



Future of Mobility

21-10-2019

ALSTOM
• mobility by nature •

ALSTOM, leader of Sustainable Mobility Solutions

URBANISATION

ORGANIC
GROWTH

PUBLIC AND PRIVATE
FUNDING

SUSTAINABLE
DEVELOPMENT

DIGITAL
TRANSFORMATION

280 CUSTOMERS

60 COUNTRIES



ROLLING
STOCK



SIGNALLING



SERVICES



SYSTEMS



All figures at 31 March 2019
Note: Annual average - Accessible market
Source: UNIFE Market Study 2018

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Value creation through innovation



VALUE CREATION THROUGH INNOVATION

2020 GOAL: Innovate to achieve differentiation and gain a competitive edge.

Innovation, a source of competitiveness & differentiation

1

Boost innovation
to increase
differentiation



2

Invest
in competitiveness-
oriented technology



3

Optimize
customers' total cost
of ownership



30% of orders booked will come from newly-developed products by 2020

Value creation through innovation – Rolling Stock



ROLLING STOCK

Metro



Metropolis

High Speed Trains



Avelia Horizon

Tramway



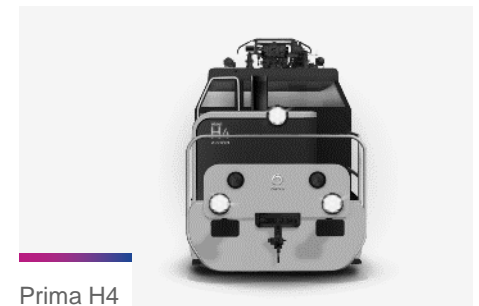
Citadis X05

Regional Trains



Coradia Stream

Locomotives



Prima H4

© ALSTOM SA, 2019. Design&Styling | METROPOLIS™ - AVELIA HORIZON™ – CITADIS X05™ – CORADIA STREAM™ – PRIMA H4™

Value creation through innovation – Services



SERVICES



- Commercial Success of **HealthHub**, implementing predictive maintenance



- StationOne release, the on-line Market for rail professionals

www.station-one.com

Value creation through innovation – Systems



SYSTEMS



- **Appitrac**: successful in Riyadh



- **SRS** for tramways in commissioning in Nice (France)
- Partnerships with Volvo for a **Electric Road System Project** (APS for Highway)

Value creation through innovation – Smart Mobility



- **Urban Optimet Map**, a smart metro map that provides real time information for passengers



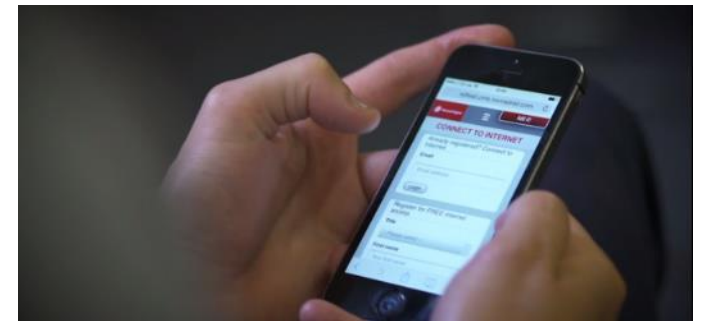
**SMART
MOBILITY**



- **Optimet**, train occupation in real-time, visual support that allow passengers to decide where to wait the train on the platform



- **Mastria**, first solution of multimodal supervision



- **Nomad Digital and 21net**, acquisition of world leaders on onboard connectivity

Value creation through innovation – e-Bus

- 1st commercial success of **Aptis**, 100% electric bus in France – currently in tests in whole Europe and Latin America (Chile)



Innovation Label
Busworld 2017



Environmental excellence – preparing the future of mobility

- Active member of the main bodies and participation in the main events for the **decarbonization of mobility and promotion of hydrogen for transportation.**



**Hydrogen
Council**



Joining the public debate and common initiatives for sustainable mobility

Clear political objective: drastic reduction of CO₂

Our railway sector contributes!

