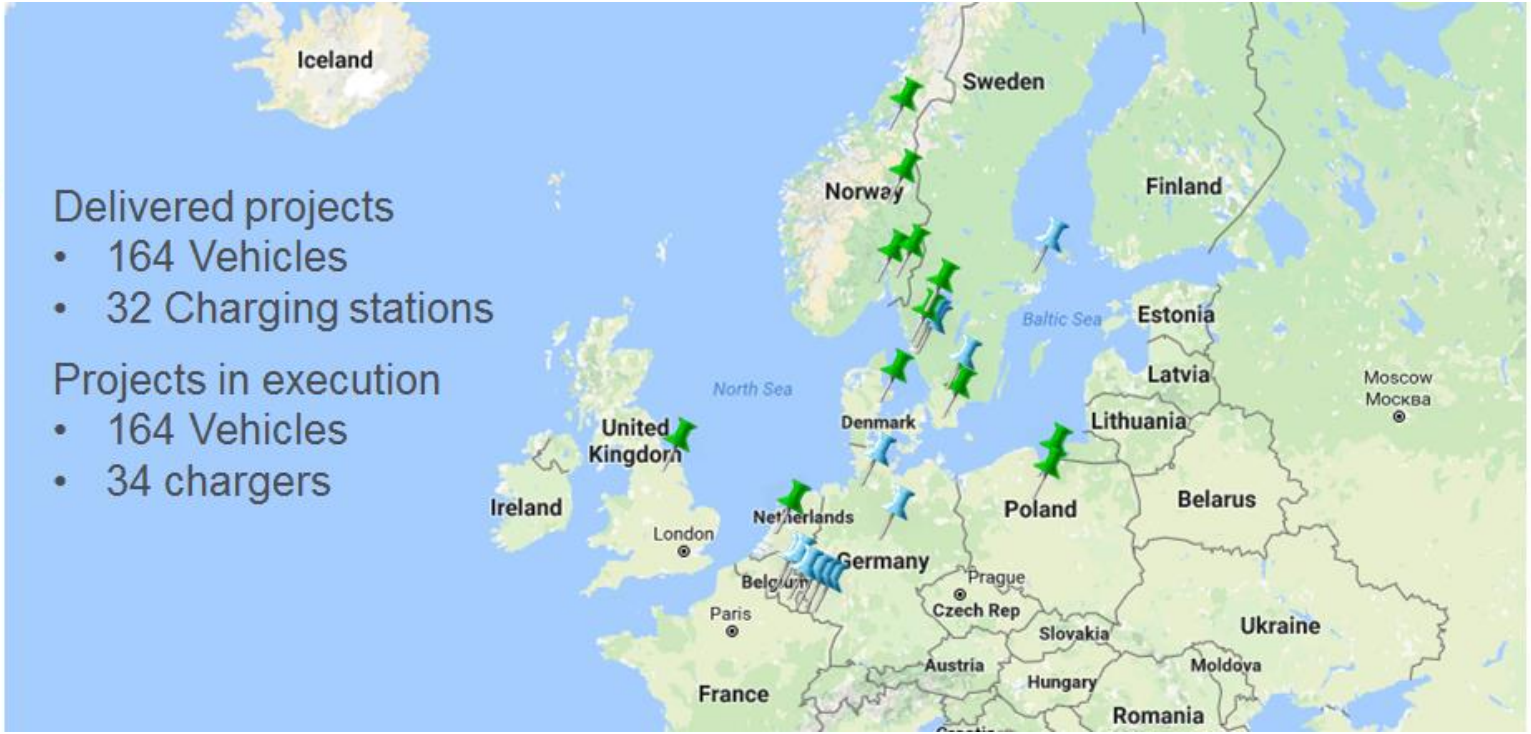
ELECTRIC JOURNEY

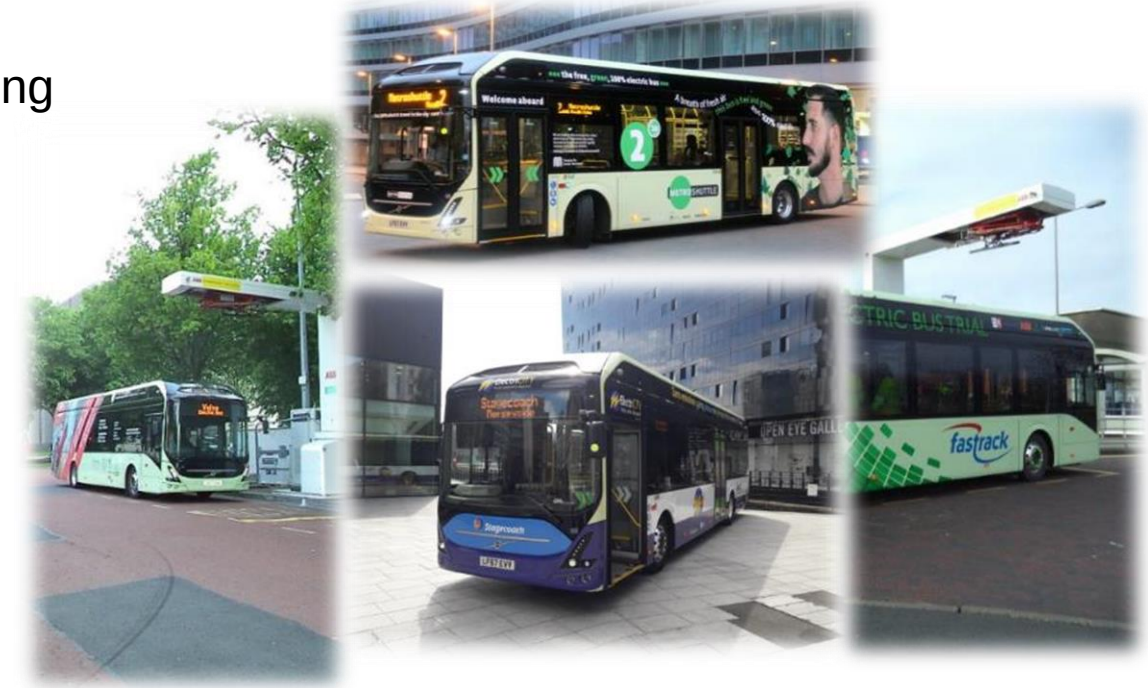
Volvo Bus and ABB

Electric Journey So Far



UK Demonstration Programme

- Investment in 12 month UK programme.
- Design of mobile charging station.
  - Manchester
  - Heathrow
  - Kent
  - Cardiff
  - Liverpool



