



GLOBAL TRANSPORT DEVELOPMENT CHALLENGES



100-YEAR ANNIVERSARY INTERNATIONAL CONFERENCE
OF SJSC "LATVIJAS DZELZCEĻŠ" (LATVIAN RAILWAY)

Mobility of the Future

Wolfram Schwab

Latvia 12th Sept. 2019



ALSTOM

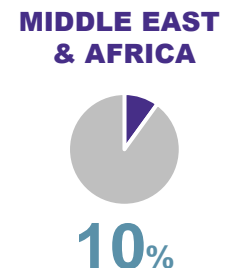
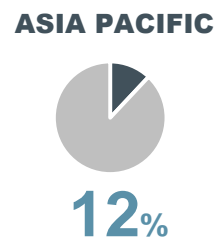
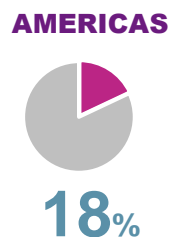
2018/19, an exceptional commercial momentum

ACTIVITY (% of sales)



€8.1
BILLION
SALES

ORDERS (% per region)



€12.1
BILLION
ORDERS

7.1%

OPERATING MARGIN*

€2.3

**BILLION
NET CASH**

*All figures at 31 March 2019
* Adjusted EBIT margin*

A diverse and innovative portfolio of solutions



ROLLING STOCK

- High Speed & Very High Speed
- Suburban & regional trains
- Metros
- Tramways
- Locomotives
- Bus



SERVICES

- Maintenance Modernization
- Parts & Repairs
- Support services



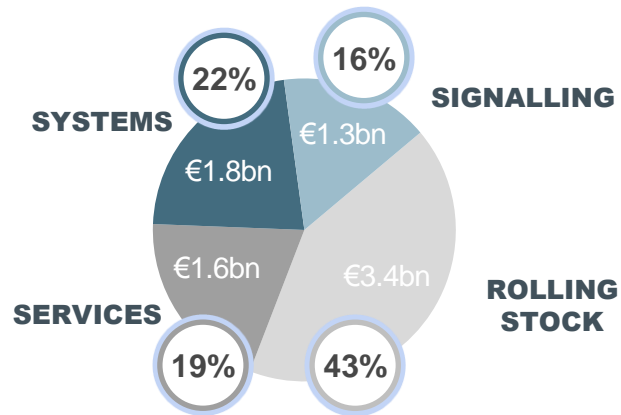
SYSTEMS

- Infrastructure
- Integrated solutions



SIGNALLING

- Mainline networks
- Urban networks
- Network and passenger monitoring and surveillance systems



