



The new path to realize the future of e-mobility

NDE Germany Webinar
June 17 2020

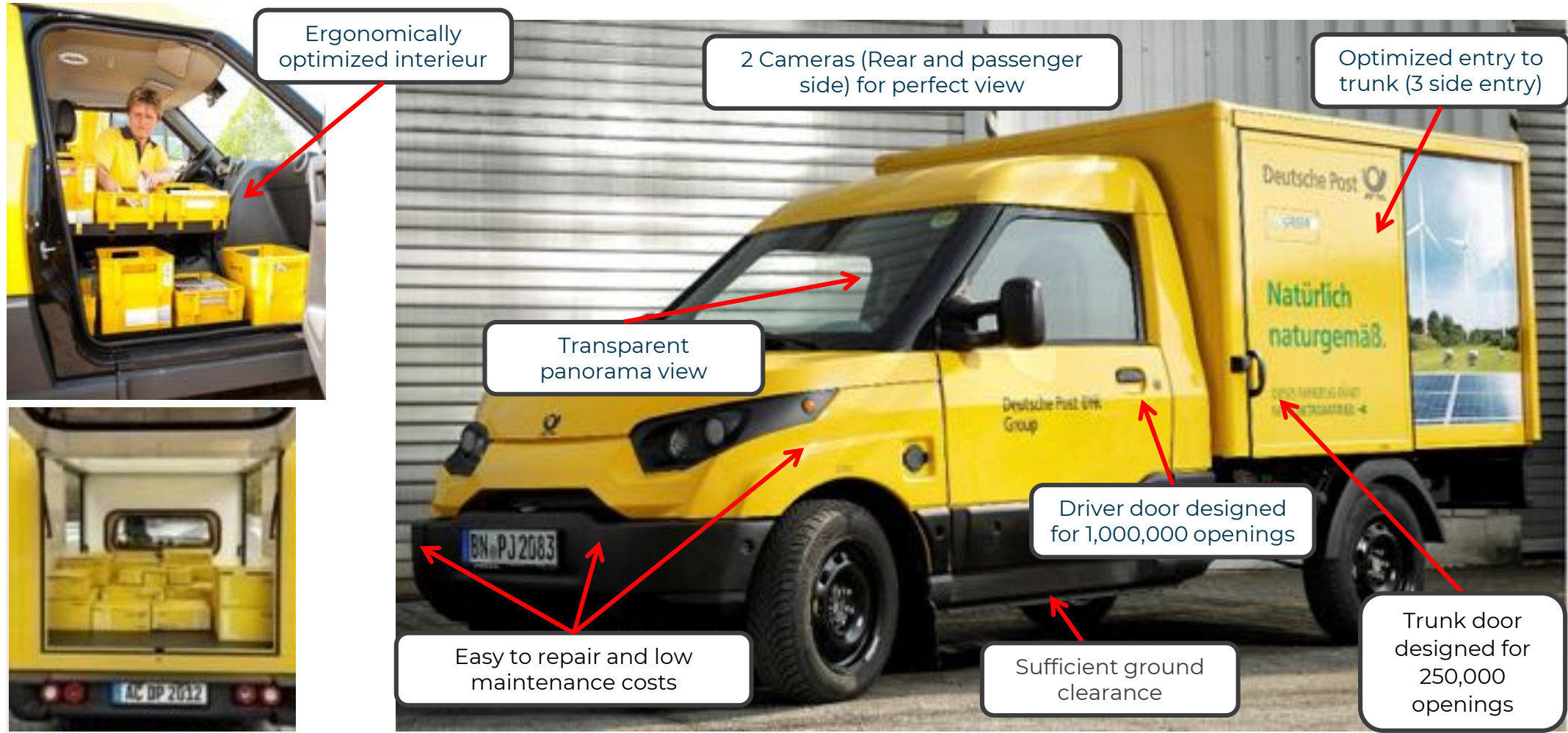
Structure

1. The StreetScooter Story

- 2. PEM Motion
- 3. PEM X



StreetScooter quickly became the perfect E-Post-Car



From idea to production in 3.5 years

2010: Foundation

2011: Presentation Compact Prototype

2012: Presentation WORK Prototype

2013: Testing und Pre-Series Production

2014: Pre-Series Field Test: nationwide 150 vehicles

2015: Start Series Production, since 12/2014 Deutsche Post DHL Group

2016: Significant increase production volume, new derivatives and models



And there is more than the vehicles: Integrated Logistics



Autonomous driving prototypes with automated delivery solutions



Charging technology and load management software



Battery system development and production



Pedelec bikes and trikes for last mile delivery



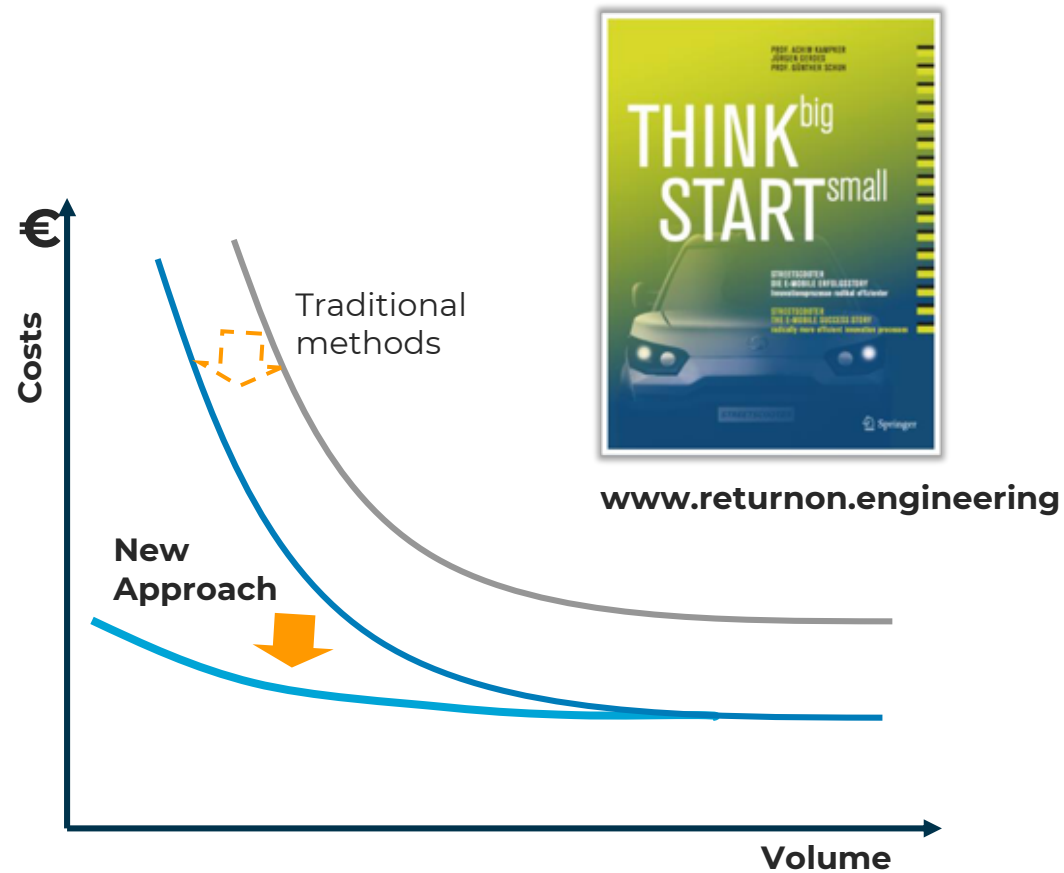
Retro-fit concept to extend lifetime to 16 years



Stationary battery and bi-directional charging



Outstanding achievement is the fast industrialization



Reduction of
industrialization efforts:
50% less time (T)
& 90% less investments (I)

$$\text{RETURN ON ENGINEERING} = T/2 + I/10$$



The results of the StreetScooter success story



