



Developing a hydrogen infrastructure in China

Shanghai, 14th November 2018

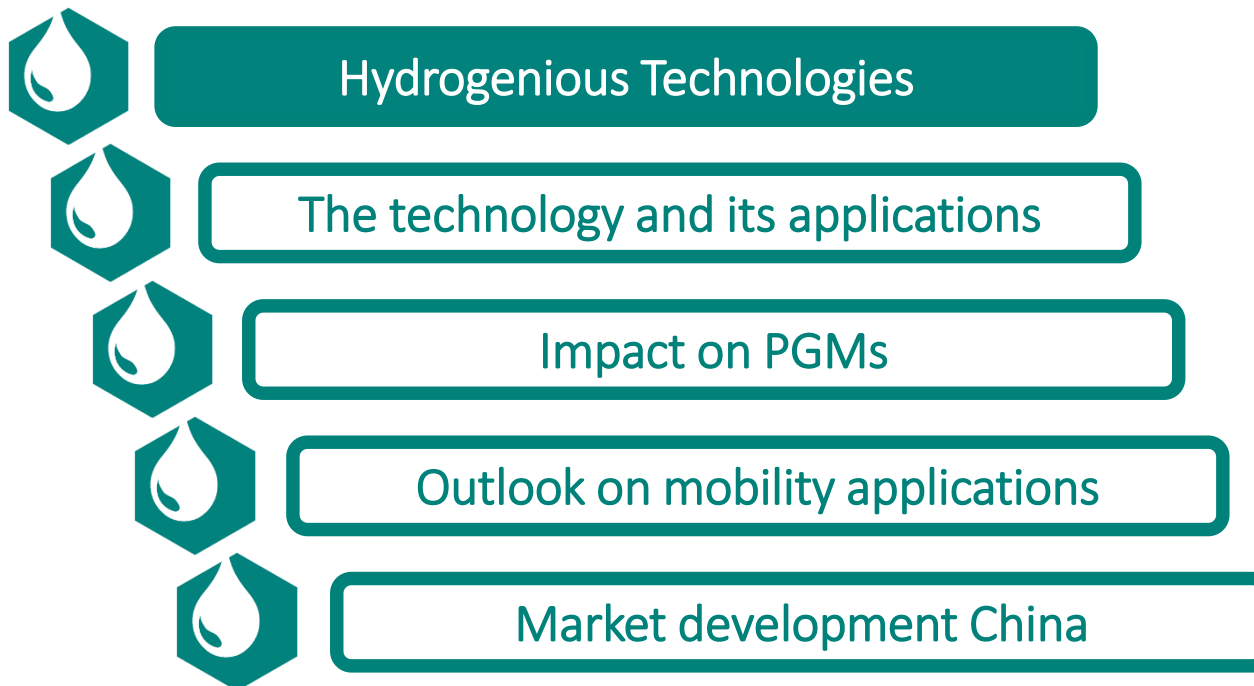


HYDROGENIOUS TECHNOLOGIES GmbH

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AGENDA



OUR VISION

We enable the breakthrough
of hydrogen technologies and
emission-free mobility

Hydrogenious Technologies GmbH – the pioneer in chemical hydrogen storage

- Founded in 2013 by Dr. Daniel Teichmann and Profs. Arlt, Schlücker and Wasserscheid
- Global technology leader for Liquid Organic Hydrogen Carriers (LOHC) – the revolution in hydrogen storage and transport
- Focus on commercialization of hydrogen storage and release systems for industrial and mobile applications
- Frequently awarded, e.g. with “German Innovation Award 2016”

Key Partners:



APVentures
ADVANCE & PIONEER

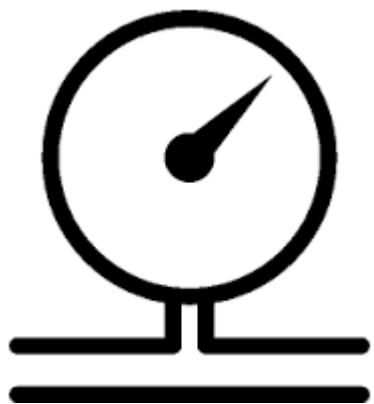


United Hydrogen
FUELING THE FUTURE



Today's hydrogen transport is designed for industry handling and is thus prohibitive for a public roll-out

