

#### Railways get even greener, smarter and off-rails Sept 19<sup>th</sup>, 2019

**Christophe Wacrenier** 



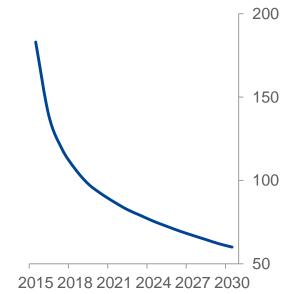
### Growing environmental concerns while rapid advancement of green technologies



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



**Increased availability** of green technologies Li-ion battery cell cost development, USD/kWh; 2016 - 2030



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Source: Corporate websites, 2025-2040 Mobility trends - Alstom 2025 Launch Days Roland Berger

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### Be the leading global innovative player

### for a sustainable and smart mobility



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# Hydrogen trains: now a reality



In commercial service in Germany Deployment/tests in France, UK,



## Diesel replaced by hydrogen and fuel cell technology

Electric drive system
Primary energy by fuel cells
Intermediate storage by li-ion batteries...

 ...for additional acceleration
 ...for the recovery of braking energy

Combined propulsion and energy storage system

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# Notice anything weird about these trams?



# Rio de Janeiro Orleans Reims Sydney

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# Dubai Bordeaux Angers Tours

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# No catenary, yet they are still electric

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## We are extending Electric ground power supply to roads

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### **Electric roads**

### Future: greener road freight transport

**Electric road** is a good solution for:

- Reduction of CO<sub>2</sub> emissions
- Reduction of other air pollutants (NOx, PM)





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### Leveraging our electric know-how "off-the-rails"



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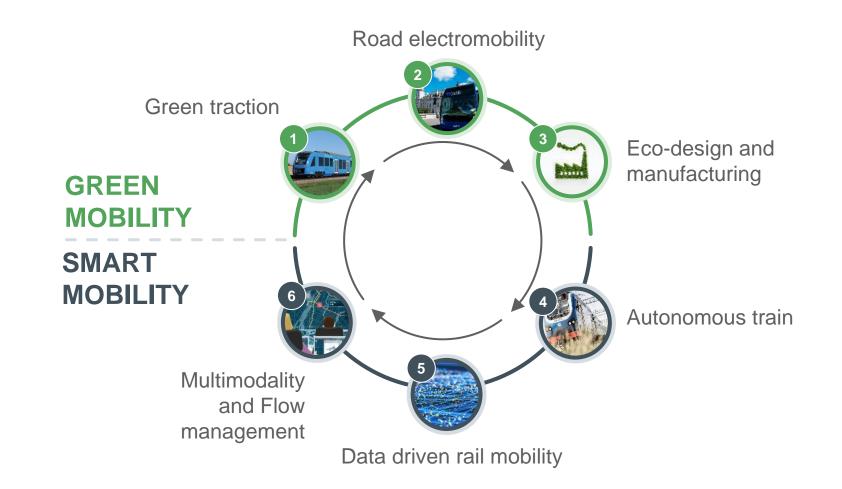
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## Mastria: Multimodal flow management system



### Not just delivering green products, but being green ourselves



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