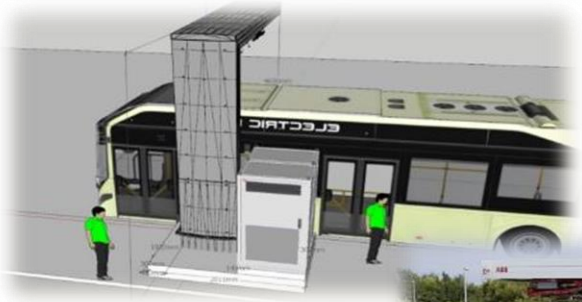
The Infrastructure

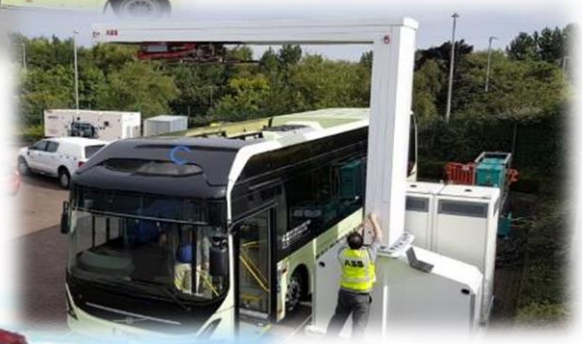
The concept

- Early concept to deliver mobile high power charger
- Design allowing for easy movement

The reality

- Delivered the concept
- Fully flexible single deck and double deck compatible
- Installed and removed within 4 hour window.