- + Over 12,000 StreetScooter are currently in use at DHL and at third party customers
- + More than 11,000 installed charging stations
- + Only the DHL fleet has over 100,000,000 km driven and 37,000 t CO₂ saved
- + StreetScooter is on the road in more than 6 countries, including right-hand drive countries
- + Realization of more than 700 electrified depots



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PEM Motion offers engineering & consulting solutions

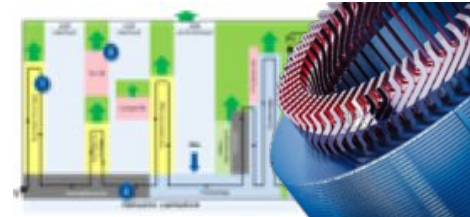


Facts about PEM Motion

- + > 100 employees with 60% engineers
- + 8 Locations in Germany and North America
- + 8.8 m€ revenue PEM Motion Group in 2019
- + 41% CAGR since foundation in 2014
- + > 150 PEM Motion customers with 2/3 established companies and 1/3 young start-ups

Overview PEM Motion

- + PEM Motion is an engineering service provider with consulting and development solutions focusing on batteries, fuel cells and electric motors as well as the industrialization of mobility products.



Consulting



Digital Drive



Engineering



Validation



PEM Motion is realizing the future of mobility



Your advantage working with PEM Motion



Proven success stories with our approach “Return on Engineering”



