Addressing the Technical Challenges

A Whole System Perspective

UIC RailAdapt Beijing 18/06/2017
A Whole System Challenge

Crucial Role of Rail in Addressing these Systemic Challenges

Population Increase  Pollution  Climate Change  Urbanization

CO₂ emissions per passenger per km
Reduce Systems’ Needs

**HESOP Reversible Substations**
- 99% of braking energy returned to power grid
- or re-used in station equipment
- Up to 40% energy savings
- Reduce tunnel and in-station ventilation

**Permanent Magnetic Motors**
- 15% energy savings vs asynchronous motors
- 40% lighter, contributes to train mass savings
- Dirt reduction by 15%, noise by 4%
- No cooling water consumption: self-ventilated design

- Energy recovery, mass reduction, reduced or no ventilation
Adapt to Non-continuous Electrification

Catenary-less Trams
Three feeding systems
3rd Rail, Static Recharge, SuperCapa

Aptis
Electricity-fuelled mobility
On the road
Dual charging modes

Coradia iLint
Hydrogen Fuel Cell
Regional Train

And reduce environmental impacts of urban transport
Adapt to Non-continuous Electrification

Prima H3
Shunting Locomotive

- Hybrid Diesel Battery
- Bimode Diesel Electric
- Diesel consumption down 50% to full autonomy
- Emissions down by over 50% to emission-free
- Max speed 100 km/h
- Traction force 240 kN

Prima H4
Shunting and Mainline Locomotive

- Hybrid Diesel Battery
- Bimode Diesel Electric
- Diesel consumption down 50%
- Emissions down by over 50%
- Driving speed 120 km/h
- Traction force 300 kN

Increase flexibility and reduce environmental impact of freight and shunting operations
Adapt to Changing Environmental Conditions

- Sizing and protection of electric and electronic equipment
- Sand protection
- Thermal isolation reinforcement
- AC reinforcement and air-flow management
- Condensation protection

Adapting to a world ~2°C hotter by 2050
Resilience to slow-onset environmental changes

Australia Tram System Project

Heatwave events across NSW actual and projections

Actual data: 1990 - 2009
Near future: 2030
Far future: 2070

Source: heatwaves climate change impact snapshot

Design to withstand outside $T^\circ > 40^\circ C$, $>50^\circ C$ in degraded mode
Resilience to Increasing Intensity of Climatic Events

Australia Tram System Project

Climate Change Risk Assessment and Mitigation Measures
Optimize System Resilience: Real-time Condition M&D

Train, Track, Catenary and whole System detection of intrusions and theft
Optimize System Resilience and Safety: Traffic Optimization

Optimet

Metro Connectivity and real-time information for Passengers

- Real time information about traffic conditions and service interruption
- Live estimation of journey times
- Urban life information through social media

Mastria

Multimodal mobility advisory overlay

- Coordinate all public transport modes from rail to road
- Alternative mobility solutions rapidly offered in case of incidents
- Predicting with data analysis and operational optimisation
Sustainability and Innovation: at the core of Alstom’s DNA