



Building a business model for Low Carbon Vehicles

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Matthew Trevaskis

Head of EV, Renewable Energy Association

GROWING THE RENEWABLE ENERGY & CLEAN TECHNOLOGY ECONOMY



Introduction

- Driving EV since 1999.
- EV consultant since 2005.
- Infrastructure project (OLEV)
- Training/support OEM brands.
- EV fleet design.



Why EV? Low carbon AND cleaner air



- De-carbonisation should be hand-in-hand with improvements
- UK aim for (nearly) all new vehicles to be zero emission by 2040.
- Nowhere more important than in our major cities – and other proposed Clean Air Zones (CAZs)
- Transport is now the UK's biggest emitter of carbon (CCC)
- T-charge introduced in London on top of Congestion Charge.
- Are we just displacing the carbon/emissions problem...

2017 energy milestones in UK

- 21st April: “No coal day” – first time in 130 years.
- 26th May: Record solar PV output: 24.3% of grid (8.7GW) at 1pm.
- 7th June: First time ever where >50% of UK energy is renewable: wind, solar, hydro and biomass. (50.7%)

Increasingly de-centralised grid.

Increasingly variable generation.

Renewable Transport Fuels Group

Dealing with the existing fleet / hard-to-change vehicles:

- Bioethanol (E5, E10...)
- CNG / Biomethane
- Alternative liquid fuels (e.g. advanced biodiesels)



Back to the future...



EV market



PHEV (Plug-in Hybrid Electric Vehicle) market



Limited electric range (circa 30 miles).

Benefit-in-Kind savings.

Possibly good fuel economy, depending on duty cycle.

Case Study 1: NHS – Renault ZOE fleet



£525k Cap Ex 15x Renault ZOE 22kW AC charging
Repaid Cap Ex in 3 years 12 nurses salaries annually

Charging EVs – highway

Strategic network of Rapid Charging

Currently: 50kW

Near-term: 150kW

Longer-term: 350kW



Referenced in Automated & Electric Vehicles Bill

Local grid issues to support multiple high power connections:
requiring energy storage and/or on-site renewables?

Charging EVs –

IONITY



400x 350kW across Europe by 2020

Charging EVs – MSA/TRSA



World class exemplars in UK



12 Nissan LEAF + 1 e-NV200
3 vehicles retired at 165,000 miles.



Commercial Electric Vehicles

December 2017: ~125,000 ULEV registrations.
Currently <5% Light Commercials (LCVs)

Ford Transit 'Range Extender' trial (20 vehicles)

'Full EV' is improving with better batteries:

- Better range: 100+ real-world miles.
- Larger EV vans (factory produced models)
- Good option for vans and smaller trucks if duty cycle known.
- Rapid Charge capability to extend daily range.



