BREEZE – A HYDROGEN TRAIN BUILT IN THE NORTH WEST

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breeze – A hydrogen train built in the NW

Delivering the Hydrogen Economy NW

05/06/19
About Alstom

- 36,300 employees working on 105 sites in 60 countries serving 200 customers

Results FY 18/19

Orders: €12.1bn
Sales: €8.1bn
Net income: €681 million
Net cash: €2.3bn

Employees:
- Americas: 5,200 employees
- Asia-Pacific: 5,200 employees
- Europe: 22,400 employees
- Middle-East and Africa: 4,500 employees

A rail system supplier with global reach
Coradia iLint: Alstom’s *first* hydrogen train…

- Announced 2014
- Unveiled 2016
- Approved 2018
- In service 2018
- Operated >100k km
- Fleet #1 2021
- Fleet #2 2022
breeze – a hydrogen train for the UK

- Announced 2018
- Unveiled 2019
- Approved 2022
- In service 2022
- Fleet 2022/3
Hydrogen is an ideal solution for regional rail traffic

- **High speed?**
  - Very high energy and power demand and;
  - Electrified (typically)

- **Trams?**
  - If electrification is difficult in urban setting
  - For longer range than other catenary-free technology

- **Regional Traffic?**
  - Majority never intended to be electrified – need longer range than batteries can provide
  - Fits available energy/power range

- **Last mile/bi-mode?**
  - Battery suits very short range “last mile“
  - Bi-mode weight/space and high energy requirement
Diesel on UK railways today

- 29% of the UK rail fleet is powered by diesel, less than 40% of the network is electrified
- ~2,500 UK regional rail vehicles are diesel powered with no emission controls whatsoever
- But the future for diesel looks bleak…

“I would like to see us take all diesel-only trains off the track by 2040. After all, we’re committed to ending the sales of petrol and diesel cars by 2040. If we can achieve that, then why can’t the railway aspire to a similar objective?”

“Alternative-fuel trains powered entirely by hydrogen are a prize on the horizon and I’d like to see hydrogen train trials on the UK railway as soon as possible because hydrogen offers an affordable and potentially much cleaner alternative to diesel.” Jo Johnson, Rail Minister, Feb 2018

- The decarbonisation challenge set for the industry is truly a challenge. “Diesel-only” sweeps up not just regional passenger trains but also high speed trains and freight.
- 70 years ago the first diesel trains entered service in the UK, we now have 20 years to get rid of them…
Creating hydrogen powered trains

- Diesel traction replaced with electric traction system
- Primary energy supply from hydrogen fuel cells
- Intermediate energy storage from Li-Ion batteries
  - to boost during acceleration
  - to recover kinetic energy during braking
- All electric auxiliary supply

Modern energy supply and storage system combined with intelligent energy management
The hydrogen we need

- One fleet of 10 trains operating a regional service will require **over three tonnes of hydrogen per day, every day, for at least 10 years.**

- The train is agnostic to the “colour” of its hydrogen but its carbon reduction contribution is greatest with green hydrogen.

- Whatever the colour, clean air comes for free…
Next steps

- Completion of business cases with operators to include full system provision – trains, fuelling, operation and technical support
- Approval to proceed, including appointment of hydrogen supplier
- Launch system safety case approval process with operator
- Detailed design of the train conversion including the hydrogen propulsion system integration
- Parallel design of the hydrogen refuelling facility(ies)
- First unit build with train level testing commencing late 2021
- Fleet build early 2022
- Fleet in passenger service late 2022
- Roll-out additional fleets to expand network, keeping production flowing in Widnes well into the mid 2020s