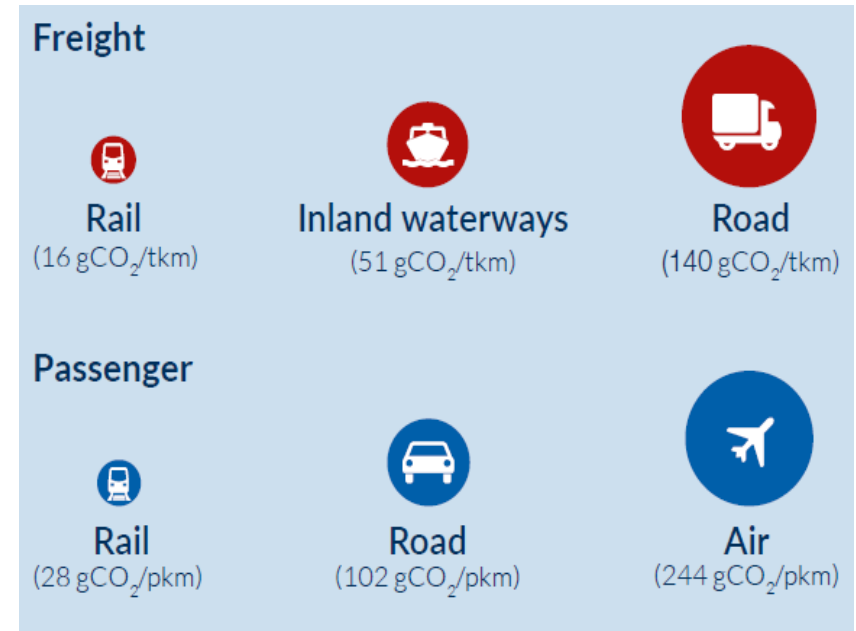


COP24 • KATOWICE 2018
UNITED NATIONS CLIMATE CHANGE CONFERENCE

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: European Environment Agency (EEA) 2017

Backbone of low carbon motorized transport for cities and regions

If not electrifying: Need for alternative propulsion technology



Considerable part of the **railway network not electrified**

Emission-free trains for not-electrified routes



Medium and long-term **rising prices for diesel**

Alternative to fossil fuel



Legislation and forecasts regarding **climate protection and noise reduction**

Climate protection and noise reduction



Falling acceptance and political discussions about **diesel driving ban in urban areas**

Compliant technology

Hydrogen as key towards emission-free mobility

ALSTOM's contribution: CORADIA iLINT



Why hydrogen? Technology leaps through fuels with higher energy density

HYDROGEN



DIESEL



COAL



Energy
Density

120
MJ/kg

34
MJ/kg

43
MJ/kg



The key benefits: Reduction of greenhouse gas emissions

Reduction per train



minus
700t CO₂
per year...



...equals annual
emissions of
400 cars

Reduction per fleet (30 trains)



minus
22.000t CO₂
per year...

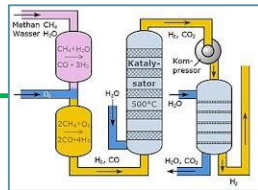


...equals annual
emissions of
12.000 cars

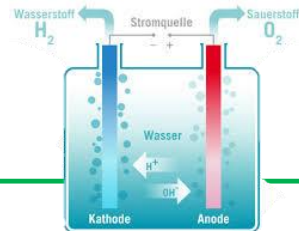
Different sources to produce hydrogen: from by-product to regenerative energy