Alstom Sales 19/20

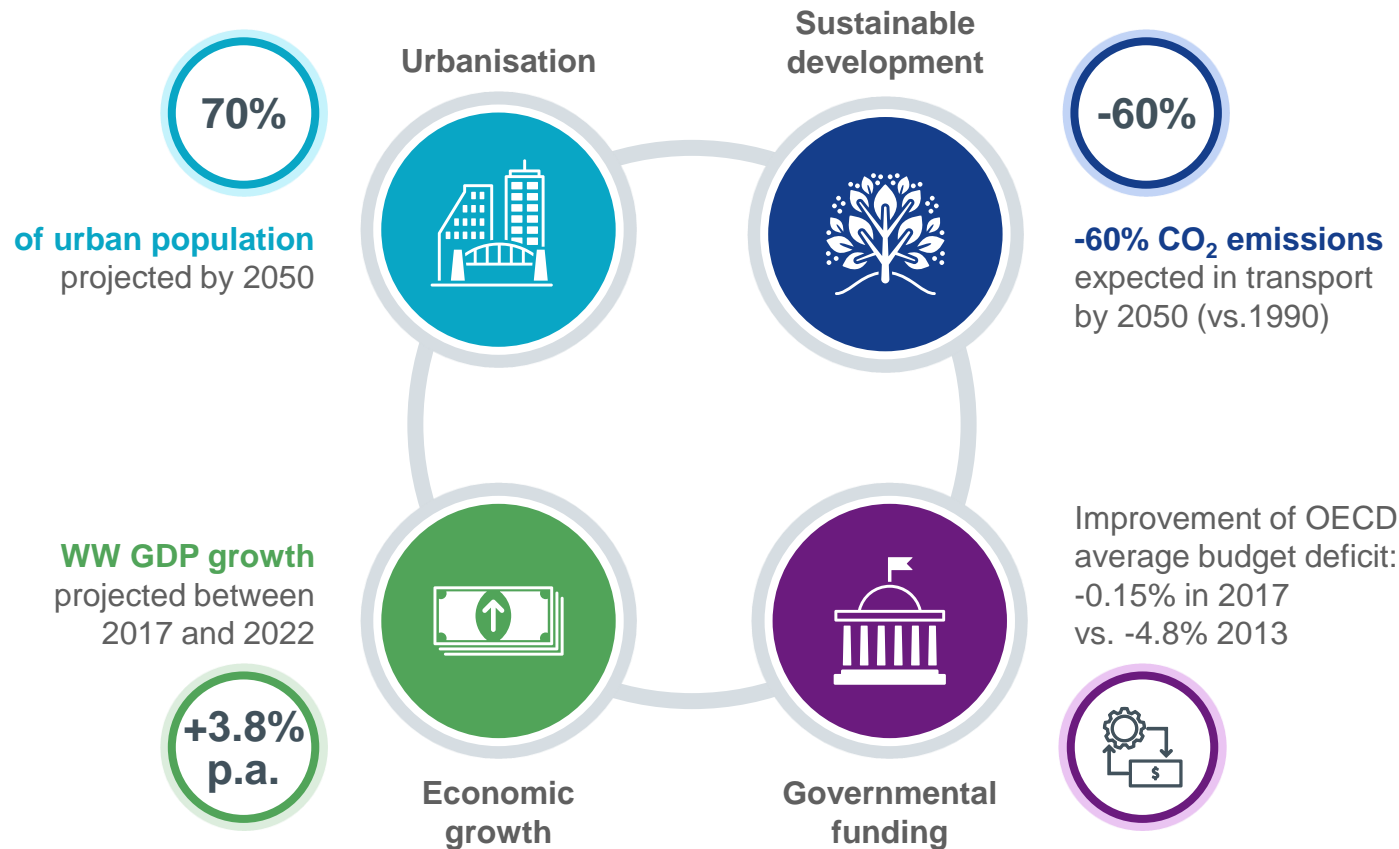
New platforms and breakthrough innovations in all product lines

Tramway Citadis XO5 Alu	Regional Coradia Stream	Regional Coradia iLint
E-Bus Aptis	High-speed Avelia Liberty - Amtrak TGV du futur	Locomotive Prima H3
Systems Montreal (REM)	Infrastructure SRS	Services Health Hub