Compressed (CGH₂)



160 – 700 bar

or



Cryogenic (LH₂)

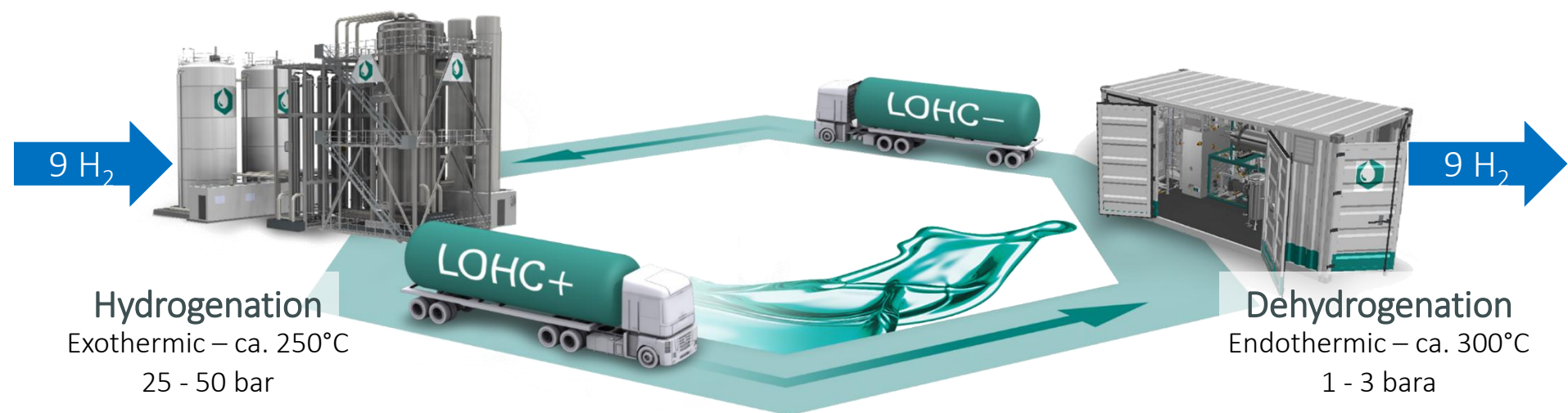


-253°C

- Low storage density
- High capex and maintenance costs
- Large safety zones

- Very high energy consumption
- Very high capex and maintenance costs
- Not suitable for longer-term storage
- Large safety zones

Liquid Organic Hydrogen Carrier (LOHC) enable a safe and efficient transport of hydrogen at ambient conditions



The LOHC technology eliminates the complexities of today's hydrogen handling by using a non-dangerous, non-toxic, non-explosive liquid carrier.

Our LOHC technology has significant advantages in performance and handling compared to competing technologies

CGH2 vs **LOHC**



57 kg



Our LOHC is...

Efficient

- 6.23 wt% storage density
- 57 kg H₂ / m³ LOHC

Safe

- Non-explosive
- Not classified as dangerous good (ADR, etc.)

Easy to handle

- Diesel-like liquid
- Ambient conditions

Low priced

- <4 €/kg
- Reusable

Hydrogenious provides disruptive solutions for hydrogen logistics and emission-free hydrogen mobility

Efficient and safe supply of industrial consumers and Hydrogen Refueling Stations with hydrogen

LOHC logistics



USP

- Low cost supply & bulk storage
- Existing infrastructure use
- Safety for public operations
- Ambient conditions

Focus

- Field demonstration of LOHC network operations
- Development of global footprint
- Commercialization through partnerships and own operations

Disruption of today's emission-free mobility concepts by on-board usage of a liquid fuel

