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Sustainable road transport: What are the options for decarbonising long-haul road freight?

Charging Ahead: The Electrification of Transportation Infrastructure

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Start with the Low Hanging Fruit!

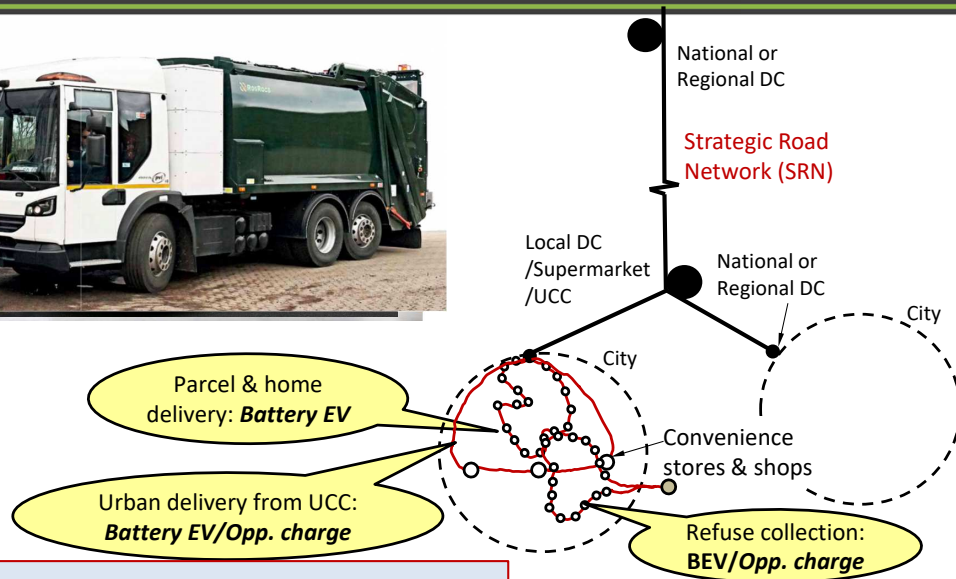
1. Engineering
 - Tyres, aerodynamics, light-weighting
 - Driver performance
 - Higher-capacity vehicles
 -
2. Logistics
 - Collaboration / information sharing
 - Relaxing time constraints
 - Reducing demand
 - Vehicle fill
 - ...

Not sufficient for 'Near Zero' ...Change energy source:

→ Electricity or Biofuel or Hydrogen?



Urban Freight



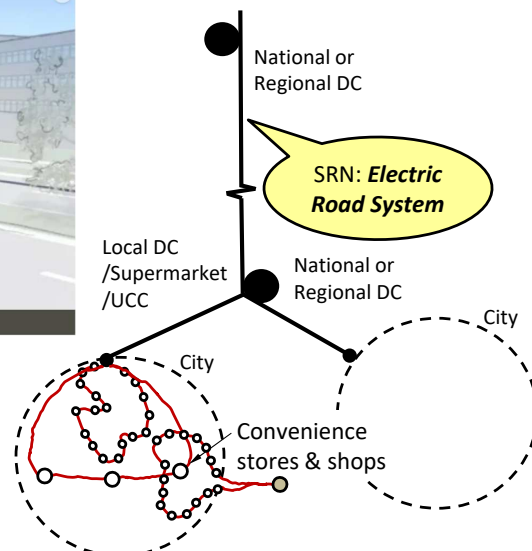
- Rolling-out now...
- Building technologies and supply chains for higher capacity BEVs



Electrification of Strategic Road Network

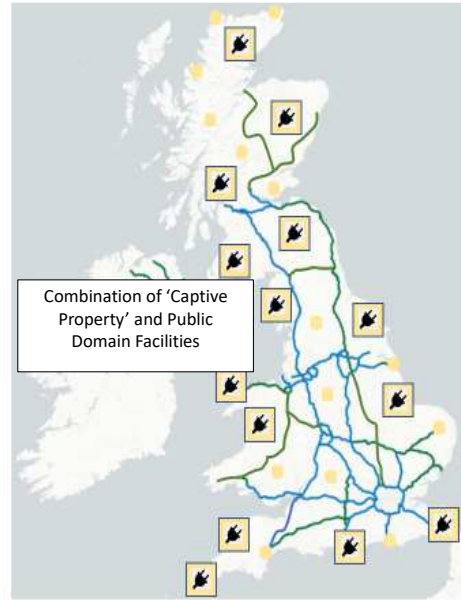
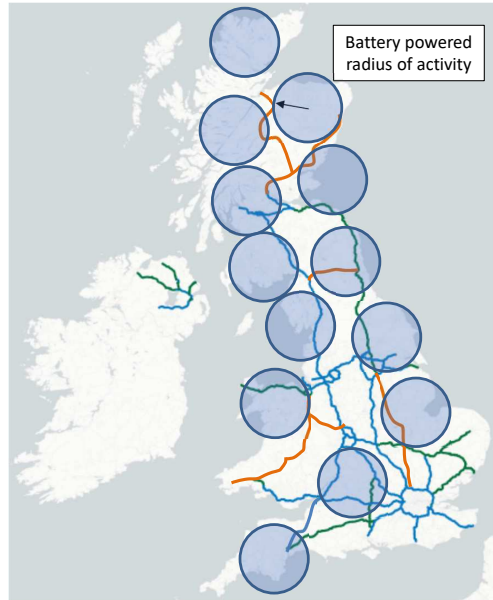