Combining deep knowledge in future mobility and practical skills



Bridging the gap between engineering and consulting

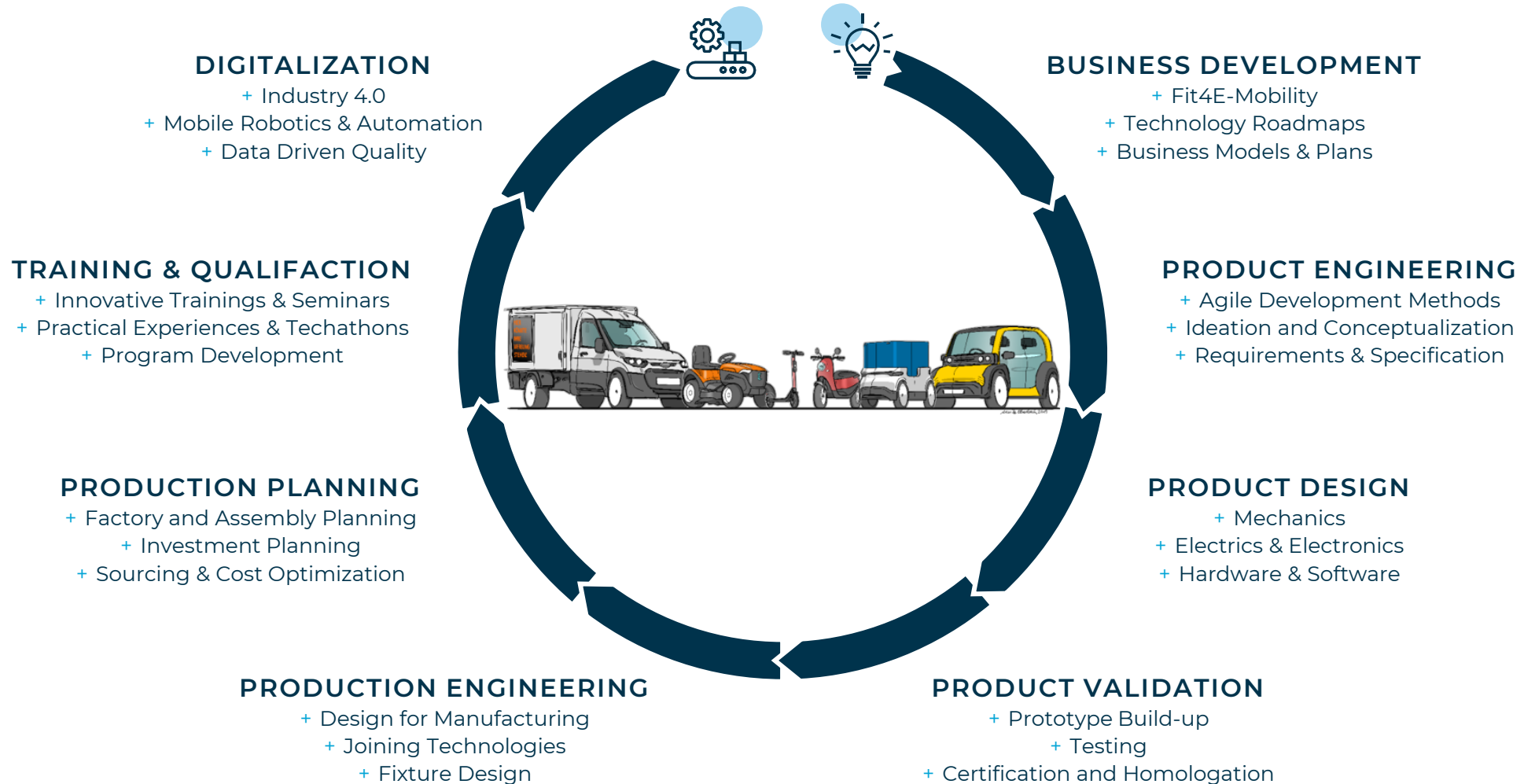


A strong network in research, manufacturing and within PEM X spin-offs



Customized product development & consulting services

TURNING IDEAS INTO TOMORROW'S MOBILITY SOLUTION



Solutions and manufacturing offered by PEM Motion

Solutions



PEM Start-Up
Workshops



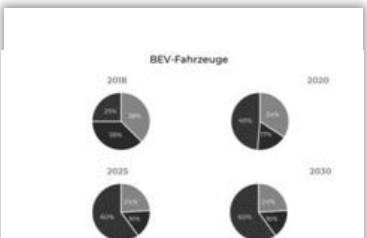
PEM Re-X
Audit



PEM
Academy



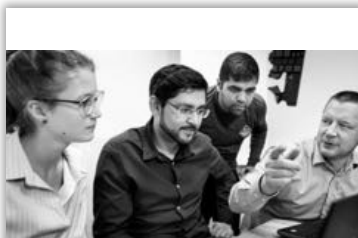
PEM
Box



PEM
Database



PEM Chassis
Lightweight
Vehicles



PEM Testdesign
EV Life Cycle



PEM E-Truck
Retrofit

Manufacturing



- + Production of prototypes and pre-series volumes
- + Broad range of production technologies available
- + Extensive testing equipment for components and vehicles