Commercial Electric Vehicles



24kWh -> 40kWh

NEDC: 106 miles -> 174 miles



22kWh -> 33kWh

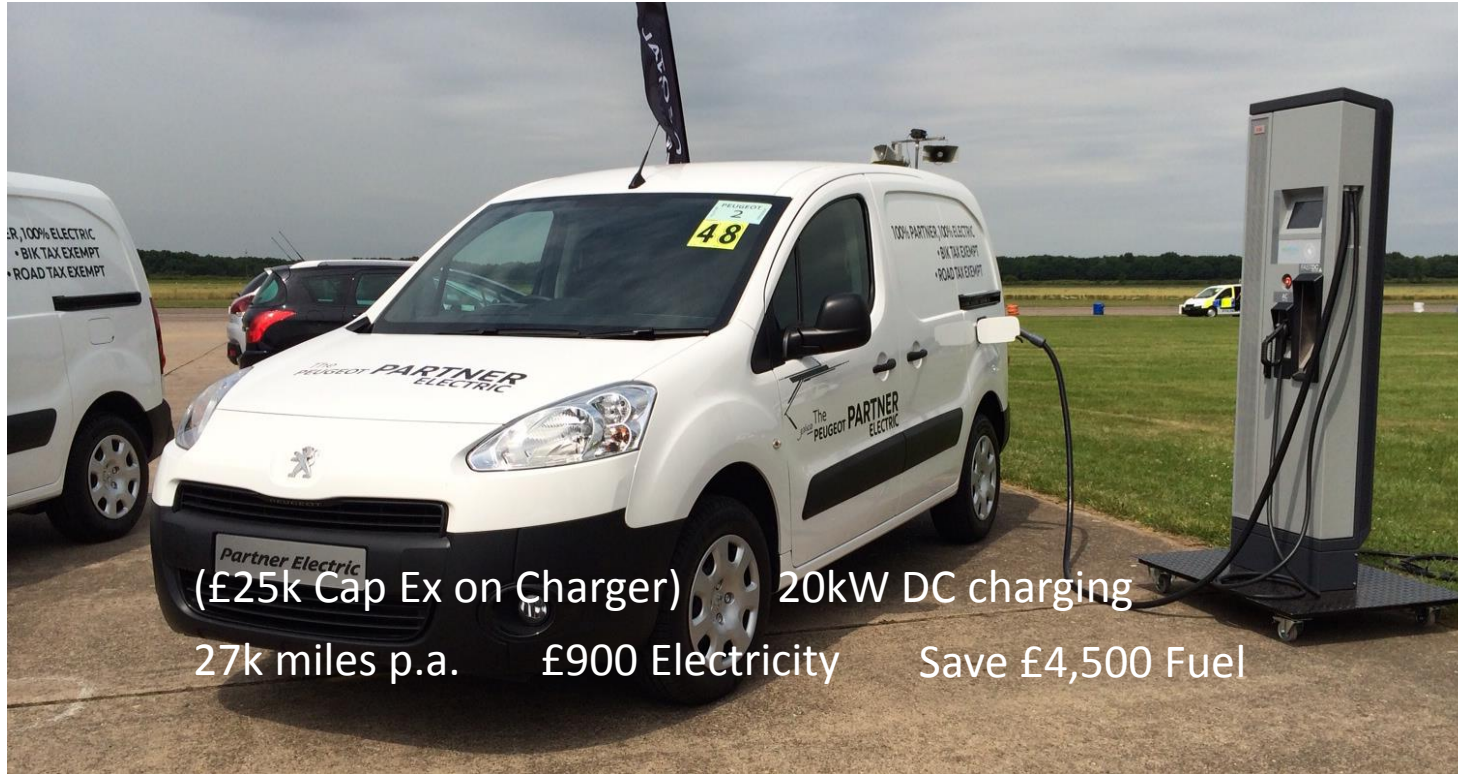
NEDC: 106 miles -> 170 miles

Commercial Electric Vehicles

- Peugeot Partner Electric
- Citroën Berlingo Electric



Case Study 2: Peugeot parts delivery



(£25k Cap Ex on Charger) 20kW DC charging
27k miles p.a. £900 Electricity Save £4,500 Fuel

Total Cost of Ownership

- Longer operating lifetime on fleet vehicles anyway
- Strong warranties
- e.g. 8 year lifetime
ICE: fuel+servicing+RFL
same as purchase cost
EV: lower TCO overall.
- Potentially lower project cost including charging infrastructure



Total Cost of Ownership



Servicing:	£ 197	£ 197	£ 517	£ 384	£ 380	50k/4yr
Residual Value:	10%	10%	20%	20%	20%	
Residual Value:	£ 2,130	£ 2,130	£ 2,609	£ 2,883	£ 2,749	
Congestion Charge:			£ -	£ -	£ -	
Total Cost of Ownership:	£ 15,057	£ 14,515	£ 21,524	£ 18,907	£ 19,037	per vehicle
Fleet size:	5	5				
	£ 75,286	£ 72,575	£ 107,618	£ 94,533	£ 95,186	Total cost for

	H	I	J	K
Duty cycle				
Daily Mileage	29	5	days/week	
Annual Mileage	7,540			
Operating term	8	years		
Total mileage	60320			
Congestion Charge	£10.50	per day	<input type="checkbox"/> Select	
Energy costs				
Energy cost	7.5	p/kWh	e.g. 7.6p	
Energy efficiency	2.8	miles/kWh	Spread: e.g. 2.0-5.0	
(Range)	70	miles)	circa 70-90 miles	
Cost per mile	2.7	p/mile		
Petrol costs (Official: 34.0mpg Urban / 43.5mpg Combined)				
Fuel price	£ 1.10	/litre		
Fuel efficiency	30	mpg	real world	
Cost per mile	16.6	p/mile		
Cost ratio	6.2	:1 cheaper as Electric		
Diesel costs (Official: 44.8mpg Urban / 51.4mpg Combined)				
Fuel price	£ 1.10	/litre		
Fuel efficiency	40	mpg	real world	
Cost per mile	12.5	p/mile		
Cost ratio	4.7	:1 cheaper as Electric		

EVs, Renewables & Energy Storage



V2G – Vehicle 2 Grid



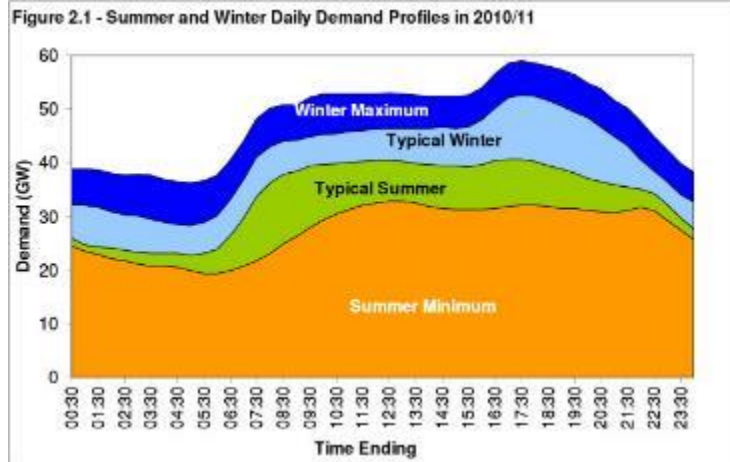
Charging EVs

Issues with local grid (customer side of transformer)

- Electric Avenue / Electric Nation projects

DNO's grid in an area of clustering (11kV/33kV)

Overall energy supply and demand nationally





THANK YOU

Matthew Trevaskis

mtrevaskis@r-e-a.net