Graphics: Peter Nyrell

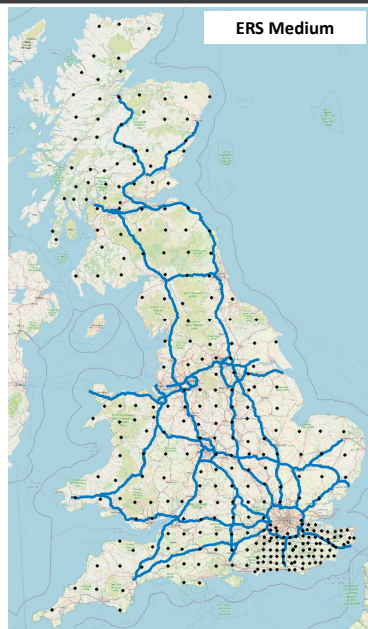
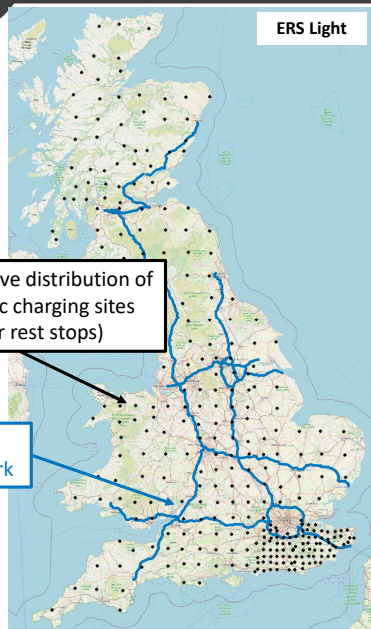




The Network Design Challenge

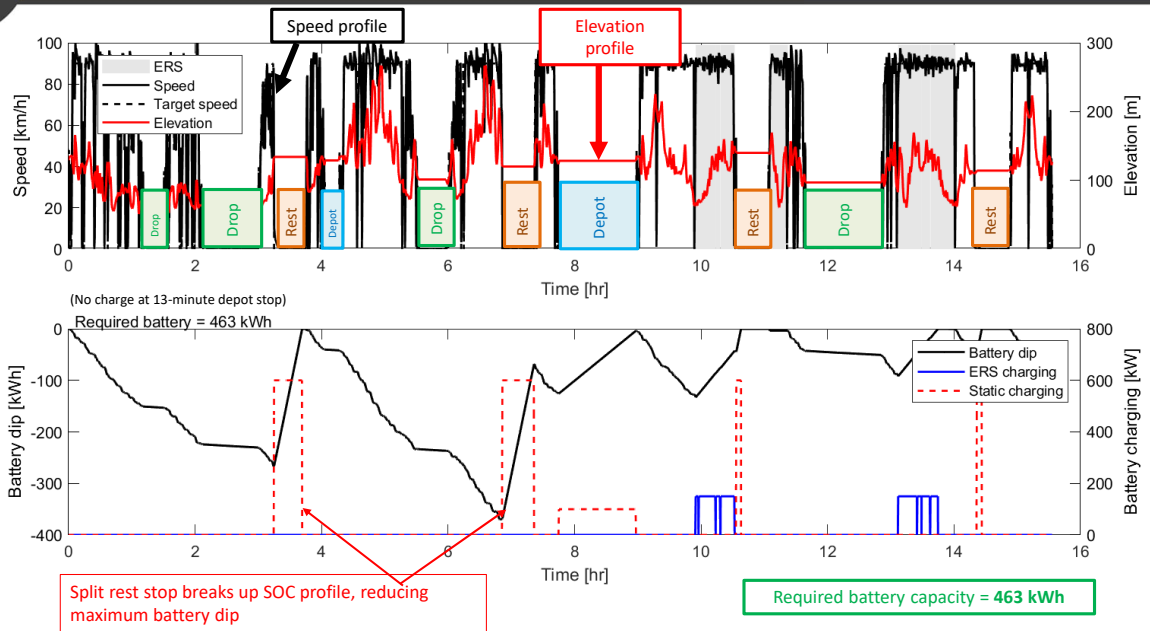


ERS Scenarios





Scenario: ERS Light + BEV rest stop charging



Logistics journey simulations

Operator H	Required battery capacity (kWh)			
	ERS topography			
	None	Lite	Medium	Heavy
No static charging	1666	1043	290	224
Charge at drop-off sites (600 kW)	397	243	103	81
Charge at public rest stops (600 kW)	794	794	290	224
Charge at both drop-offs/rest stops	388	240	103	81