Locations in 8 cities in Germany and North America



Köln



Frankfurt



Stuttgart



Berlin



Aachen



Monterrey, Mexico



San Luis Potosi, Mexico



Sacramento, California



Structure

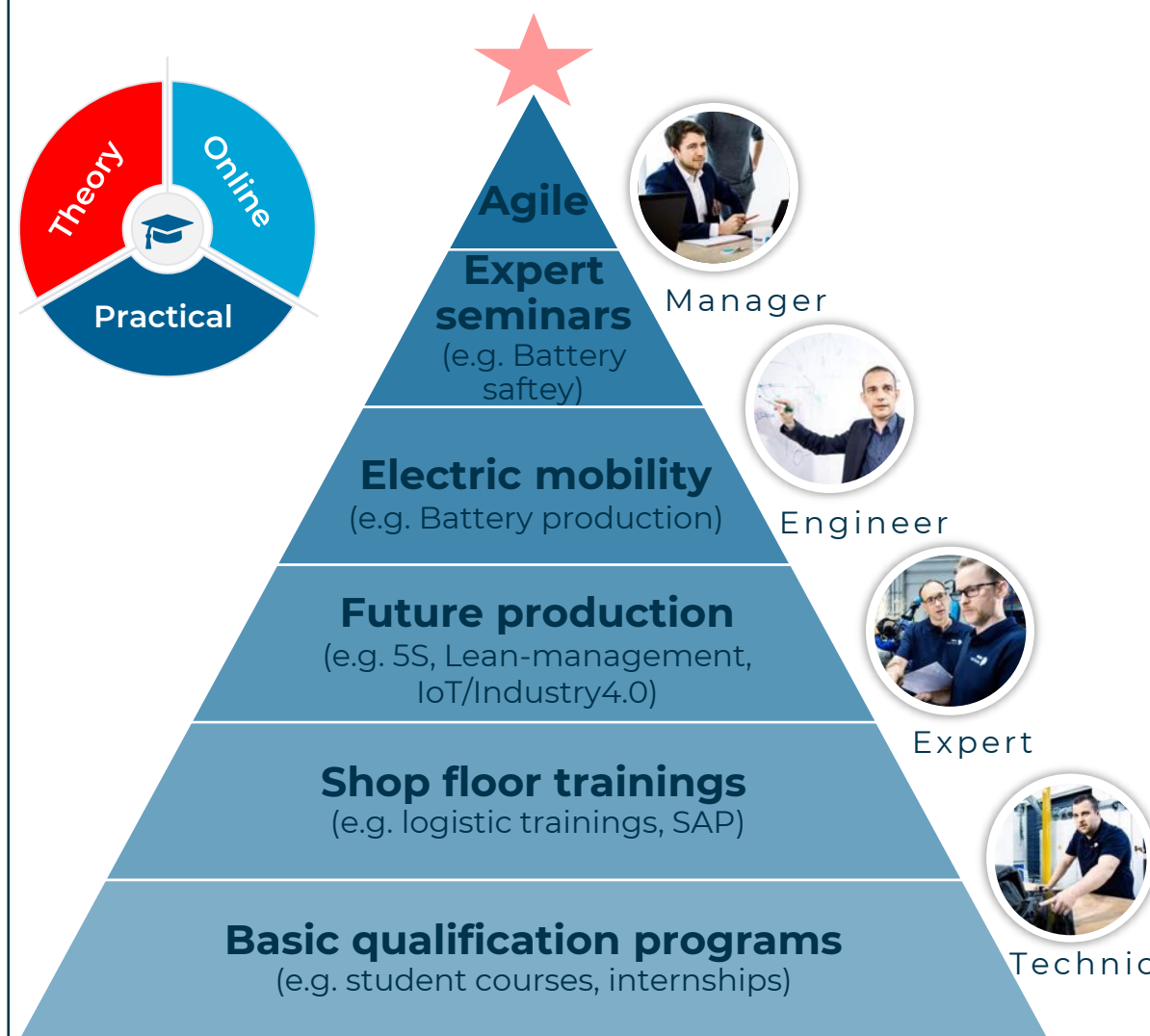
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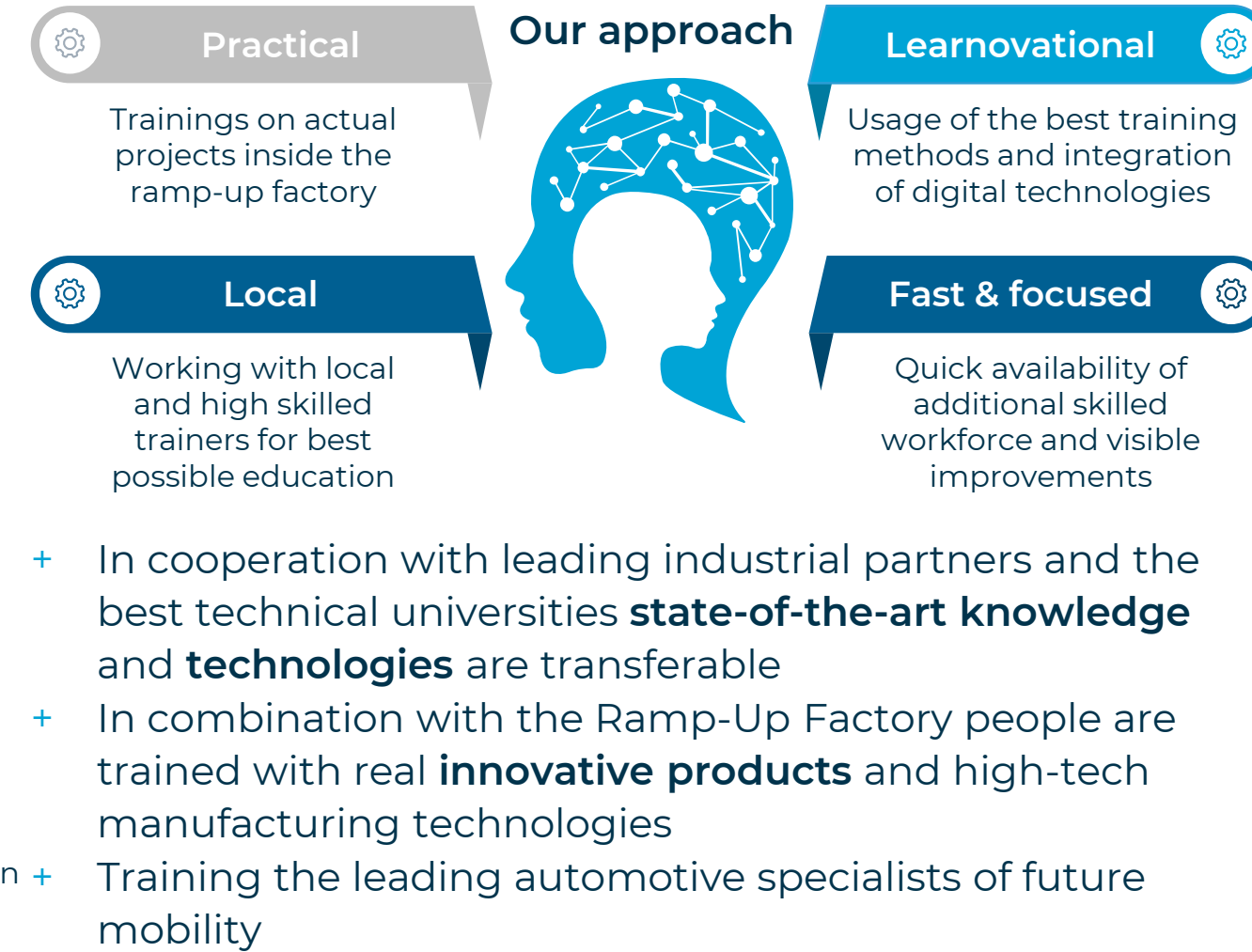
3. PEM X