On-board
LOHC-systems



USP

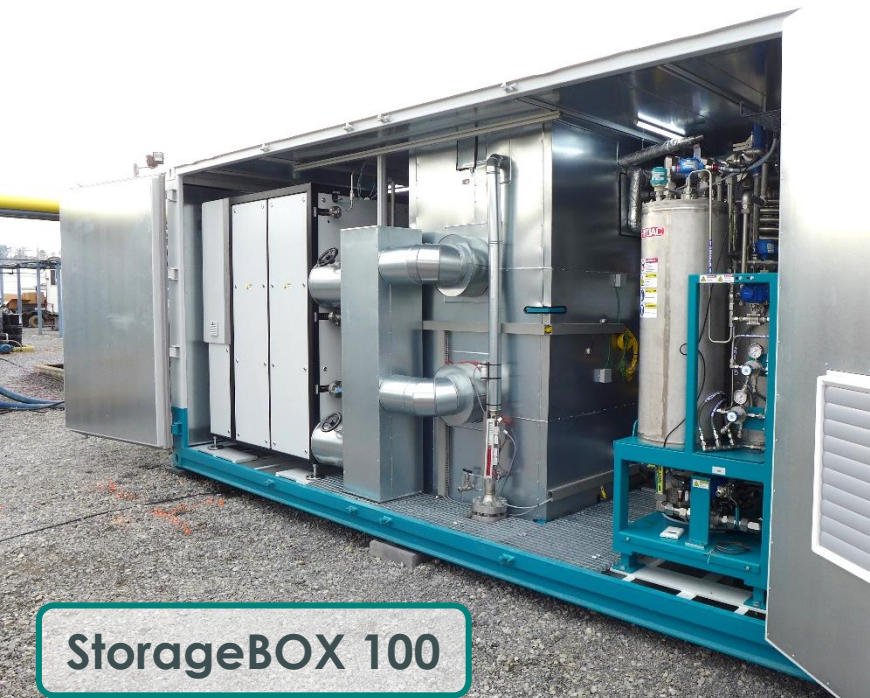
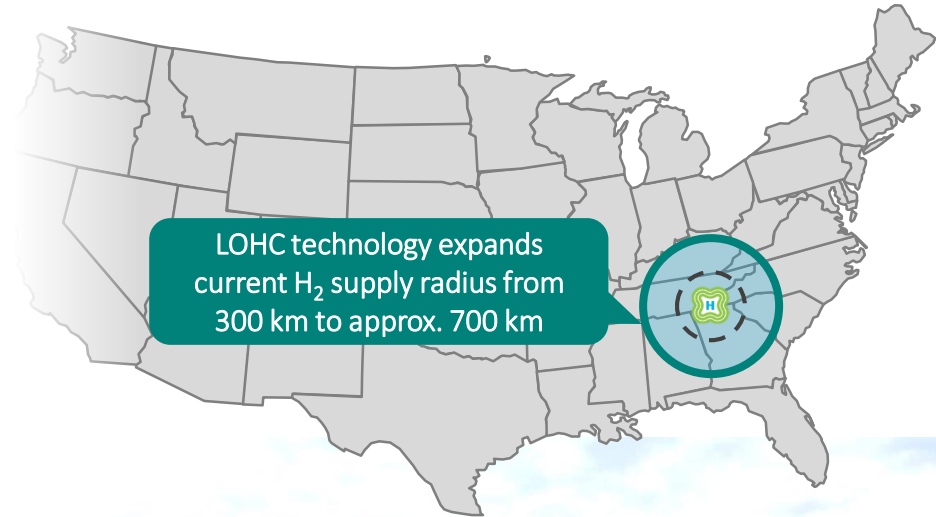
- Usage of liquid fuels
- Hydrogen-free on-board storage
- Low cost hydrogen supply

Focus

- Prove of Concept
- First "rolling" systems
- Development of partnerships

Latest commercial systems have been commissioned at United Hydrogen Group's site in Tennessee

- 2 systems commissioned at UHG site in Charleston (USA)
- Commercial test operations of hydrogen delivery to a power generator cooling application
- 3rd system to be delivered in 2019