No ERS

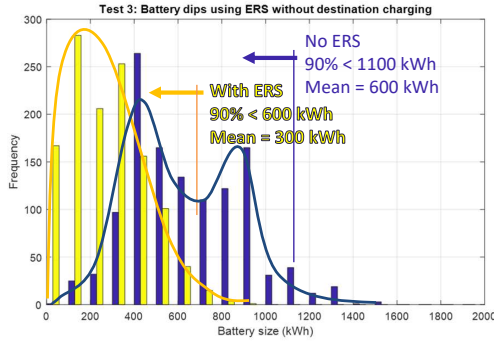
ERS Lite

ERS Medium

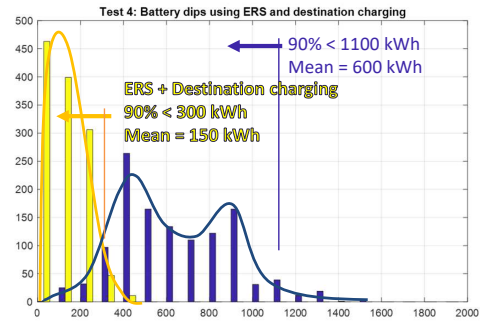
ERS Heavy



Batteries for Challenging Journeys



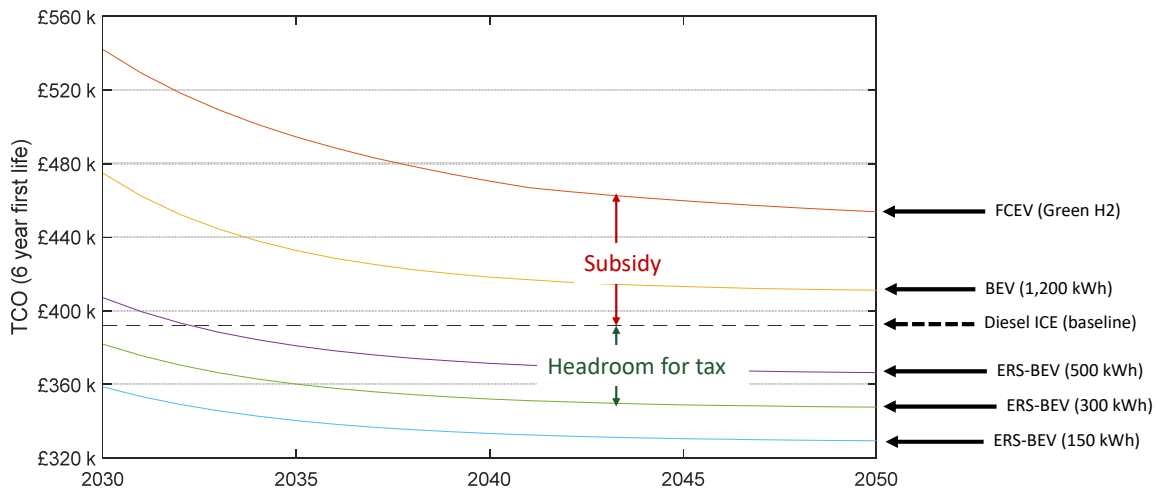
Battery size with and without 'Light' ERS



Battery sizes with 'Light' ERS and destination charging



Total Cost of Ownership (TCO)





Conclusions

1. **Hydrogen will always be too expensive:** CapEX x 2; OpEX x 3
2. **Battery Electric Vehicles (BEV)**
 - 42t BEVs are **available now**, but with substantial payload loss 29t → 22t
 - Weights and dimensions changes need to get to 44t
 - **MegaWatt charging standard (MCS)** is coming soon
 - **Electric logistics is doable** at a cost... improved by ERS.
3. **Charging is the challenge!**
 - Truck Stop Charging is necessary, but not sufficient.
 - Warehouse Charging is essential to reasonable journey durations.
 - Electricity supply to warehouses is very challenging - major infrastructure issue
4. **BEV + ERS**
 - **Lowest cost**, lowest carbon, lowest weight
 - **Reduces battery size/cost/weight** by ½ to ¼
 - **Eliminates loss of payload** on 40% of trucks
 - Headroom for fuel tax recovery by Government
 - **Eliminates most static charging and 000's of warehouse grid connections**



Perfect for decarbonising aviation too...

