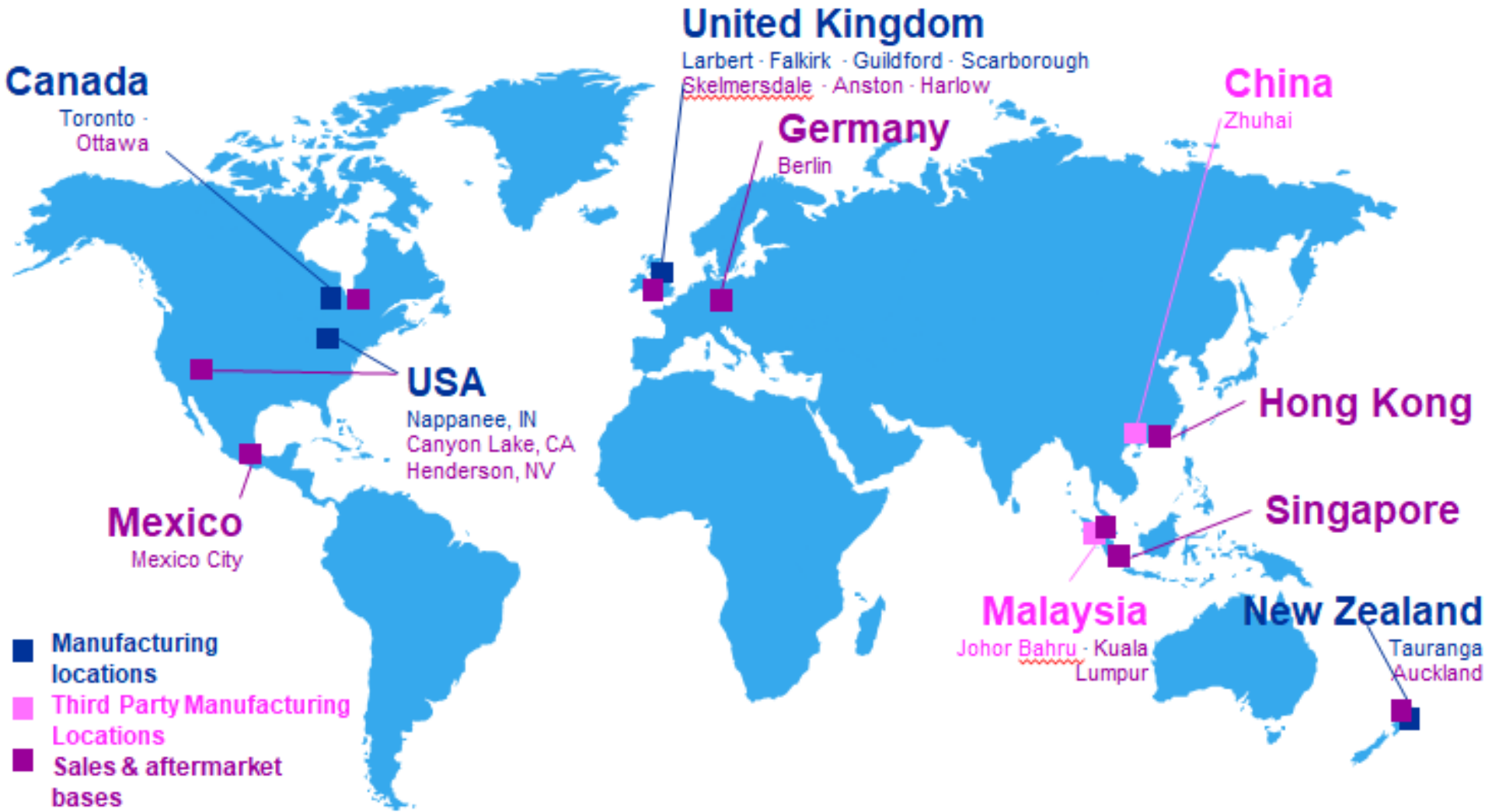


# Alexander Dennis & Electric Buses

# Growing our Global Footprint

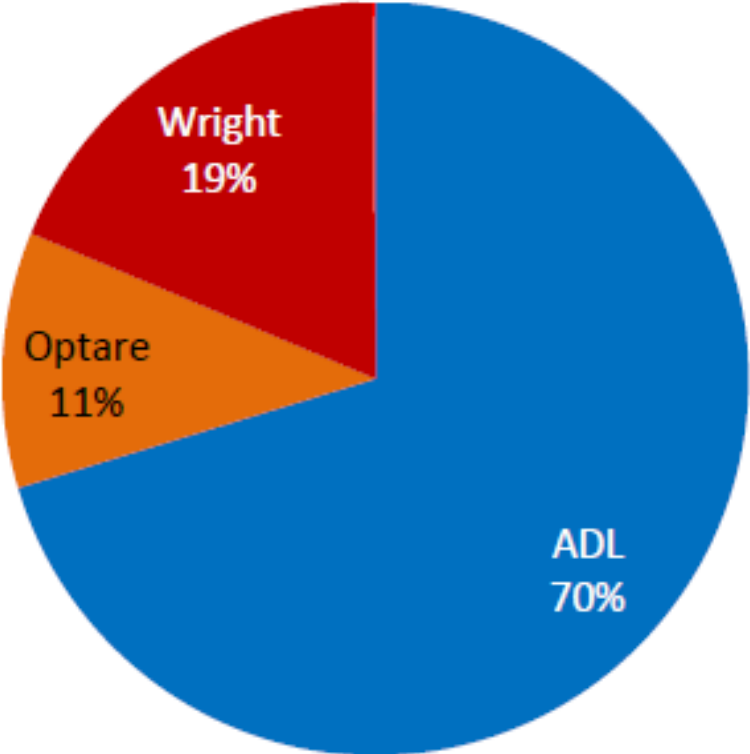


# Proud to be British

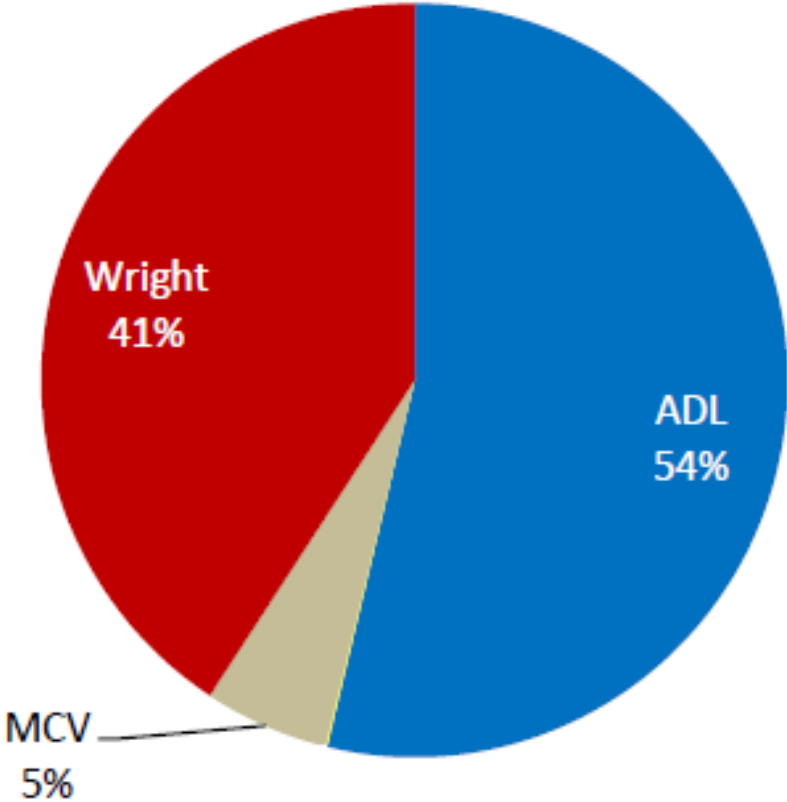