Use of by-product hydrogen

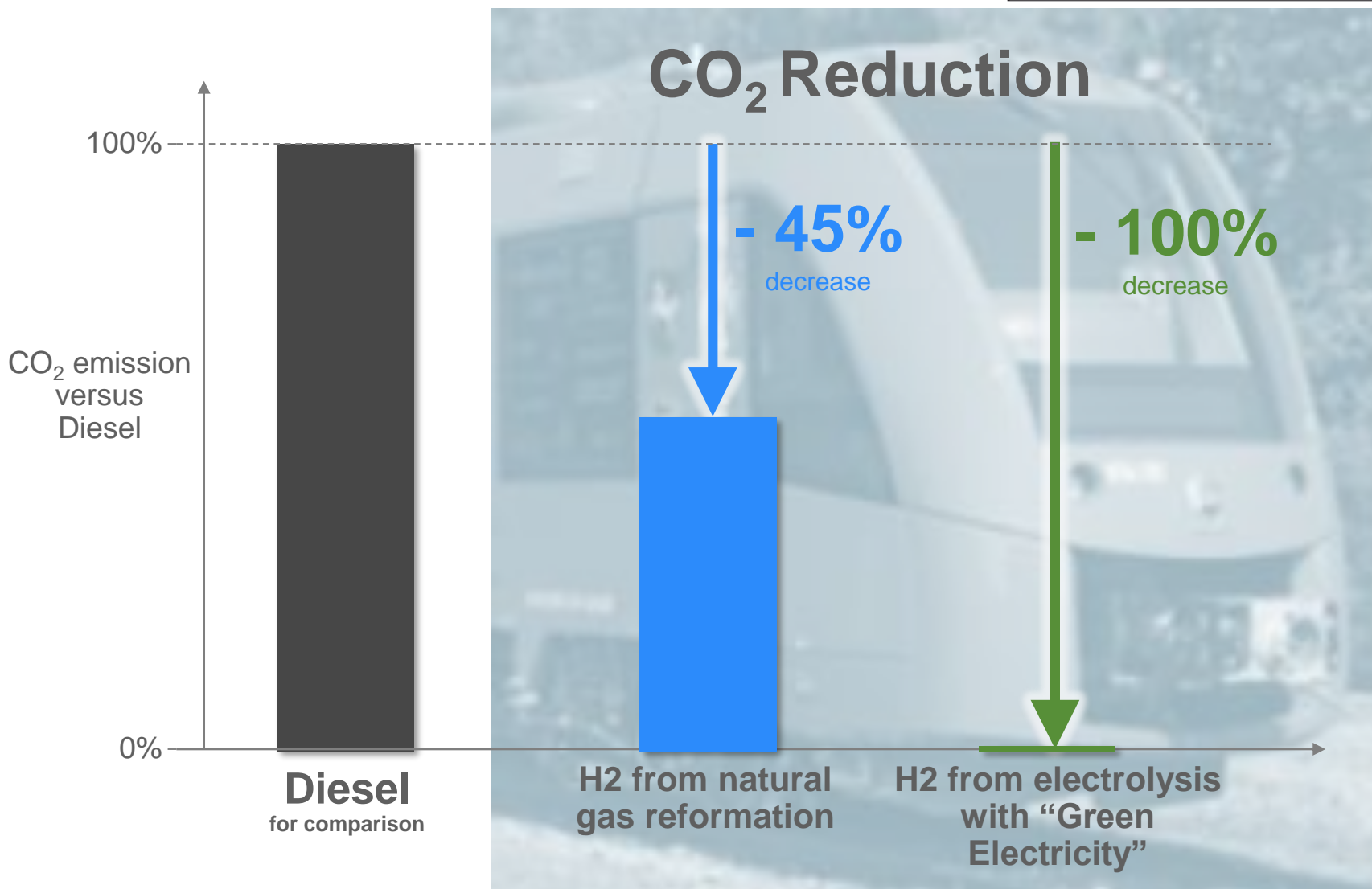


Steam/Gas reformation

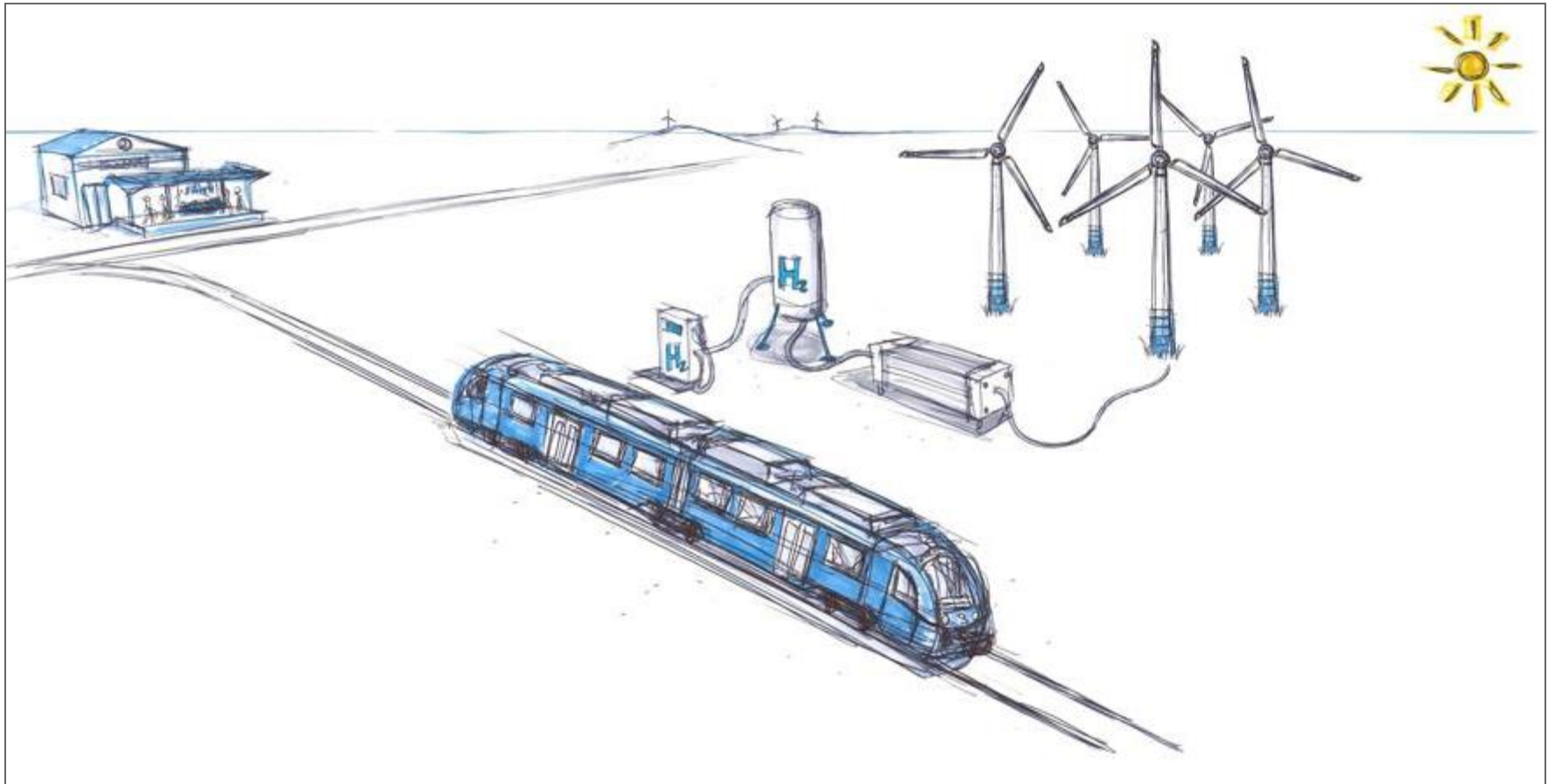


Elektrolysis

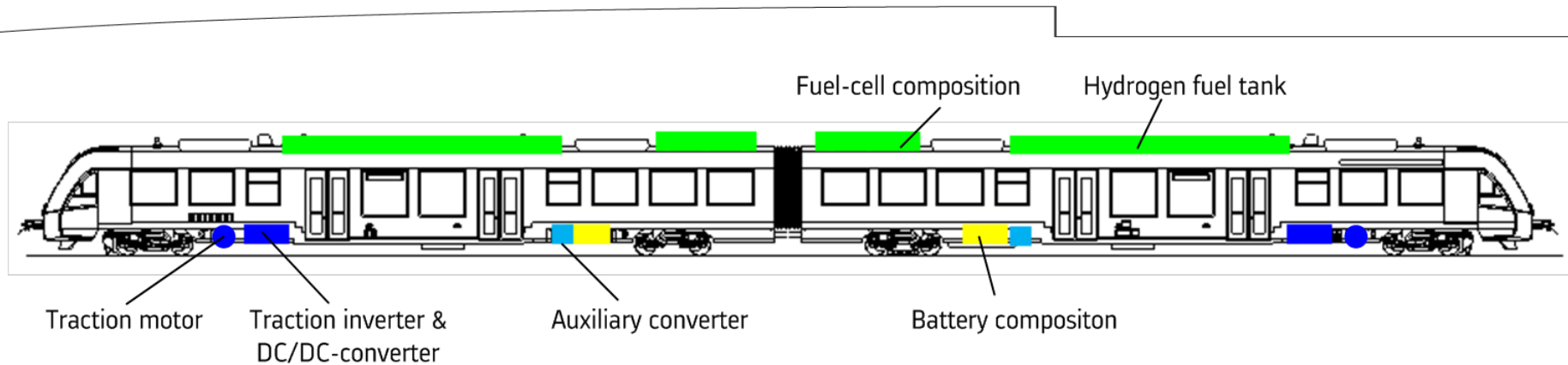
The hydrogen production method determines the achievable reduction of CO₂



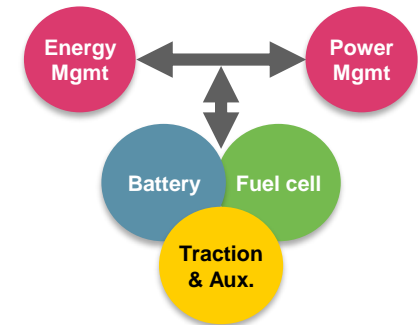
Hydrogen supply: Use of regenerative energy



Coradia iLint: Diesel replaced with hydrogen and fuel cell technology



- Replacing diesel traction by electrical traction system
- Primary energy supply by hydrogen fuel cells
- Intermediate energy storage by Li-Ion batteries
 - to boost during acceleration
 - to recover kinetic energy during braking
- All electrical auxiliary supply



Modern energy supply and storage system combined with intelligent energy management

Our mission: A joint service out of one hand – emission-free availability!

Operator
receives a
maintained
and tanked
vehicle!

**Delivery of the
trains**

Zero-emission train
Coradia iLint
A major breakthrough
for tomorrow's rail transport

**Construction
and operation
of the H2
infrastructure
(with partners)**

**Maintenance
and service**

Coradia iLint - More than one year of passenger services

Summary after one year:

- Certification for Coradia iLint operation received in July 18
- Start of operation for both pre-serial trains Sep 18
- Coradia iLint are operating in daily revenue service
- Mileage to date > 150.000 km
- Supply of hydrogen via mobile refuelling station