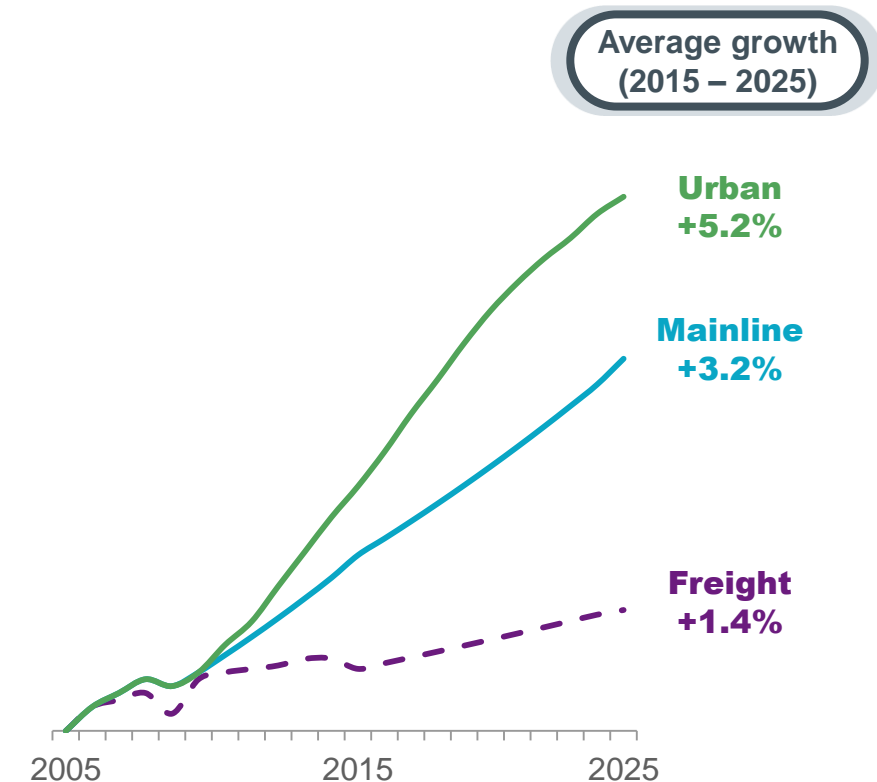
4%-5%
SALES

Constant R&D investments
2015/16 – 2018/19

Robust macro-economic drivers supporting the steady growth of rail traffic



Passenger traffic per market segment In basis 100








Sources: Statista, United Nations, OECD, 2011 EU White Paper, UIC & CER Rail transport and Environment Facts & Figures report, BCG analysis
Note: Urban traffic figures are for Top 30 cities worldwide; Mainline & Freight traffic figures are for all major national operators worldwide

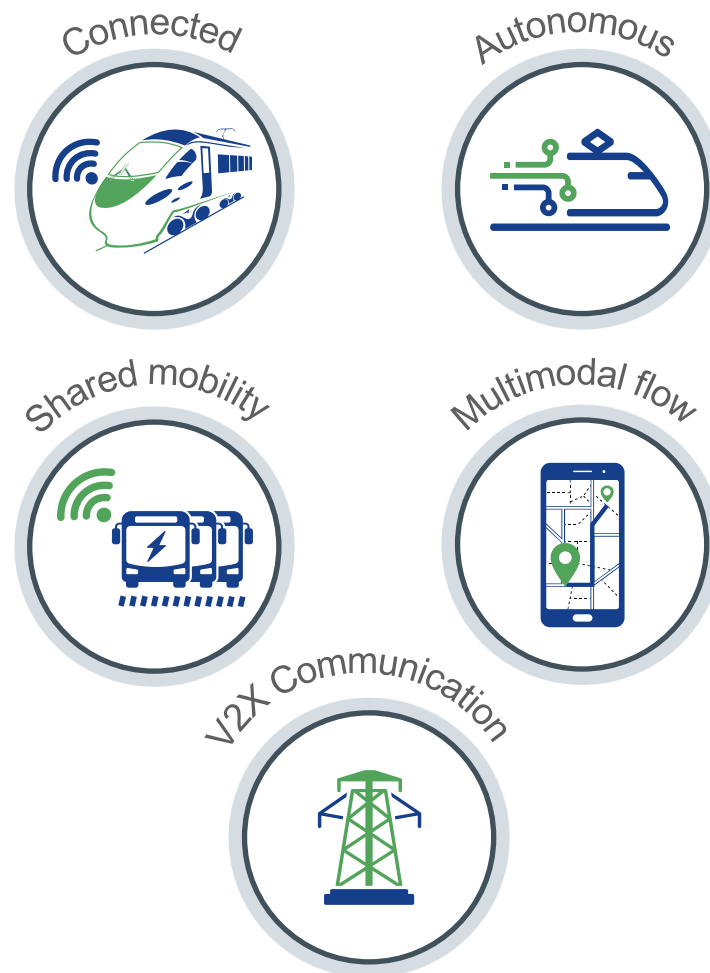
Data: Rail transport markets – global market trends 2016–2025 - SCI Verkehr multi client studies 2017

Digital revolution carrying changes in our industry

New digital technologies...

-  Big data
-  Advanced analytics
-  Cloud
-  Sensors
-  IoT
-  Network & Telecom
-  Artificial intelligence