# UK Market Share 2018 by Body

## Midi

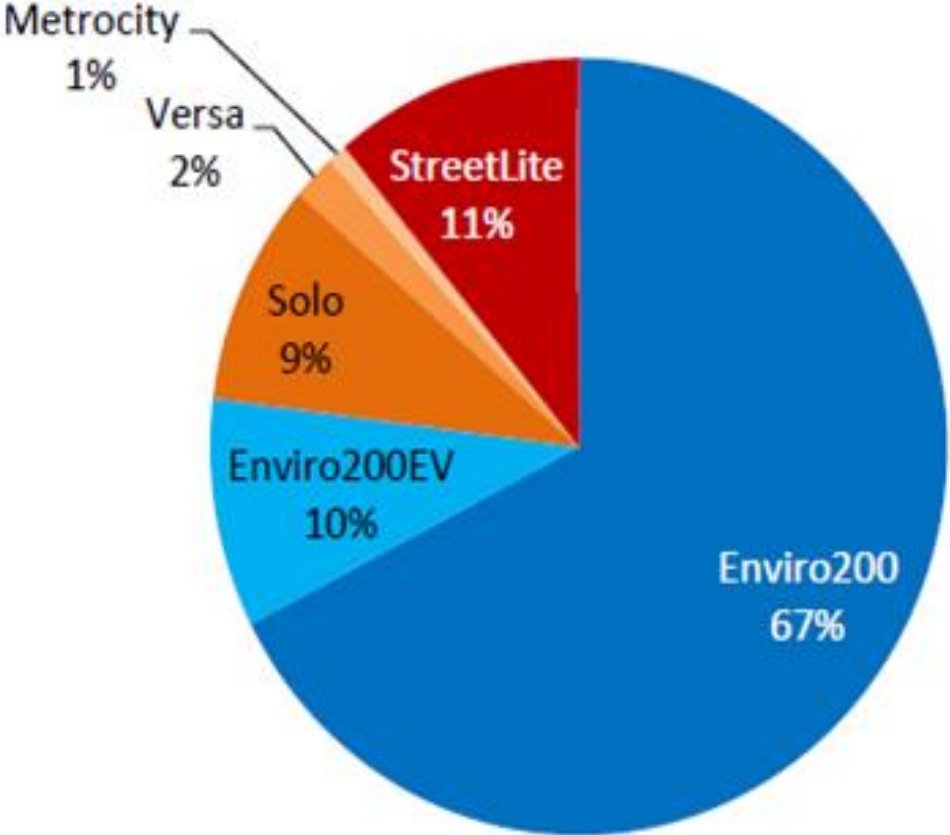


## DD

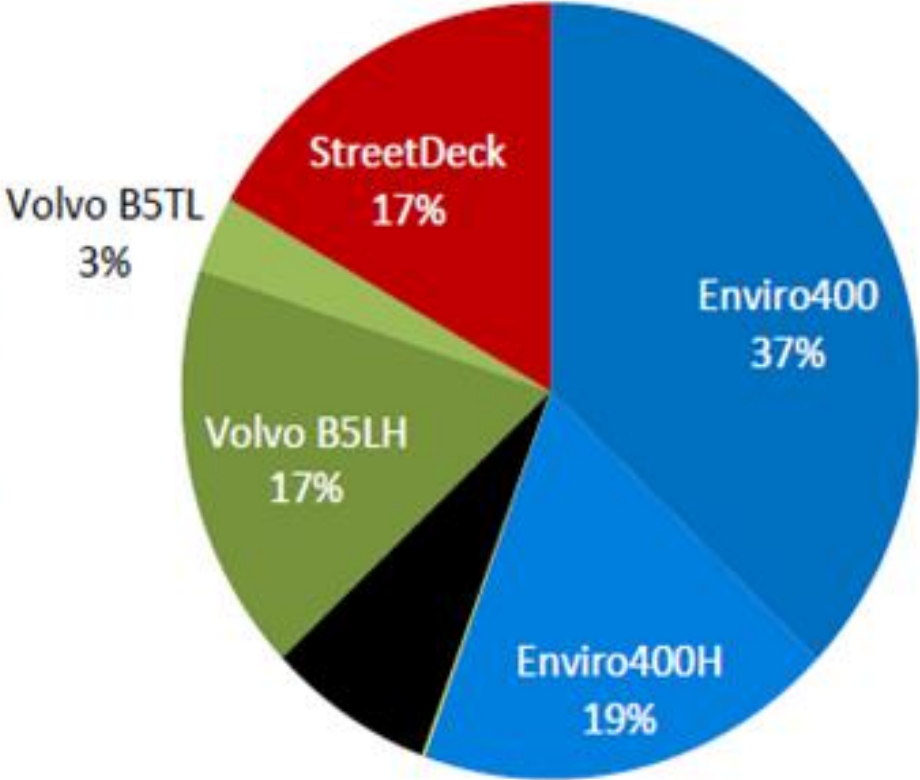


# UK Market Share 2018 by Chassis

## Midi



## DD



# Product Portfolio – Bus



## Single deck Enviro200

- 8.9–12.7m length
- 12t - 14t GVW
- Up to 45 seated passengers
- Light-weight, fuel efficient
- Over 17,000 produced



