

# LowCVP Zero Emission Fleet Series “Challenges for EV Manufacturers”



Mat Lawrence

EV Business Director – Alexander Dennis Ltd.

# Zero Emission Bus Experience

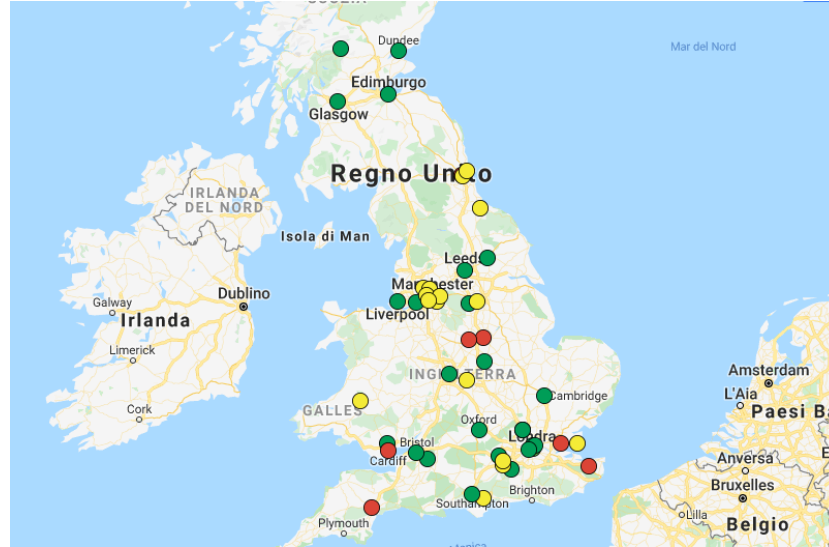
- 50 Years experience
- 1,700 ZEBs in Total
- 7,300 electric buses (including hybrids) driven by motors and batteries
- In 2018, New Flyer delivered 581 electric buses, including 128 ZEBs
- Offering includes:
  - All Battery Electric (AEB)
  - Trolley Electric (some with batteries)
  - Fuel Cell Electric Bus (FCEB)



- UK partnership formed in 2015
- BYD Chassis / ADL body
- Over 400 buses in service or on order so far
- Offering includes:
  - E200EV Single Deck
  - E400EV Double Deck
- BYD Founded in 1995
  - Built more than 65,000 EV Buses
  - Worlds largest manufacturer of heavy duty batteries



# Drivers for change



- Clean Air Zone expected or being planned
- Area required by government to produce a CAZ plan
- CAZ not expected or opposed by local authority



Department  
for Transport



Office for  
Low Emission  
Vehicles

This relates to air pollution – CO2 (global warming) is also a key driver



# EU Clean Vehicles Directive

- The directive sets out **mandatory** minimum procurement targets in Member States for clean light-duty vehicles, trucks and **buses**
- Buses that use the following technologies/fuels are considered as clean
  - Electricity (inc. plug-in hybrids)
  - Hydrogen
  - LNG, CNG & Biomethane
  - Biofuels
  - Synthetic and paraffinic fuels
  - LPG

Came into effect in August 2019

Member states have 24 months to transpose the Directive into national law

**2021 – 2025\***

45.0% Clean

22.5% ZE

**2026 – 2030\***

65.0% Clean

32.5% ZE

\* Bus figures only

Directive (EU) 2019/1161 (20 June 2019) amending Directive 2009/33/EC  
<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019L1161>

# Enviro200EV

- 3rd generation liquid cooled batteries
- 330 kWh battery capacity
- Range 160 miles @ 75% SOC year 10
- 44mph maximum speed
- 2 x 90Kw hub motors
- Maximum passenger capacity 69
- Heat pump electric heating
- Batteries roof mounted under new sleeker roof pod



Introducing DC charging with Type 2 CCS plugs from mid 2020

# Enviro400EV

- 382kWh battery capacity
- 150kW hub motors
- Range 160 miles at 75% SOC year 10
- 67 seated (43 up 24 down)
- 85 capacity 2 door version
- Heat pump electric heating
- All forward facing seats
- City body styling



Introducing DC charging with Type 2 CCS plugs from mid 2020

# Enviro400H2

- 5.71kg/100 km or 9.14kg/100 miles
- 200 - 230 miles range subject to load and terrain
- 5 minute re-fill time
- 50mph maximum speed
- 70kW fuel cell providing all of the electrical energy
- 45kWh battery provides transient power and drive through ZF drive axle
- 87 passenger capacity



Not yet available for orders – watch this space



# An operator's EV delivery journey

## Route analysis:

- PVR
- Route profile (km/kph)
- Energy consumption (range)
- Heating load
- Charge profile
- Run-outs



## Depot visits:

- Charger locations
- Charging logistics (parking)
- Power demand vs. supply
- Existing site plans
- Timing to route start



## Execution:

- Buses
- Chargers
- Grid connection
- Civil engineering
- Training
- Service



Turn-key solution delivered through an ecosystem of providers



Range calculations use predicted energy storage capacity after 10 years service



Connect  
Collaborate  
Influence





# An operator's EV delivery journey

## Route analysis:

- PVR
- Route profile (km/kph)
- Energy consumption (range)
- Heating load
- Charge profile
- Run-outs



## Depot visits:

- Charger locations
- Charging logistics (parking)
- Power demand vs. supply
- Existing site plans
- Timing to route start



## Execution:

- Buses
- Chargers
- Grid connection
- Civil engineering
- Training
- Service



Turn-key solution delivered through an ecosystem of providers



Scottish and Southern  
Energy



Range calculations use predicted energy storage capacity after 10 years service



Connect  
Collaborate  
Influence



# An operator's EV delivery journey

## Route analysis:

- PVR
- Route profile (km/kph)
- Energy consumption (range)
- Heating load
- Charge profile
- Run-outs



## Depot visits:

- Charger locations
- Charging logistics (parking)
- Power demand vs. supply
- Existing site plans
- Timing to route start



## Execution:

- Buses
- Chargers
- Grid connection
- Civil engineering
- Training
- Service



Turn-key solution delivered through an ecosystem of providers



Scottish and Southern  
Energy



Range calculations use predicted energy storage capacity after 10 years service



Connect  
Collaborate  
Influence



# Challenges

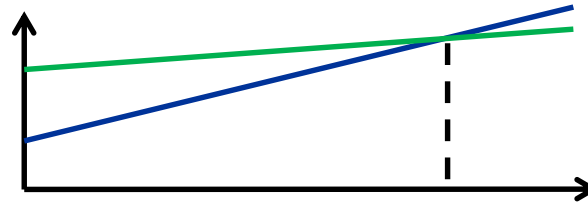


**Diesel Fuel >> Electricity**  
(lower energy costs)



**Energy Consumption**  
(different consumption model)

Purchase decision must take a long term view and be based on Total Cost of Ownership (TCO)



**Infrastructure**  
(new up-front costs)



Department  
for Transport

**Complex subsidies & rebates**  
(e.g. BSOG)



**Residual Value**  
(no precedence in the market)

# Thank you