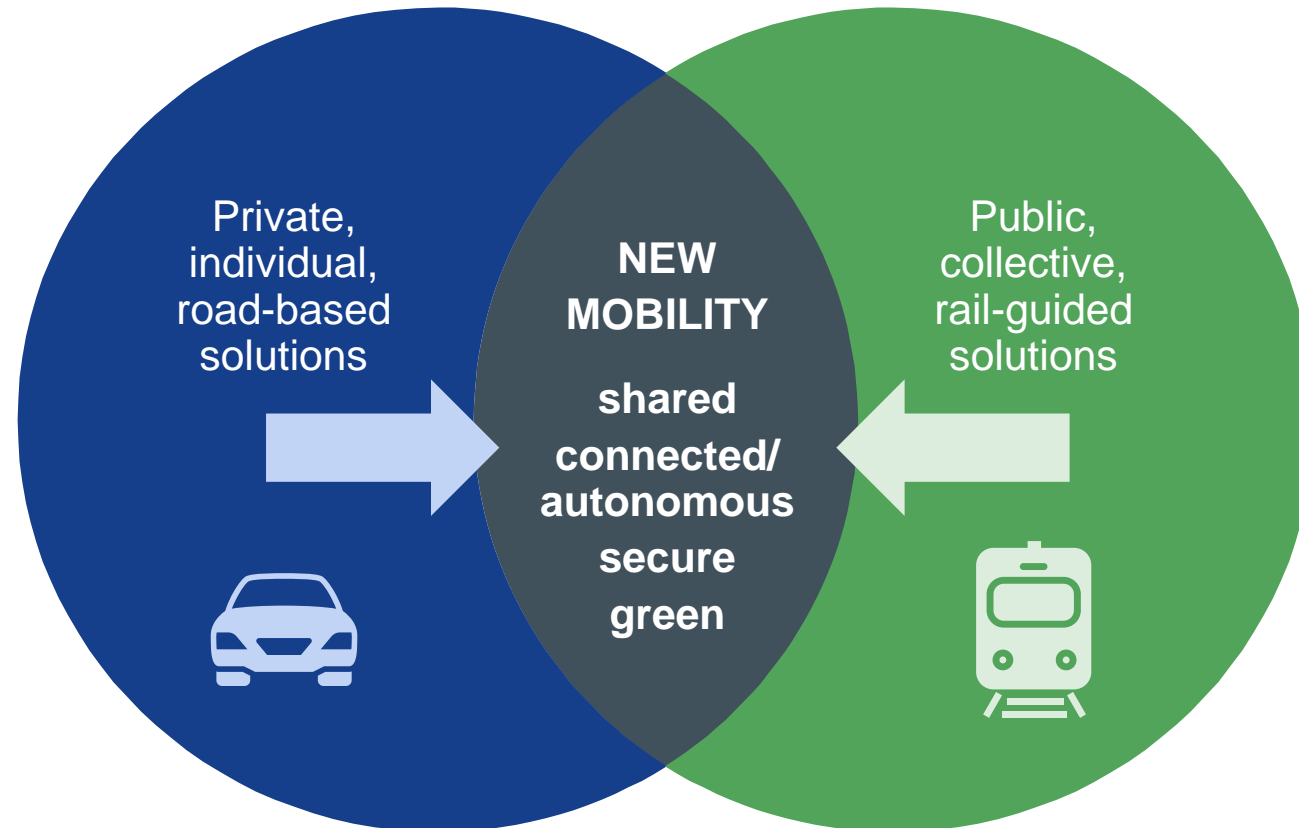
...Enabling new mobility solutions...



... And impacting the rail value chain

- **Data:** new gold for all players
- Value in **complex algorithms** for maintenance, operations or customer facing services
- **Cybersecurity** as a key concern
- **Multimodality, mobility as a service and sharing economy** blurring the frontier between different ground transportation modes

Looking further afield: convergence of rail-guided mobility and the world of private individual vehicles



THE RAIL INDUSTRY IS ALREADY:

- High safety compliant
- Already 50% electrified, and soon hydrogen or battery powered
- Autonomous technology existing (metros)
- Evolving in complex systems (infrastructure + vehicle)

ALSTOM GEARED FOR THE FUTURE MOBILITY LANDSCAPE

With new mobility requirements approaching rail requirements while rail is resilient and will remain the backbone of mass transit

Growing environmental concerns while rapid advancement of green technologies

Multiplication of "diesel ban"



- XX Ban of diesel cars
- XX Ban of all internal-combustion cars
- XX Ban of sales of new ICE cars, use of existing cars allowed
- XX Objective to run on 100% renewable energy

Continued investment in hydrogen

Hydrogen Council: ~\$10bn investment (2017)



H2 mobility Germany:

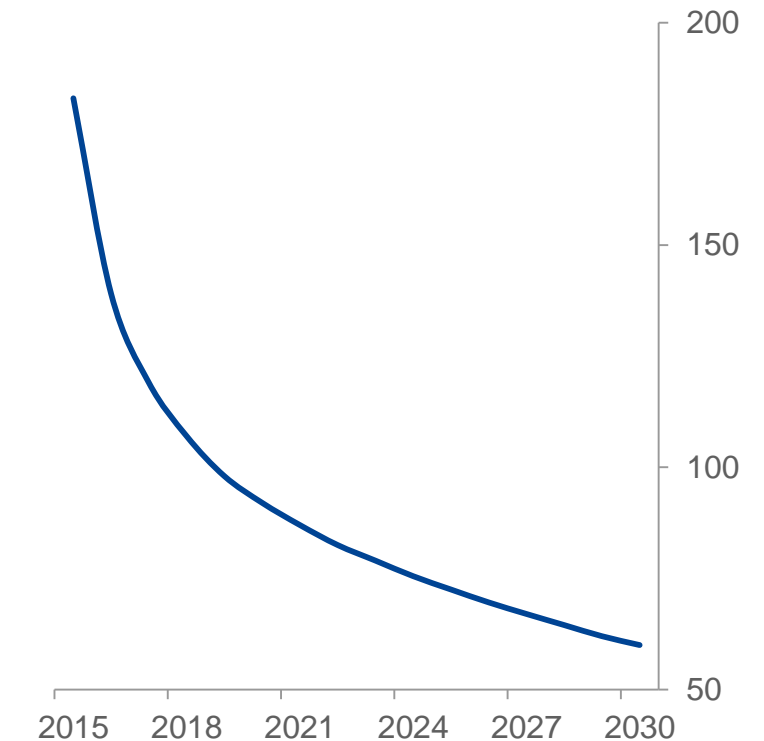
~€350m investment (2015)

Build up to 400 hydrogen refuelling stations by 2023



Increased availability of green technologies

Li-ion battery cell cost development, USD/kWh; 2016 - 2030



Clear political objective: drastic reduction of CO2 Our railway sector contributes!

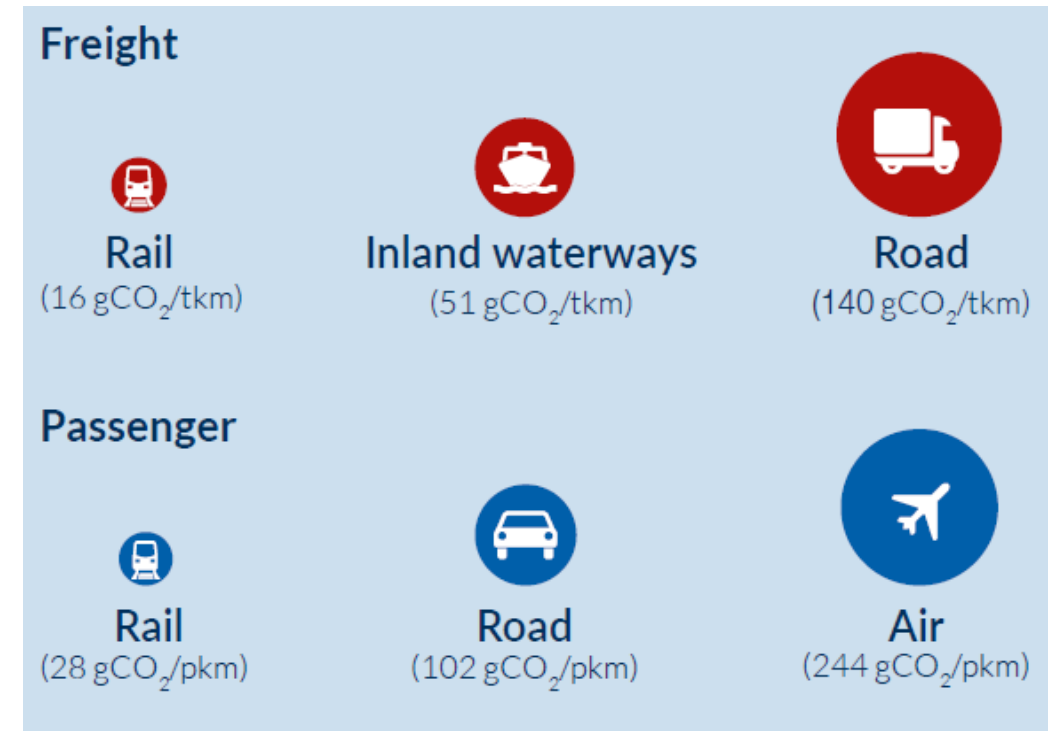


COP24 · KATOWICE 2018
UNITED NATIONS CLIMATE CHANGE CONFERENCE

The head of the Paris Conference, France's foreign minister Laurent Fabius, said this "ambitious and balanced" plan is a "historic turning point" in the goal of reducing global warming