## Double deck (2 axle) Enviro400

- 10.3–11.5m length
- 4.2–4.3m height
- 18t GVW
- Up to 86 seated passengers
- Light-weight, fuel efficient
- Over 10,000 produced

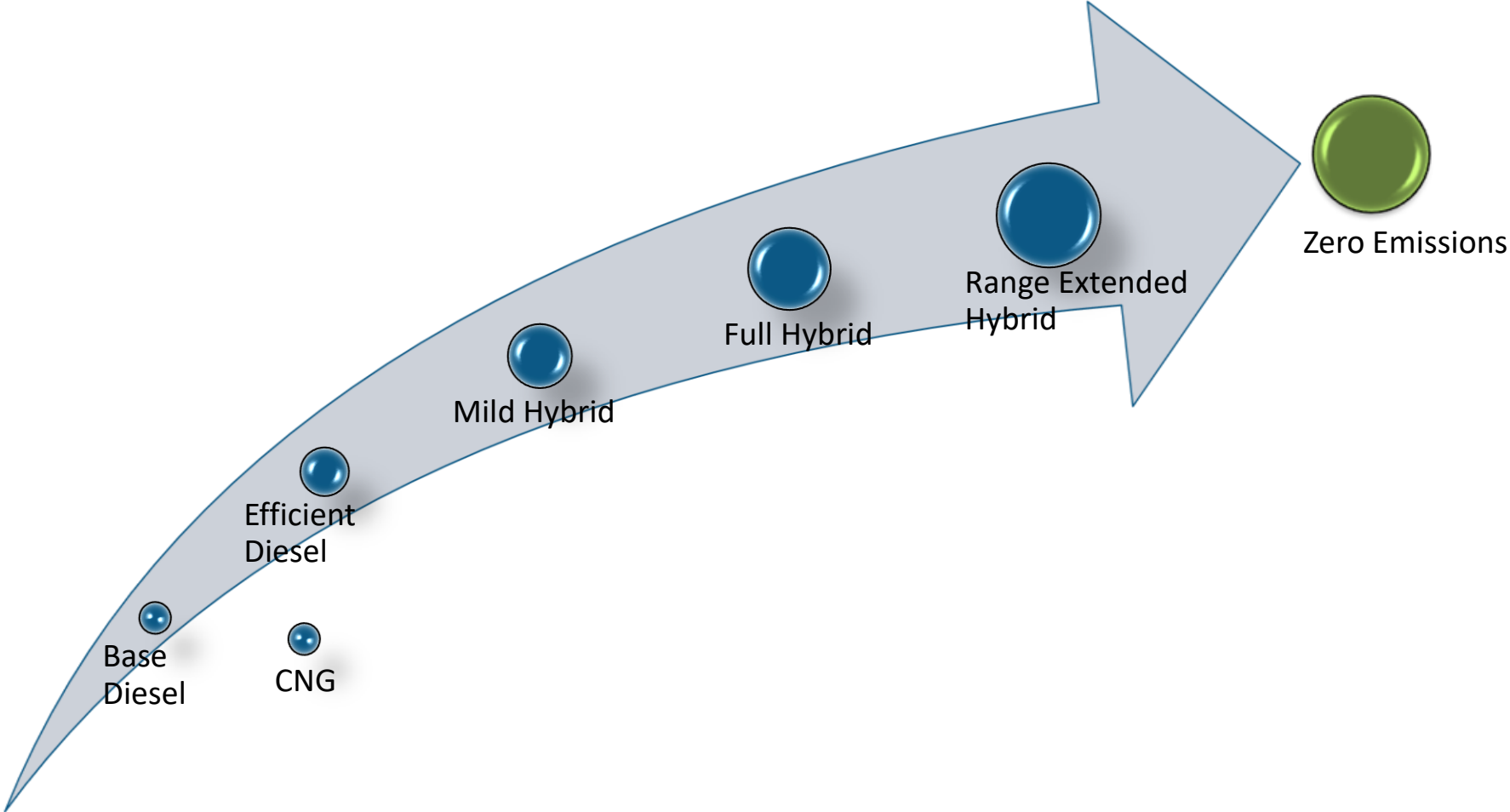


## Double deck (3 axle) Enviro500

- 11.3–14.0m length
- 3.9–4.4m height
- Up to 26.5t GVW
- Up to 98 seated passengers
- Lowest cost per seat
- Over 6,000 produced