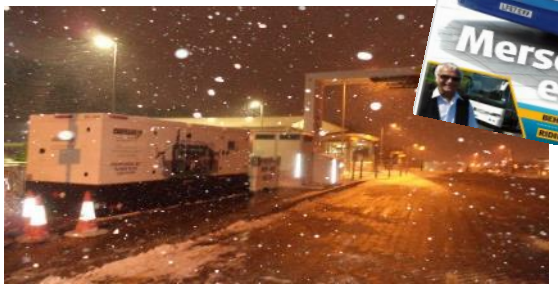
The Bus Generation 1

- 37 km Range
- 12 meter. 2 door vehicle
- Opportunity charged
- Low power 22kW depot charging
- Zone Management

UK Demonstration Programme

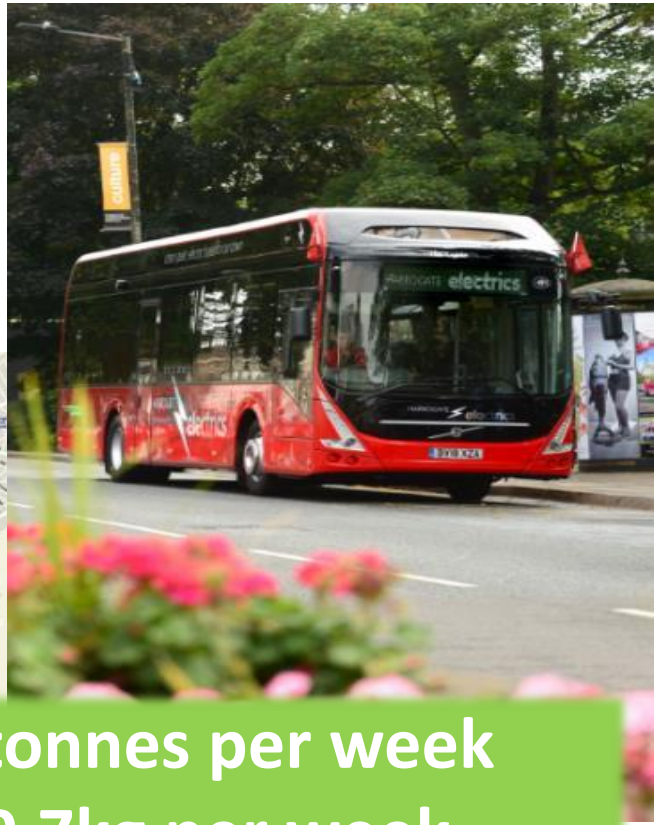
- Achievements
  - Large amount of information gathered with 21392km travelled, 11,697km in 9 weeks in Kent
  - Energy consumption an average of 1.19kW/km
  - Publicity
  - Passenger monitoring, zone management and vehicle reporting
  - Engagement with Leigh UTC
  - Stakeholder reports

- Challenges
  - Temporary connection to the grid
  - Use of diesel generator
  - Extreme weather
  - Driver training

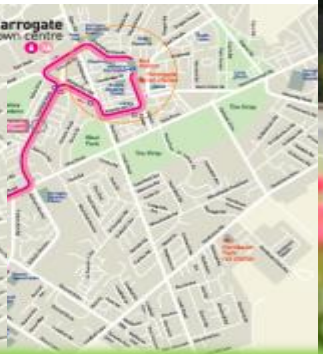


The Transdev Harrogate Story.

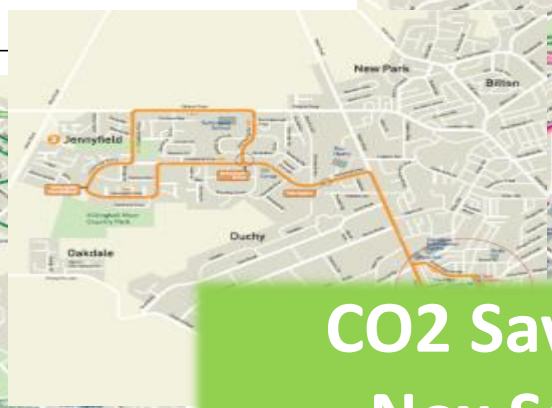
- 8 Vehicles
- 3 Routes
- 3 Charging Stations
- Traffic Start Q4-18