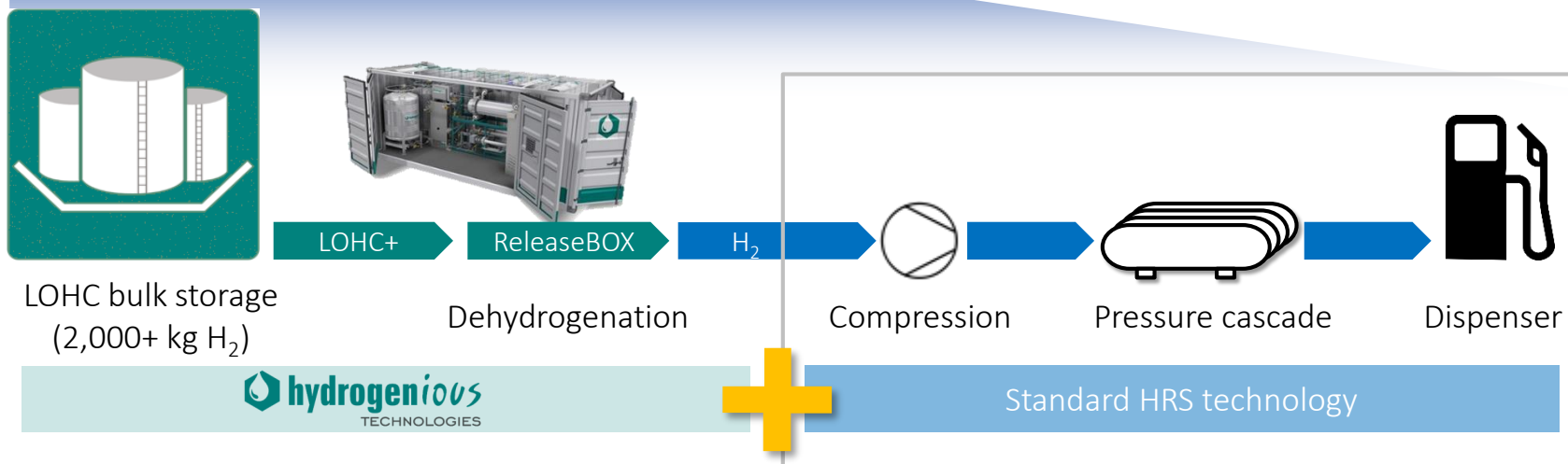


The LOHC technology offers significant advantages for large scale HRS – e.g. for bus, train or captive fleet supply