# Powertrain Portfolio



# Efficient Diesel

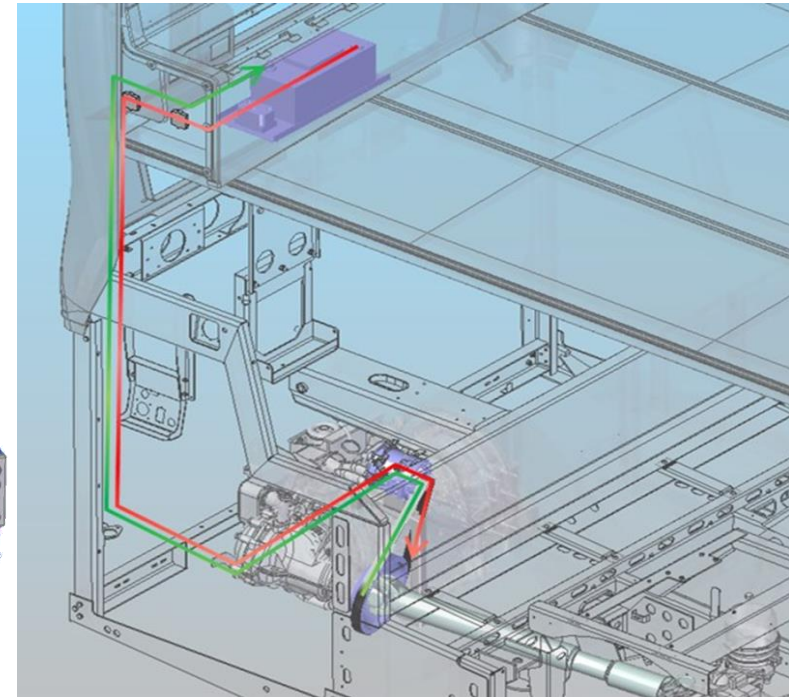
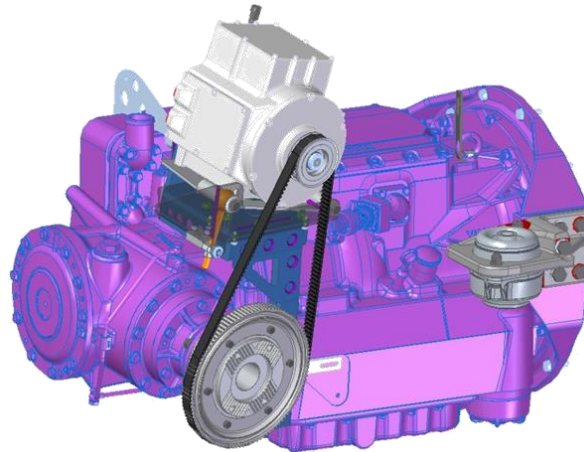
- Initially developed to meet the UK's Low Carbon Emitting Bus (LCEB) certification, administered by the LowCVP
- SmartPack:
  - E-cooling – electric radiator and CAC fans for greater control and efficiency
  - Smart Accessories – standard alternator and air compressor controlled to only charge during vehicle deceleration
  - Stop/Start – automatic engine off when stationary, and restart on pull-away
  - Lightweighting – structure optimisation for mass reduction and efficiency improvement
- CO<sub>2</sub> savings of 18% over an equivalent Euro V
- Class leading air quality performance (near zero NO<sub>x</sub>)





# Mild Hybrid

- SmartHybrid is a 48V hybrid system, it recovers kinetic energy during vehicle deceleration, stores it on-board, and uses it to provide a torque assist to the driveline when required
- SmartHybrid builds on SmartPack, adding the 48V hybrid system and EPAS
- Storage is capacitor based rather battery for better TCO
- CO<sub>2</sub> savings of 22% over an equivalent Euro V
- Excellent air quality performance, near zero NO<sub>x</sub>