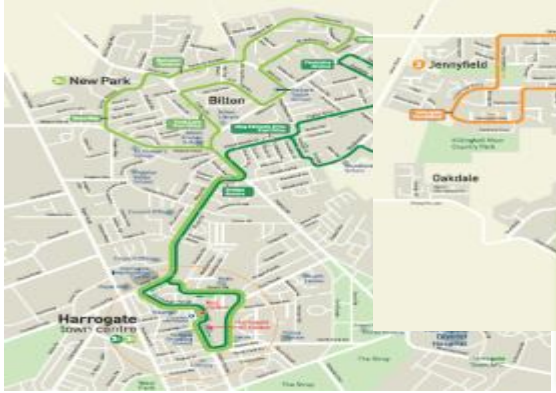
6-x6 Harrogate Panel Ash Beckwith Knowle Business Park



3 Harrogate - Jennyfield



2A Dene Park/New Park
Bilton Circular

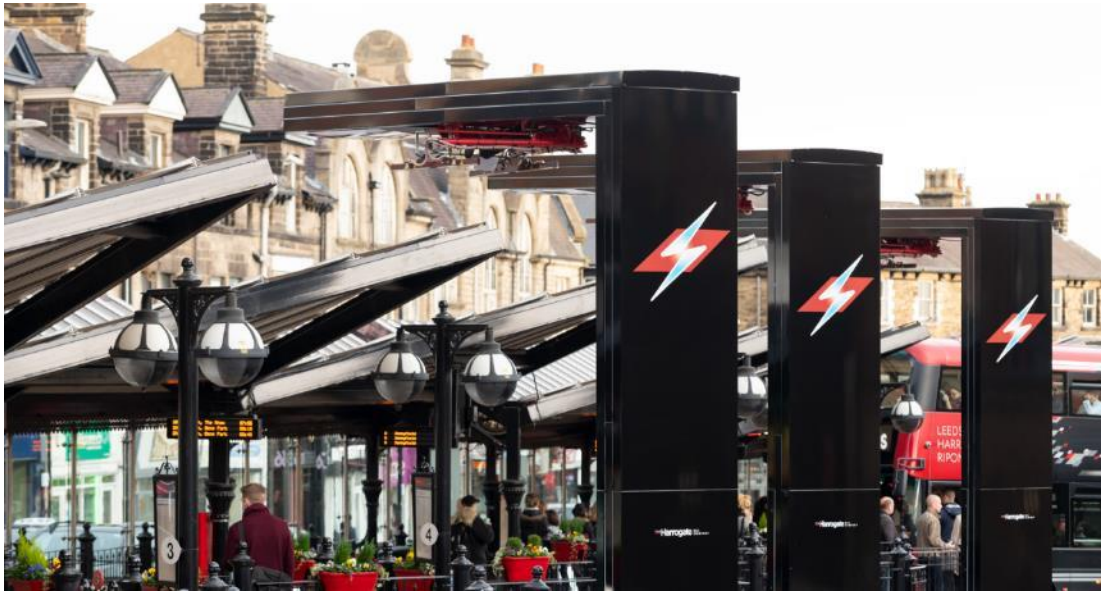


CO2 Savings 9.2 tonnes per week
Nox Savings 140.7kg per week

The Transdev Harrogate Story.

Story so far

- Vehicles now operating
- Depot converted for overnight charging giving flexibility



Challenges

- Grid connection
- Obtaining an accurate cost for DNO connection
- Planning permission

Volvo Electric Generation 2

- Extended range 120km to 160km
- Full charging flexibility
- Opp Charge 300kW high power in depot and on route
- Combo 2/CCS 150kW rapid charging in depot
- Low power 22kW depot charging
- Zone Management

Conclusions

- That there are challenges but electrification is possible and available today.
- Whist the demonstration has proved opportunity charging works it will not be the solution for all routes hence the developments in generation 2 technology giving full operational flexibility.
- The connection to the grid and the availability of information to scope out projects needs to be made much easier.
- Finally the natural evolution of battery technology will allow Volvo and ABB to meet the majority of operational requirements, not just buses but trucks, vans and construction equipment.