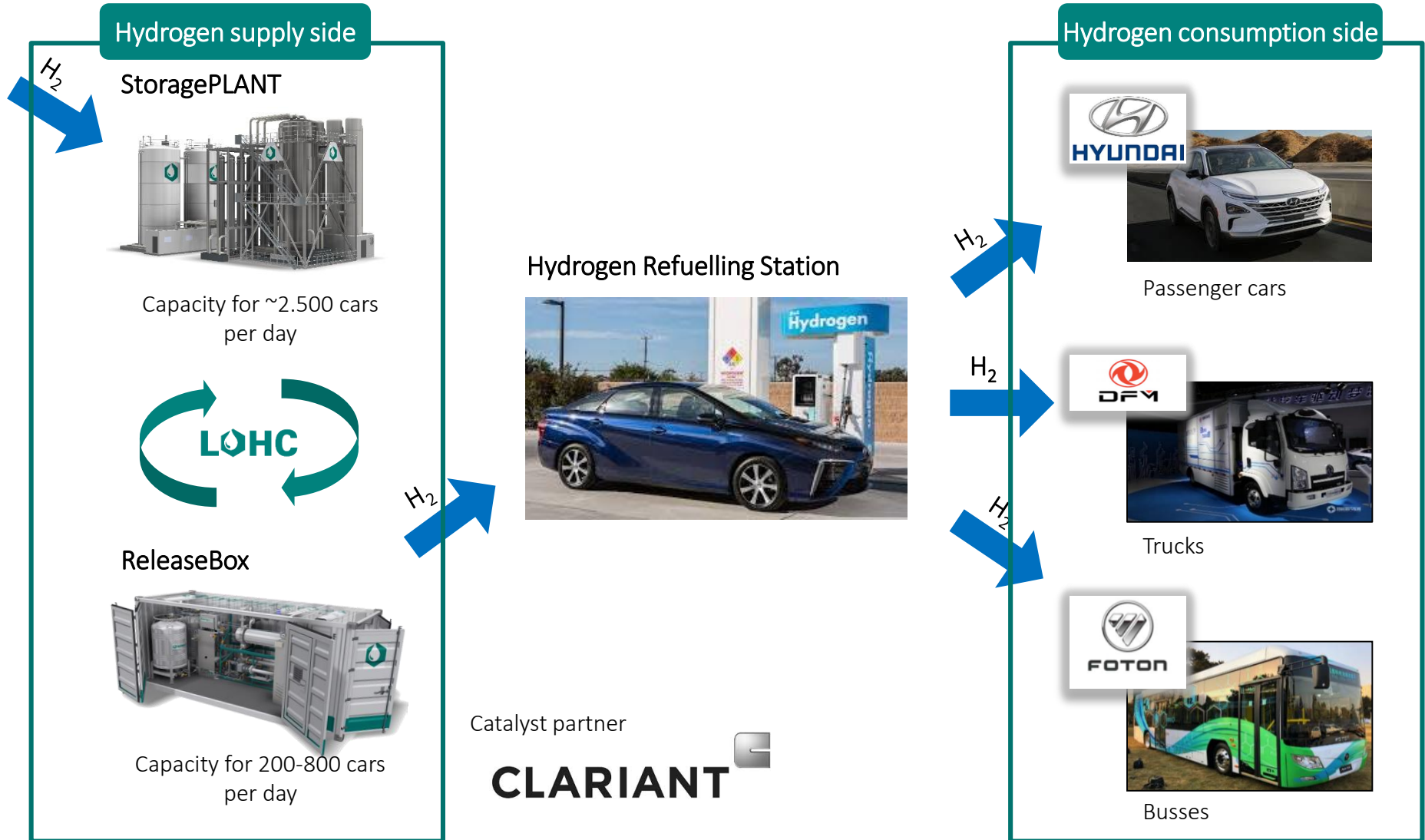


Advantages of LOHC

- ✓ Low delivery frequency to HRS
- ✓ Lowest cost for H₂ bulk storage
- ✓ No boil-off losses / discharge
- ✓ Safe handling
- ✓ Small footprint through underground storage
- ✓ Highest social acceptance through oil handling



Our LOHC technology is facilitated by PGMs, but it also acts as an enabler for PGM usage

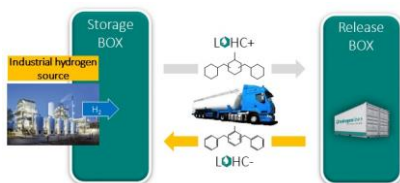


Hydrogenious will disrupt hydrogen handling and mobility in 3 consecutive steps

2017+

Step 1: Decreasing costs of industrial hydrogen

Handling of high storage density oil instead of explosive gas



USP

- Lowest cost delivery
- High safety
- Ambient conditions

Commercial field-testing on-going

2019+

Step 2: Supplying large-scale hydrogen refueling stations

Enabling commercial-scale hydrogen refueling stations



USP

- Low cost supply & bulk storage
- Existing infrastructure use
- Safety for public operations

Projects in Germany, Finland and China currently in execution

2025+

Step 3: On-board use of LOHC as fuel of the future

On-board power supply with Direct LOHC-FC



USP

- Return to liquid fuels
- Hydrogen free hydrogen economy
- Low cost hydrogen supply

Concept developed, currently intensification of activities

The direct usage of LOHC on mobile platforms will revolutionize emission-free electric mobility