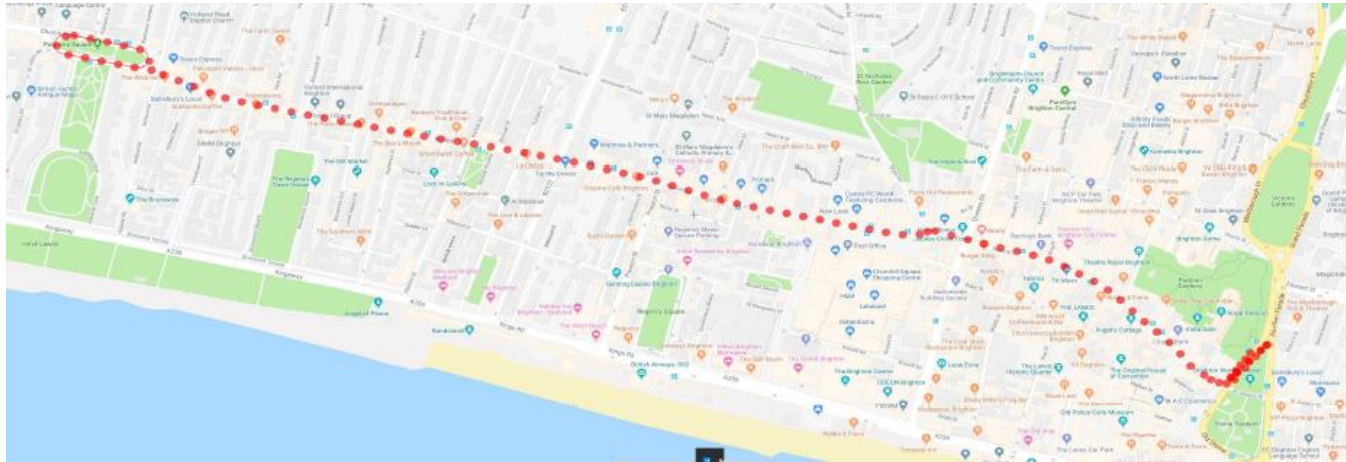
# Full Hybrid

- BAE Series-E, utilises series hybrid architecture with an ultracap energy store
- Initial tests have shown positive CO<sub>2</sub> (34% saving over equiv Euro V) and NO<sub>x</sub> performance, resulting in TfL approval
- The Series-E system has the same capabilities as previous generations, including Arrive&Go, but no ZE range beyond that
- E400H Series-E was the first vehicle to achieve ULEB certification



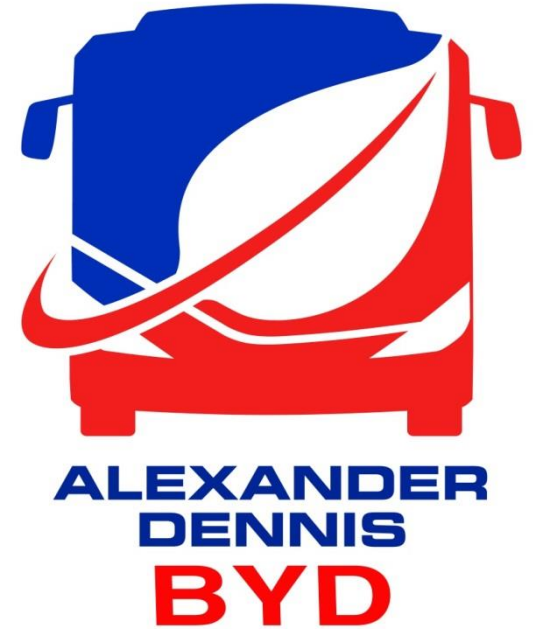
# Range Extended EV

- BAE Series-ER, utilises similar series hybrid architecture to the Series-E, but with a 32 kWh battery energy store
- Capable of up to 10km of zero emission operation
- NOx emissions are no worse than a standard hybrid
- Brighton & Hove have ordered up to 47, operating in zero emissions through their 2.2km LEZ



# ADL BYD Partnership

- ADL currently commands 60+% of the UK bus market
- BYD ADL Partnership commands 70+% of the UK electric bus market
- Joint desire to maintain and grow market presence in the face of increasing competition





# E500 13ft6 EV

- Vehicle in development for USA based on E500MMC 13ft6
- Order received, 2 pilot vehicles for customer in California
- Passenger capacity approx. 86
- 150 – 180mile target range
- Battery system being developed with Proterra, 660kWh capacity
- 2 speed drive axle in development with AxleTech
- First vehicles to be delivered Q4 2019



**PROTERRA**



**ALEXANDER  
DENNIS**

# E400 FCEV

- 25 x E400 FCEV for an OLEV funded project in partnership with Arcola, BOC, and Liverpool City Region
- Delivery by March 2020



*Liverpool City Region Metro Mayor, Steve Rotheram, with a hydrogen-powered bus*

**Fleet of zero-carbon hydrogen-powered buses coming to Liverpool city region**