The role of rail

- The least polluting means of moving people and goods in large quantities
- Responsible for 1.9% of final energy demand and 4.2% of CO₂ emissions of the transport sector*
- Transported 6.3% of global passengers (*passenger-km*) and 6.9% of global freight (*tonne-km*) in 2015 *



* Source: EEA 2017

Backbone of low carbon motorised transport for cities and regions

Alstom's contribution



Coradia iLINT

Key drivers for public transport

- **Environmental needs**
- **New regulations**
- **New technology**
- **Economical solutions**
- **Sustainable public transport**



7 AFFORDABLE AND
CLEAN ENERGY



11 SUSTAINABLE CITIES
AND COMMUNITIES



It's all about energy and weight

Energy density(in MJ/kg)

Coal



34 MJ/kg



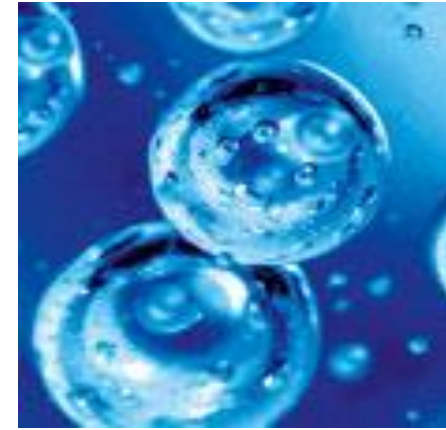
Diesel



43 MJ/kg



Hydrogen



120 MJ/kg

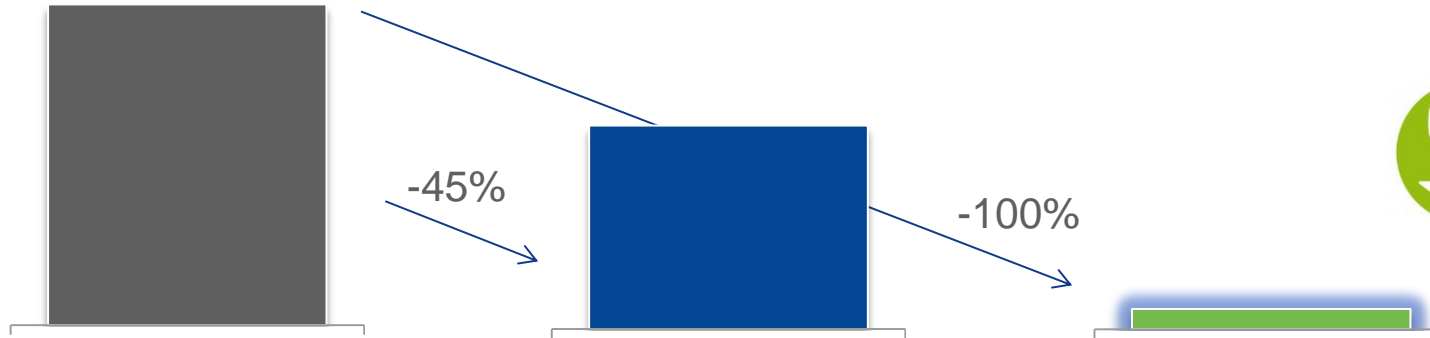


Manufacturing method of the hydrogen CO₂ savings are significant

Major decrease of CO₂ emission



...equals annual
emissions of
400 cars



minus
700t CO₂
per year...