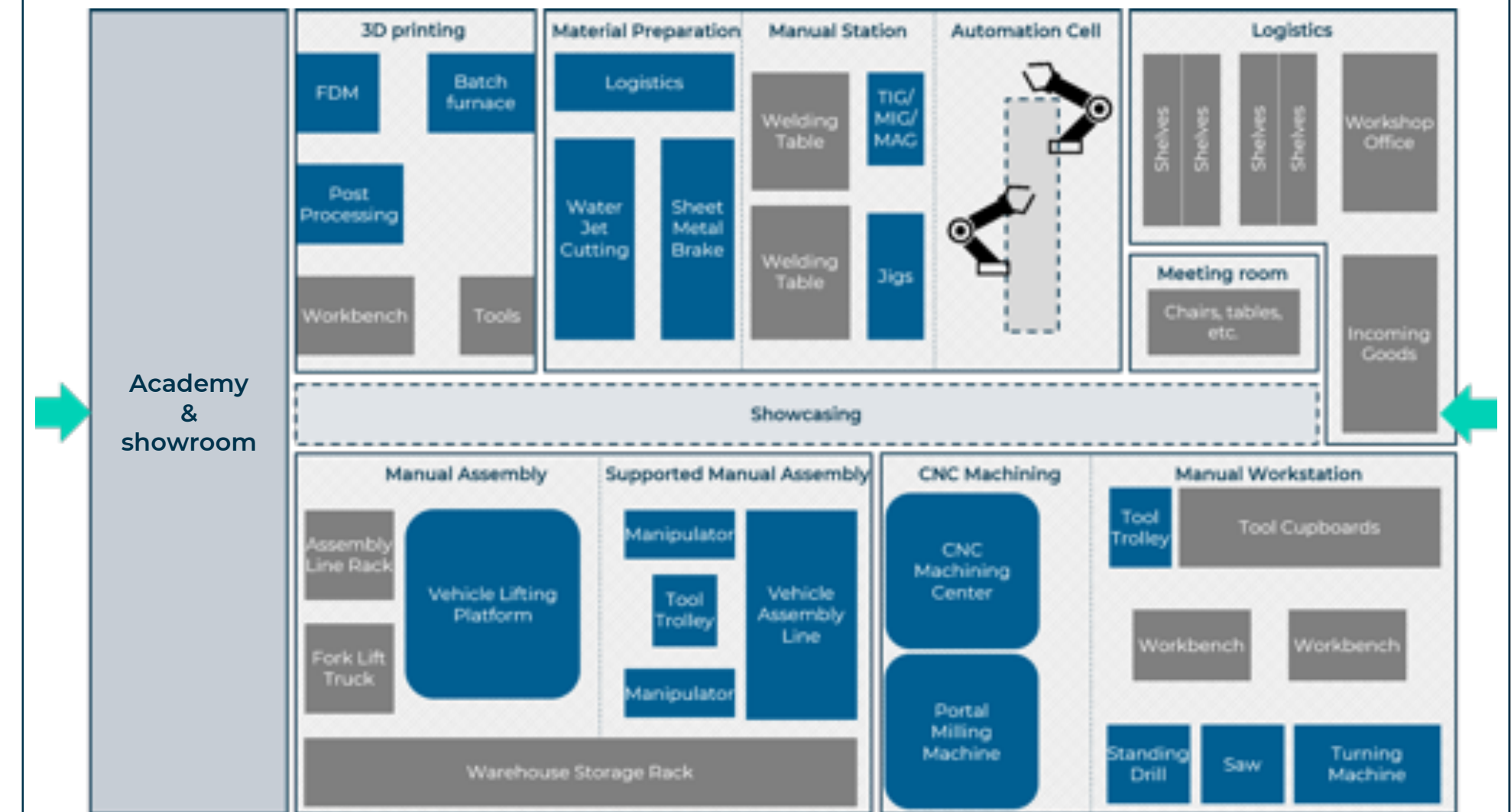
Exclusive program overview



Training Academy



Industrial Innovation Center

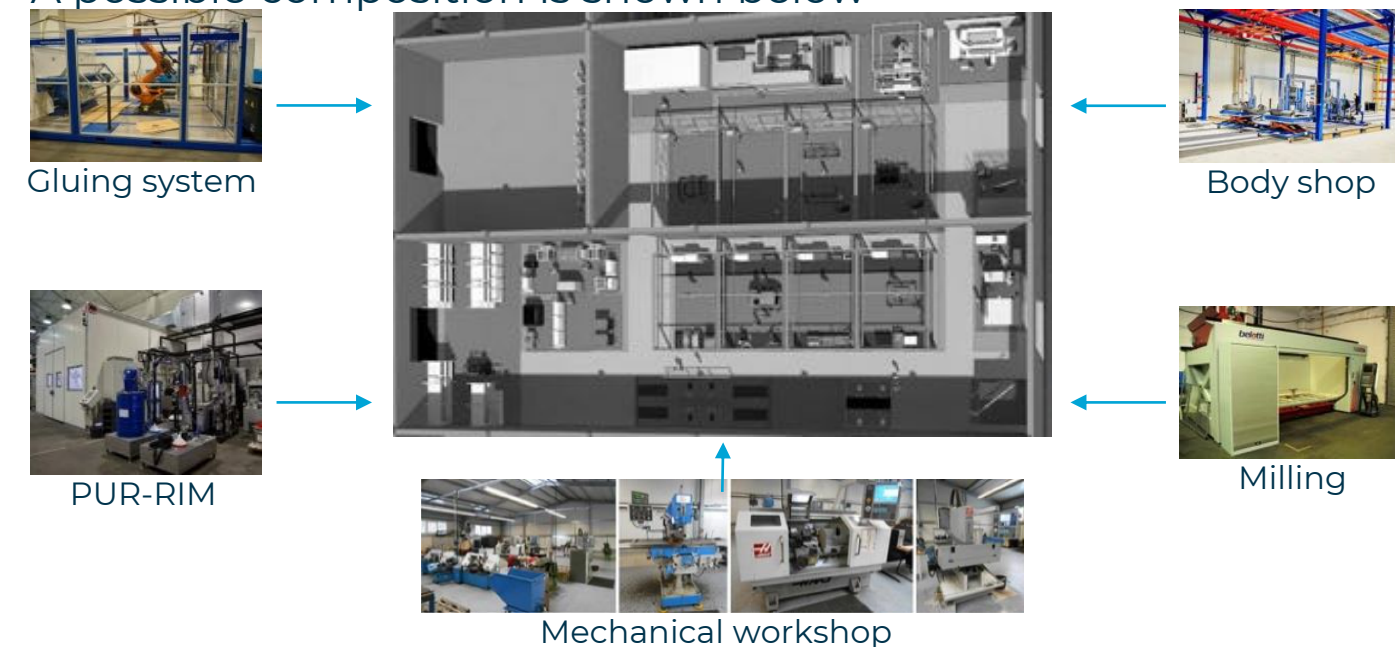


Possible layout for an innovation center

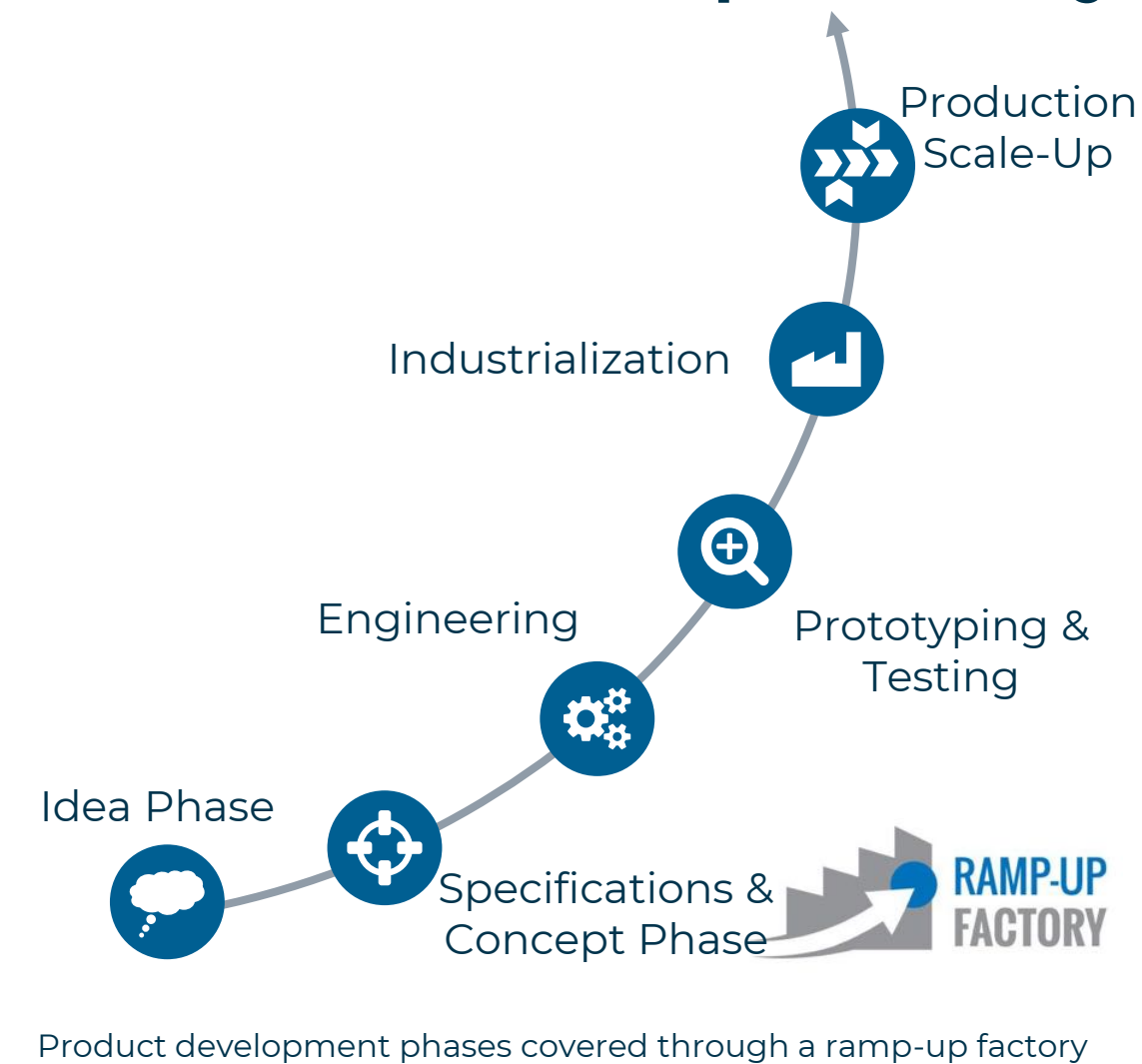
Concept

- + All crucial production steps can be addressed with the required machinery and tools in **one facility**
- + Prototyping & testing of pre-series
- + **Small series tool production** & individual 3D-printing solutions
- + Integrated **product & process development** with real demonstrators

A possible composition is shown below



Ram-Up Factory



- + The main part of a combined solution includes a **complete infrastructure** for the production of single components up to full prototypes and small series including logistics, mechanical workshop, body shop, paint shop, assembly, powertrain, plastic components and end-of-line testing areas
- + The merging of the Training Academy and the Ramp-Up Factory into an **Industrial Innovation Center** offers a variety of cooperative and competitive advantages for SME's
