuelling protocols & nozzles
- Refuelling station supply options
- Fuel costs and cost reductions
- Refuelling infrastructure

Study funding & publication



Study consortium



Study to be published by e-mobil BW in Q1/2023

GHG relevance of HDV & H₂ fuel demand projections



- Germany's ambition: Climate neutral by 2045 (Climate protection law, 2021)
 - Total GHG emissions: - 65% (1990 vs. 2030)
 - Transport sector: 164 Mt_{CO2äq.} ↘ 85 Mt_{CO2äq.} (2019 vs. 2030)
 - HDV account for about 1/5 of those emissions
- Recent studies on Germany's 2045 decarbonization target:
 - H₂ in transport sector mainly for HDV & long-distance
 - Roll-out picks up after 2025

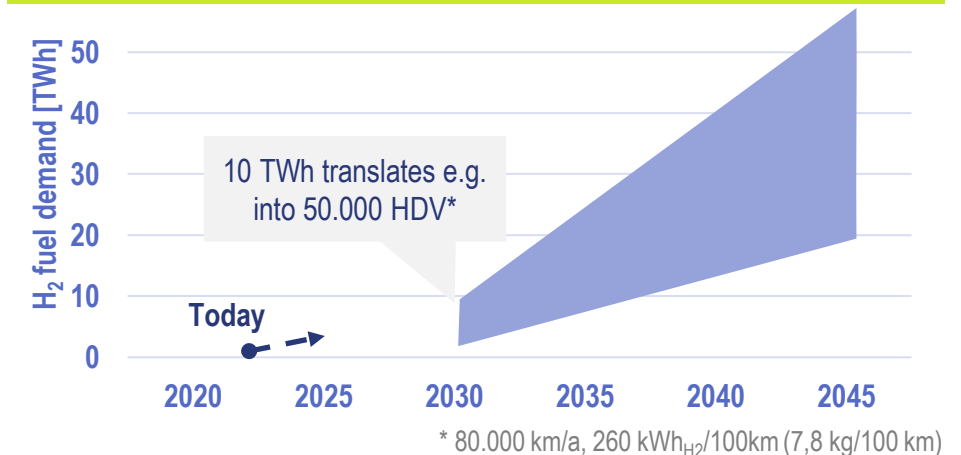
Expected 2030 numbers pose a challenge especially considering:

- The status of the new H₂ fuel options proposed for HDV long-distance applications
- The status and capacity of corresponding refuelling infrastructure

GHG emission transport sector



H₂ fuel demand for road transport in Germany



New Hydrogen fuel options



- Current FC truck deployments use 35 MPa storage technology (available & proven)



Long-distance road haulage

“New” H ₂ fuel options with increased energy density		Technology status	H ₂ supply to station	Number of tech. suppliers
Capacity: 80 kg Range: 1.000 km To be refuelled: in 10 to 15 min.	70 MPa gaseous	Most advanced	LH ₂ or GH ₂	many
	Subcooled liquid (sLH ₂)	Less advanced	LH ₂ only	few
	Cryo-compressed (CcH ₂)	Less advanced	LH ₂ (or GH ₂)	few

LH₂: Liquid hydrogen, GH₂: Gaseous hydrogen

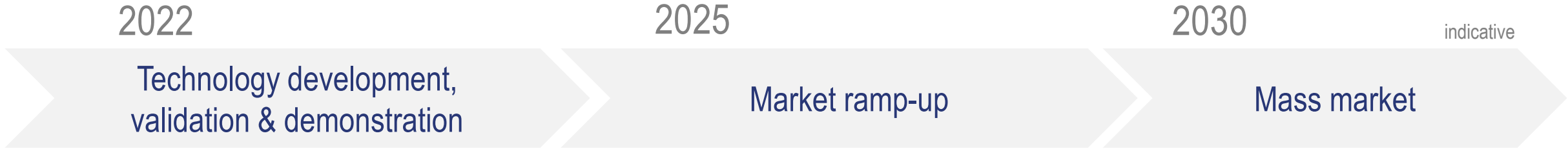
Interoperable pan-European refuelling network...



... is a mandatory precondition for successful and rapid uptake of heavy-duty long-distance FC trucks.

Requirements “pan-European”	Status	Current issue
EU-wide refuelling network	pending	AFIR: Diverging ambitions of Council & Parliament
Sufficient & efficient fuel supply (LH ₂)	missing	Limited LH ₂ availability in Europe, high costs & energy demand
Requirements “Interoperable”		
Common H ₂ fuel options used	unclear	Unclear relevance of H ₂ fuel option(s) (35 MPa, 70 MPa, sLH ₂ , CcH ₂)
Standardized nozzles (& receptacle)	pending	Still in pre-normative state (sLH ₂ , CcH ₂)
Standardized refueling protocols	pending	Risk of delays in the (ISO) standardization process (e.g. 70 MPa)

Tight timeline - Need for action



Who



Industry & RCS bodies



Politics (EU)



Industry

(vehicle & Infrastructure)



Industry

(energy & infrastructure)

What

Timely development & int. standardisation of refuelling protocols & nozzels

Adopt the AFIR with H₂ infrastructure targets in a timely manner

Take joint decision on future hydrogen fuel options

Prepare for fuel supply technology upscaling & ramp-up (esp. LH₂)

Thank you for your attention!

Project lead and contact LBST:



Jan Zerhusen

Senior Project Manager

Jan.Zerhusen@LBST.de

Contact DLR:

Mathias Böhm

Research Associate

Mathias.Boehm@DLR.de

LBST · Ludwig-Bölkow-Systemtechnik GmbH

Daimlerstr. 15 · 85521 München/Ottobrunn · Germany

www.lbst.de

