Fuel cell solutions for zero emission rail applications.

Alan Mace
March 2019
H2@Rail
Content

- Fuel cell Technology for Rail
- Rail Applications
- Ballard Experience and Solutions
- Hydrogen as a fuel for trains
Fuel cells offer the environmental benefits of electrification without significant infrastructure investment and with the flexibility of diesel.
Fuel cells offer the benefits of electrification without significant infrastructure investment

- No requirement for overhead catenary infrastructure and power substations
- No impact on existing bridges, over-path and level crossings
Fuel cell technology addresses several rail applications.

- Shunter / yard locomotives
- Regional and commuter trains
- Trams and Light rail
- Underground mining
Fuel cell system design considerations for rail

- Component choice to reduce noise level and system weight
- Flexible system layout to meet space requirements (roof-top or custom configuration)
- Protection against dust ingress (safety hazard)
- System frame design to meet shock and vibration requirements
Ballard scope of supply

Fuel cell power module composition:
- Control Unit (CAN)
- Pressure Regulation
- Air Humidification
- H₂ Safety Systems
- Stack Hydrogen System
- Coolant Subsystem
- Air Compressor & Motor
- Stack Contactors

Power Management:
- DC/DC Converter
- Battery Controller
- HV Battery
- Energy Storage System
- Traction power converters
- Drive Motor
- Motor Controller
- Radiator & Fan
- Heat Management

Option:
- Tank Control Unit
- H₂ Tanks & Pressure Relief
- Hydrogen Storage
- 24V Power Supply
- Power Supply
- Air/Water Separator
- Product Water Reservoir
- Product Water Drain Valve
- Air Exhaust
Ballard.com

Rail Standards and product testing experience

- Experienced with automotive and rail standards (~20 international rail standards)
- Extensive testing capability: vibe & shock, EMC, noise, dust ingress

Ingress Protection  
EMC/EMI  
Fire Suppression  
IP testing  
Shock & Vibration  
EMC/EMI
From bus to rail

- 15 years of experience in designing heavy duty fuel cell engines.
- Integration experience with multiple vehicle platform (bus, truck, train..)
- Proven technology with millions of operating hours in revenue service
We have the experience in rail applications

- JR East commuter rail in Japan
- Light rail projects with CRRC in China
- BNSF Railway shunt locomotive in the US
- Mireo commuter train development program with Siemens
Fuel cell tram demonstration project in Tangshan.

- World’s first Hydrogen-powered tram in pilot test phase
- 5 stations – 14 km lines
- 40 km range up to 70km/hr.
- Hydrogen refilling in 15 min
- 3 cars, 66 seats and 336 passenger capacity
- Power by 2 x FCveloCity® 150kW modules
Fuel cell tram line in Foshan

- Project with CRRC Qingdao Sifang Co, Ltd
- Expected to enter in service in 2019 in Goaming district of Foshan
- Speed up to 70km/h with 100km autonomy
- 200kW fuel cell module for rail applications
Fuel cell tram line in Foshan

FCveloCity®-XD200:

- Integrated 200kW fuel cell power module
- Robust design: reinforced frame with rigid plumbing
- Built-in fire suppression systems
- Easy service access
- Weight and noise optimized
Fuel cell tram line in Foshan

Ballard scope of work:
- Develop 200kW fuel cell system for rooftop light rail applications
- Meet rail-specific design standards
- Deliver 1 fuel cell system for engineering testing at Qingdao, China
- Deliver 9 fuel cell systems for revenue service in Foshan, China
HYDRO FLEX

Zero emissions for a greener railway
Hydroflex project

- Conversion of a classic 'Class 319' electric unit to be supplied by Porterbrook into hydrogen powered train “HydroFlex”

- Development work has commenced and HydroFlex will undertake testing and demonstration runs in summer 2019

- Ballard supplies 100kW FCveloCity®-HD fuel cell power module to be integrated to existing electric drive as “range extender”

- The HydroFlex will retain the ability to operate across existing electric routes (on either 3rd rail or 25kV overhead power) and with the addition of a hydrogen fuel-cell it will also be capable of operating in self-powered mode, without the need for diesel engines

- This demonstrator version focuses on delivering an electric/hydrogen bi-mode to UK gauge and the need to make more effective use of existing electrification with additional emission-free running beyond the wires.
Development of a new generation of hydrogen powered EMU
The focus of our innovation roadmap is the improvement of Life Cycle Cost
Mireo Plus H (Hydrogen train by Siemens Mobility)
Prototype fuel cell powered shunt locomotive.

- Moves railroad cars over short distances in yard
- 300-500kW gross power with 60kg H2
- Refueled at hydrogen station within railyard
- Public-private project partnership with Vehicle Projects, BNSF Railway, US Army Corps of Engineers & Ballard
Fuel cell and hydrogen provide an attractive solution for zero-emission rail.
Power to change the World®

- Committed to sustainable mobility and clean air for everyone
- Developed technology over 30+ years
- We have leading talent with >600 people passionate about our mission
- HQ in Vancouver (Canada) with offices in China, Denmark and USA.
Power to Change the World®

Alan Mace
541 678 8086
alan.mace@ballard.com
WWW.BALLARD.COM