 - Enabling companies access to an infrastructure to create their own prototypes and test the ramp-up with **low-risk investments**
 - Train **human capital** and offer specialized services in the field of future mobility
 - Offer **I4.0 related technologies** as IoT, additive manufacturing, prototyping, etc.
 - Develop an agile, innovative, leading **local supplier network** for mobility solution



PEM X is integrating various companies to “Future Logistic”



UZE Mobility – The Open Innovation Platform



- + UZE digitizes mobility with a new approach. UZE develops digital business cases in order to collect data or to generate additional revenue streams.
- + With this approach, UZE develops revenue opportunities that enable to reduce fleet costs by multiple business cases around the one-dimensional approach of vehicle use.
- + The first (UZE) Case is UZE ADS, which UZE has developed and is currently testing in the market environment.
 - + UZE ADS: Local digital advertising on Streetscooter vehicles (small series on public road in Germany 8/2019)
 - + UZE ADS KIT: Local digital advertising on MB Sprinter (Generation 1 Prototype finalisation 10/2019)
- + Partner: PEM Motion, Peper&Söhne LUEG, BPW, Nehlsen
- + UZE is looking for an investment of 2 Mio. € to increase sales activity and continue with the proof of concept in two German cities



Image source: UZE

<https://uze-mobility.com/en>



Velocity – Station Based Bicycle Sharing



- + Velocity is developer, owner and operator of B2B and B2C e-bike sharing networks:
- + Automatic charging of the bicycle batteries
- + In-house hardware and software development
- + Access via smartcard and app
- + Our team of 25 employees is working on our vision to make cities better places to work and live
- + More than 170.000 ebike rentals, operating in four cities
- + Current investment round (1 m€) will be used to increase sales activity to grow in more cities