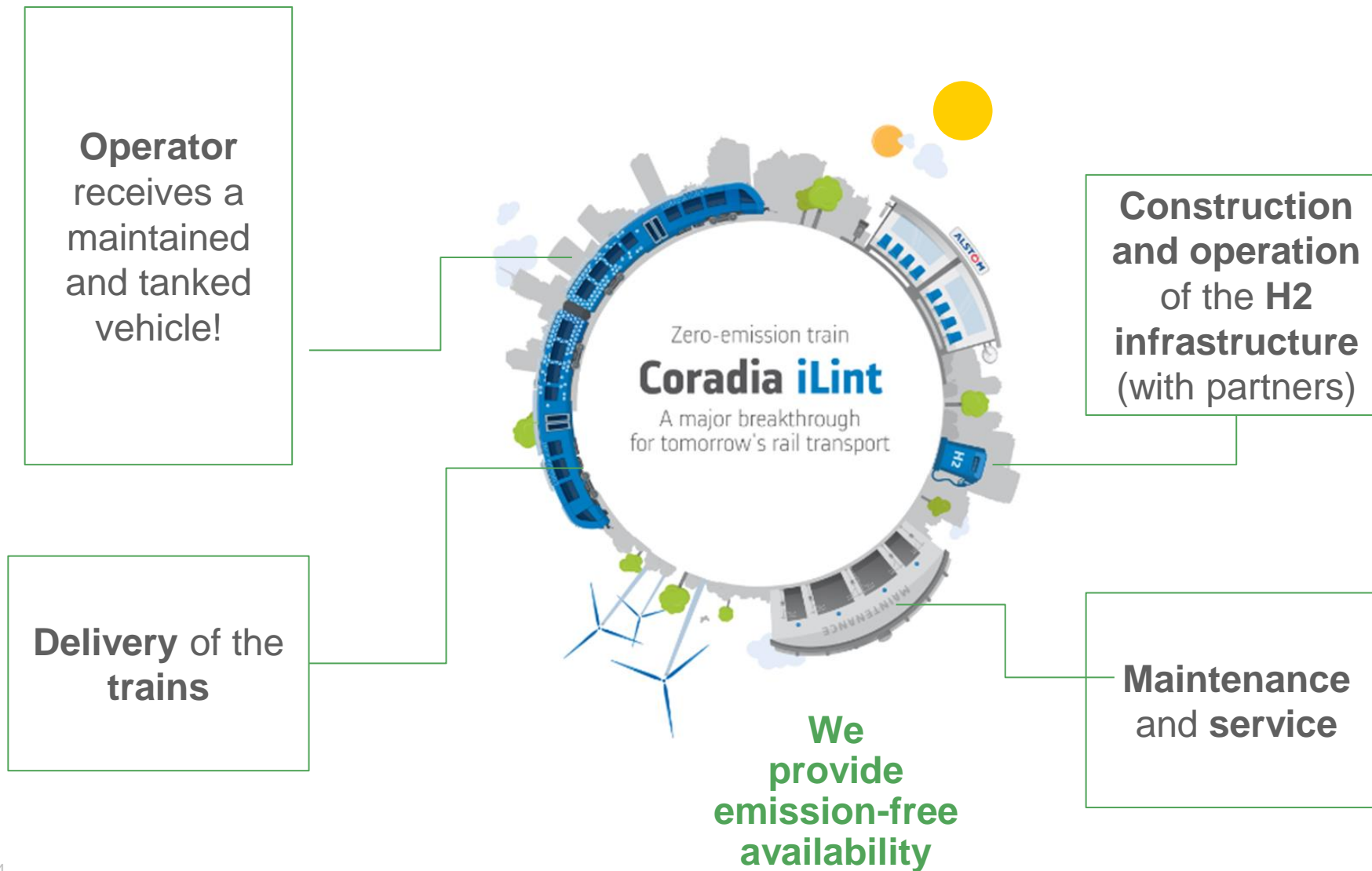
Diesel-Lint

H₂ out of natural
gas reformation

H₂ out of electrolysis
with „Green Electricity“



Our vision: A joint service out of one hand – emission-free mobility!



Coradia iLINT



in daily passenger service: > 150.000 km in 15 months

Be the leading global innovative player
for a sustainable and smart mobility





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Dipl.-Ing. (TU) **Wolfram Schwab** studied Mechanical Engineering and Railway Engineering at the University of Hannover, Germany and has over 36 years experience in the Rail Industry.

He is member of the boards of Hydrogen Europe and VDB – German Railway Association.

Since 2018 he is Vice President of R&D and Innovation at Alstom Transport S.A.

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