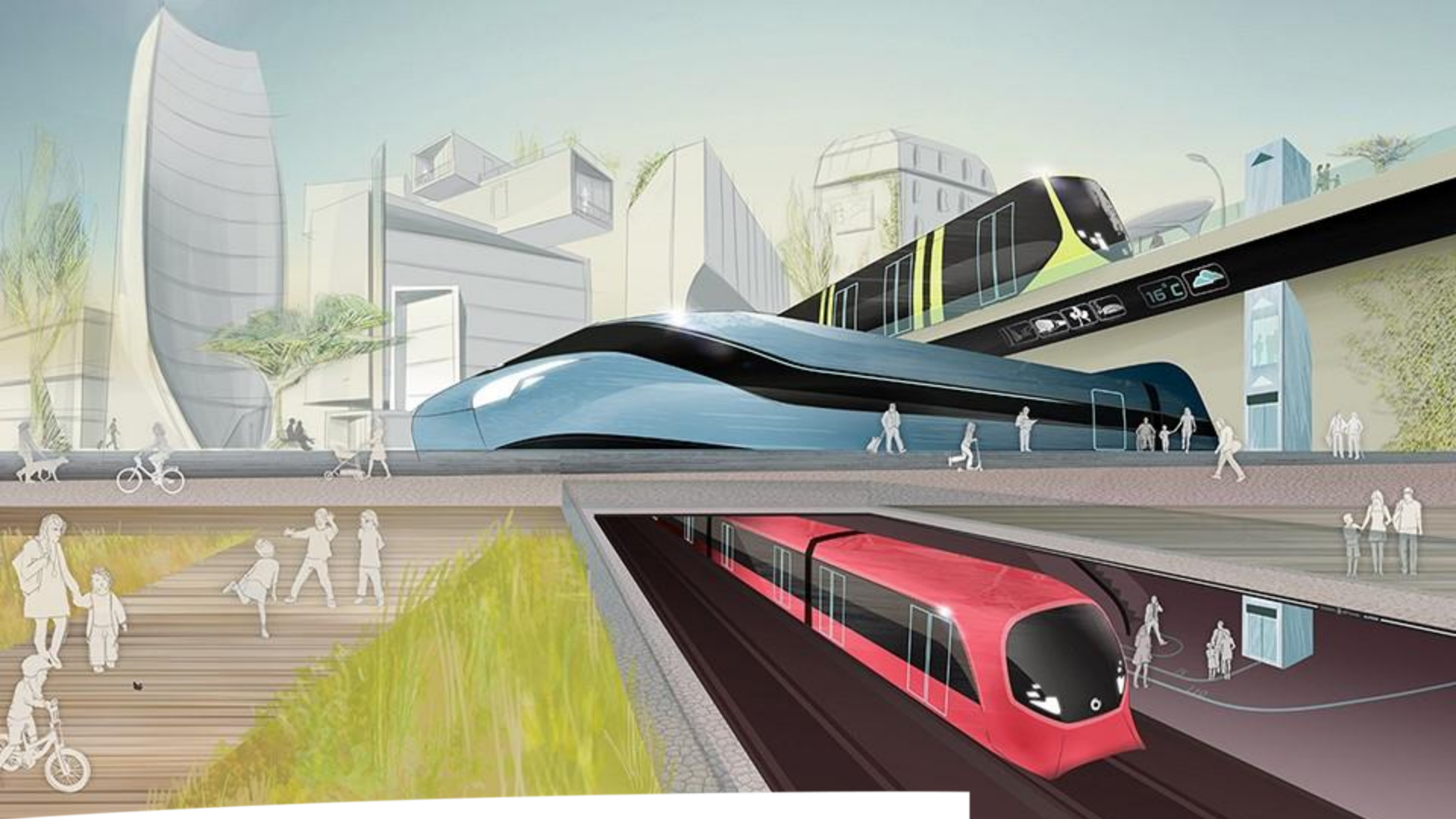
Coradia iLint – next steps



- Passenger service mileage with pre-serial trains
- Development of the hydrogen infrastructure
- 2021/2022 Start of operation of fleet operations
- Homologation in other European countries

Alstom Coradia iLINT





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