<https://velocitymobility.com/>



Image source: Velocity

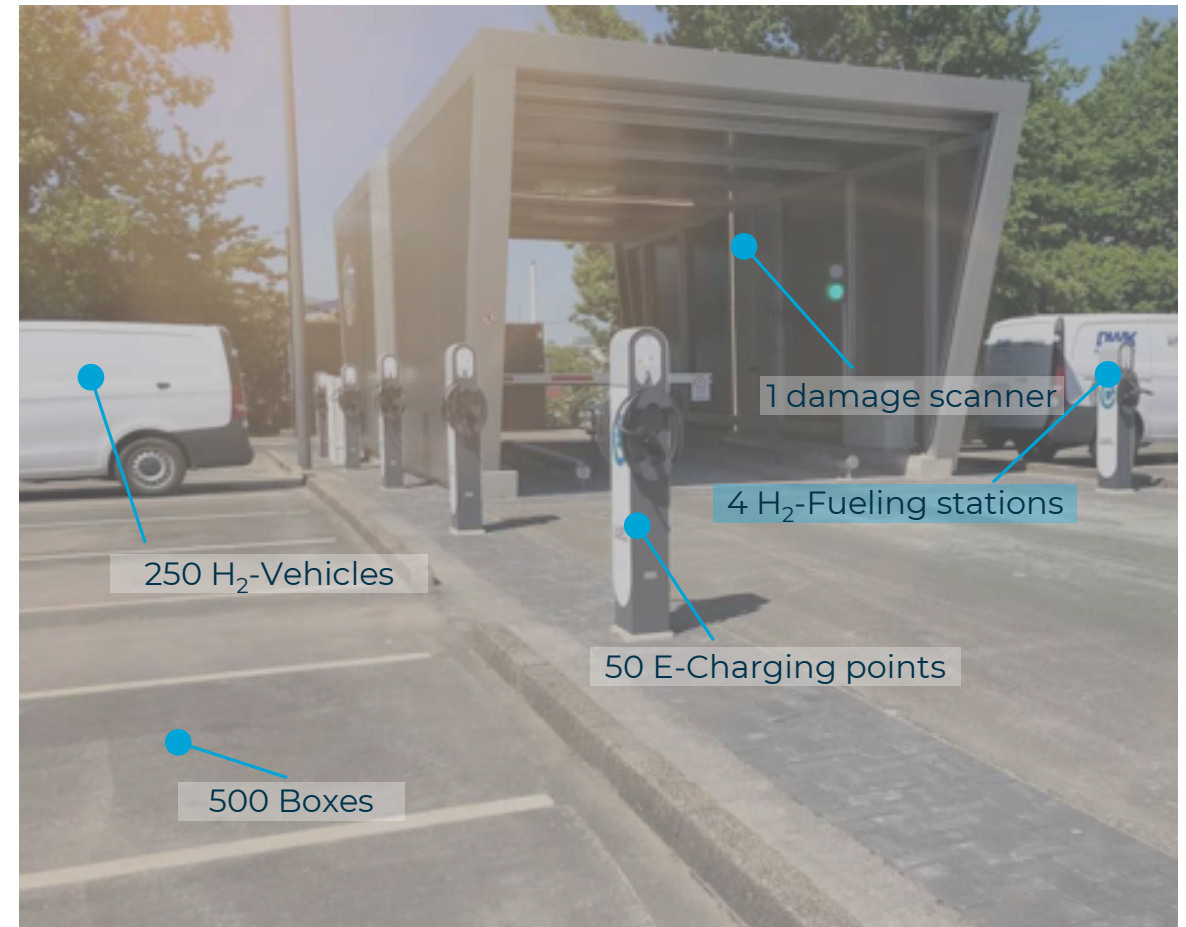


AE – Alternative Energy Driven Solutions



- + AEDS sees itself as a supplier of hydrogen mobility with value proposition based on two pillars:
- + As a product company, AEDS develops and produces fuel cell systems for modular powertrains for medium and heavy duty commercial vehicles
- + As general contractor, AEDS equips base camps with the associated infrastructure, in particular mobile hydrogen filling stations and thus creates its own market for hydrogen applications
- + Start-Up Phase requires 5 Mio.€ invest to scale up fuel cell assembly line, build first city camp and equip vehicles with fuel cells

<http://alternative-energy.solutions/>



India Goes Electric With Battery-Swapping Rickshaws

Because even an electric autorickshaw can be out of reach for many, SUN Mobility is trying a different tack to clean up India's air.





Ducktrain: Logistic infrastructure-as-a-service



- + Ducktrain business model is to offer infrastructure-as-a-service for logistic companies (DHL, UPS, ...) in urban environments. Starting with the Ducktrain vehicle system.
- + Ducktrain is a semi-automated lightweight trailer, which can follow any objects without physical connection. To be used in platoons for city supply and as single vehicle for final door-delivery.
- + Driveable prototype under finalization (06/2020), first test on public road in Germany starting 08/2020.
- + 1 m€ round currently ongoing (1 ticket available).
- + See videos: ducktrain.io/gallery.html



Image source: Ducktrain

<https://ducktrain.io/>