Key benefits



High safety

No elemental hydrogen



Familiar fueling process

Use of a liquid as a fuel



Low fueling station OPEX

No high pressures and no low temperature



Low fueling station CAPEX

Use of existing liquid fueling technology

Target products



Public transportation bus



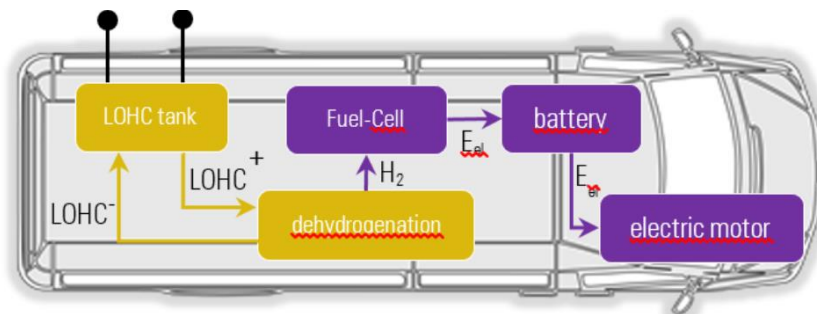
Heavy duty vehicle



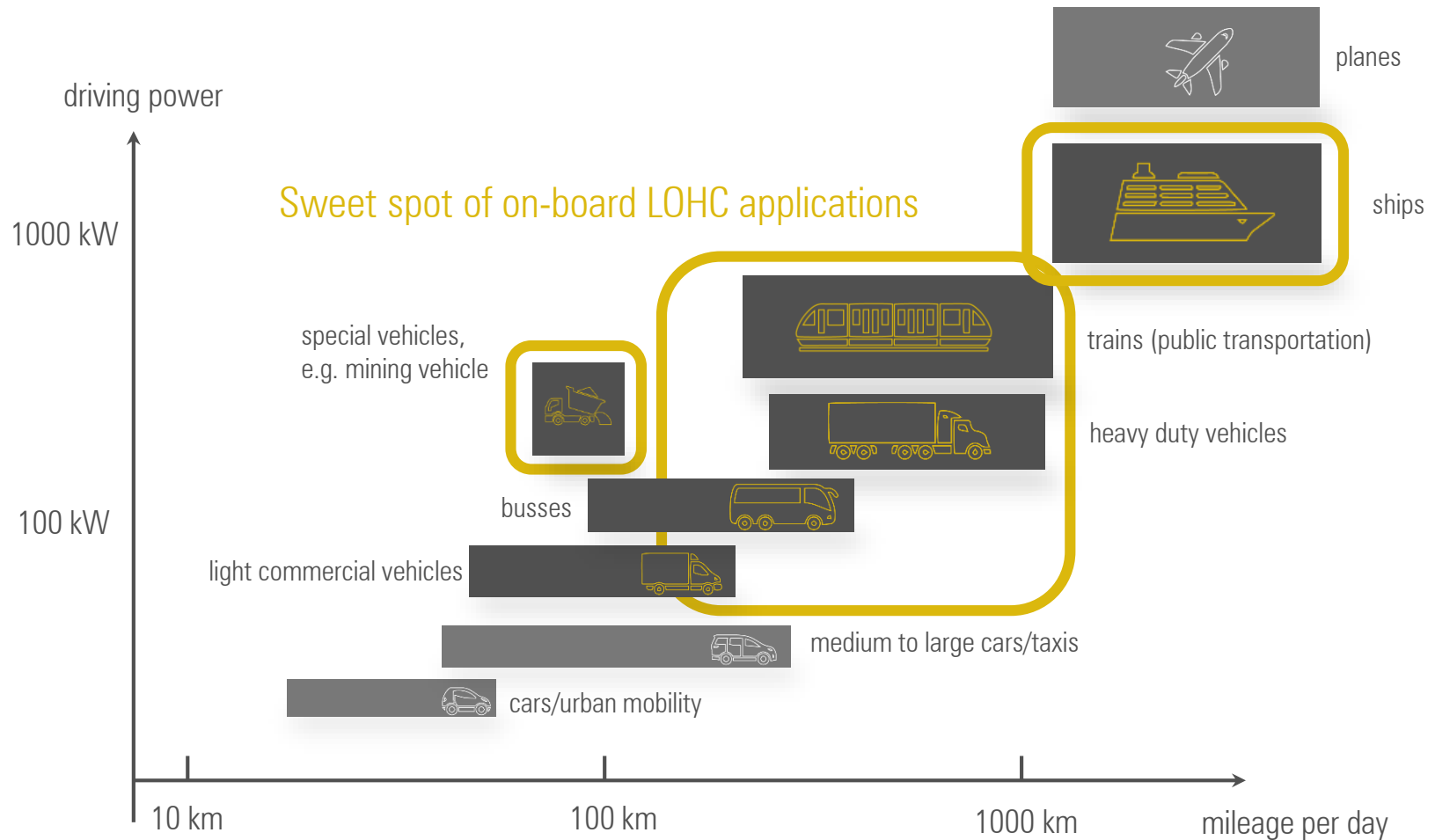
Public transportation train

Technical concept

(delivery van prototype)



LOHC is the perfect on-board fuel for mid- to large-sized vehicles enabling long ranges and high payload



Thank you for your interest!

CEO & Founder

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