## Electric Vehicles

What do you need to know to keep one on the road?





# Benefits Overview

## Benefits of Electric Vehicles (EVs)

- More than 20 manufacturers are bringing or have brought electric cars to market
- Improve the environment
- Lower running costs
- An improved driving experience
- Opportunity for free parking
- More convenient refuelling (charging)



## Improved Environment

- No tailpipe so no exhaust gases
- Better air quality
- City Clean Air Zones designed to discourage polluting vehicles are generally charge free for EVs
- Eg London's Ultra Low Emission Zone is free for registered EV users
- EVs are much quieter than petrol & diesel vehicles so noise pollution is greatly reduced; in fact they are too quiet so require an AVAS (Acoustic Vehicle Alert System) to signal their presence to pedestrians

## **Environmental Impact**

- Positive
  - No CO<sub>2</sub> emissions when driving; over a year, 1 electric car can save on average 1.5 tonnes of CO<sub>2</sub> equivalent to 4 return flights from London to Barcelona
  - Noise pollution is reduced particularly in cities where speeds are low
- Negative ?
  - Making EVs uses a lot of energy and emissions created during production tend to be higher than for an ICE vehicle; primarily due to manufacturing lithium batteries
    - More than a 1/3 of the lifetime CO<sub>2</sub> emissions from an electric car come from the energy used to make the car itself – this should reduce with technology advances
    - Reusing and recycling batteries is a growing market
  - Electricity generation required to fuel an EV creates pollution but around 17-30% lower than compared with driving a petrol or diesel car



## Running Costs I

- EVs are cheaper to run when compared to petrol or diesel
- On average an electric car costs £2 to drive 100 miles whilst a petrol equivalent car would cost £11.60 for the same distance
- Zero road tax
- Fewer moving parts so EVs need less maintenance and servicing is simpler



## Running Costs II

- The cost of running an EV varies depending on the model, make and vehicle specifics
- However EVs are likely to cost less over the period of ownership; electricity costs much less than petrol or diesel and there is less maintenance compared with an ICE vehicle
- Incentives:
  - Government grants
  - Vehicle excise duty discounts or exemption
  - Fuel duty exemption
  - Usually free driving into and through Congestion Charge and Ultra Low Emission Zones



## Driving & Parking



- 3 advantages of driving an EV versus an ICE (internal combustion engine) vehicle
  - Instant torque from the electric motor giving high and responsive acceleration
  - Regenerative breaking when easing off the accelerator which feeds back into the battery adding to efficiency
  - Weight and distribution of the batteries with a low centre of gravity benefits handling, control and safety



## Refuelling (Charging)

- No need to go to a petrol station
- Just charge wherever there's an appropriate electrical socket or plug
  - At home
  - At work
  - In public places such as car parks

## Charging Options

- Charging costs at a public charge point depends on the charge point network and the charge point location; many local authorities offer a pay per session approach to on-street chargers. Occasionally they can be free to use if you have paid a network subscription.
- Public charge point costs vary depending on the power rating and whether it's:
  - Slow (lamp post charging)
  - Fast (car park charging) or
  - Rapid (at motorway services)
- Rapid charge points are typically at motorway services and are generally a more expensive option because they can typically charge an EV to 80% in 20-40 minutes
- Alternatively charge at home using an EV electricity tariff



### Recap

- Do you get the sense that the preceding has just scratched the surface of a really complex, perhaps even an unnecessarily complex, system? Or are we just in unfamiliar territory?
- Well much of the preceding is promotional 'propaganda' with lots of promise of:
  - Improving
  - Reducing
- But the devil is in the detail!
- Before you can even consider charging an EV you need to appreciate the different charger connection types, their interaction with the different charging options and associated costs



## Charging in more detail

## Charger Connection Types I

CHAdeMO 50 kW DC



CCS 50-350 kW DC



Type 2 43 kW AC



Tesla Type 2 150 kW DC



- Rapid DC Chargers provide power at 50 kW & use CHAdeMO or CCS connectors
- **Rapid AC Chargers provide power** at 43 kW & use Type 2 connector.
- Rapid AC units are typically able to charge an EV to 80% in 20-40 minutes depending on battery capacity and starting state of charge
- Many are located at motorway service stations

Type 2 -7-22 kW AC





Commando -7-22 kW AC



- Fast chargers are typically ٠ rated at 7 kW or 22kW with the vast majority AC but some networks use 25 kW DC with CCS or CHAdeMO connectors
- A 7kW charger will recharge a 40kWh battery in 4-6 hours
- A 22kW charger will recharge a 40kWh battery in 1-2 hours
- Usually located in car parks, supermarkets & leisure centres
- Majority are 7kW untethered





## Charger Connection Types II



- Slow charging is very common for overnight at home and provide power at 3 – 6 kW
- BUT using a standard 3-pin socket is not recommended because of the higher current demands of EVs and the longer time spent charging
- Alternative connectors are Type 1, Type 2 or Commando
- Typical charging times are 6-12
   hours



## Charger Connection Types III

Slow chargers

٠

٠

٠



Fast Chargers



Rapid chargers



- The choice of connectors depends on the charger type (socket) and the vehicle's inlet port
- European EV models (Audi, BMW, Renault, Mercedes, VW and Volvo) tend to have Type 2 inlets and the corresponding CCS rapid standard, while Asian manufacturers (Nissan and Mitsubishi) prefer a Type 1 and CHAdeMO inlet combination
- However Asian manufacturers are increasingly switching to European standards for cars sold in the region
  - Hyundai and Kia plug-in models feature Type 2 inlets, and the pure-electric models use Type 2 CCS
  - The Nissan Leaf has switched to Type 2 AC charging for its second-generation model, but has retained CHAdeMO for DC charging

 Most EVs are supplied with two cables for slow and fast AC charging; one with a three-pin plug and the other with a Type 2 connector charger-side, and both fitted with a compatible connector for the car's inlet port

Charging connector type	Power rating	Approx. range per 30 mins of charging	Charging cable features
UK three pin plug	2.3-3 kW AC Single Phase (Standard Charge)	5 Miles	Standard UK domestic electricity outlet     Not designed for prolonged use needed to fully charge an electric car     Very slow charging with maximum power output of 3 kW
Type 1	3-7 kW AC Single Phase (Slow/Fast Charge)	12 Miles	<ul> <li>Only available in single phase</li> <li>Less common in modern electric cars</li> <li>Has no locking mechanism when car is connected to supply</li> </ul>
Type 2	<b>3-43 kW AC</b> Single Phase/Three Phase (Fast Charge)	75 Miles	<ul> <li>Is becoming the standard European electric car charging cable connector type</li> <li>Compatible with both single and three phase electricity supply</li> <li>Has an in-built locking mechanism when connected to power supply</li> <li>Tesla has a 120 kW DC version of type 2</li> </ul>
CHAdeMO	50 kW DC Three Phase (Rapid Charge)	85 Miles	<ul> <li>Is the older type of charging cable connector for rapid charging</li> <li>Is compatible with Japanese vehicle manufacturers</li> <li>Is the most common rapid connector type due to the popularity of the Nissan Leaf</li> </ul>
Combined Charging System (CCS)	50 kW - 350 kW DC (Rapid Charge)	85 - 200 Miles	<ul> <li>Is the most versatile rapid charging connector</li> <li>Likely to become the most popular DC connector standardisation</li> <li>Enables a higher power rating to support larger ultra rapids chargers</li> </ul>

## Charger Connection Types IV

Charger Types How Electric Vehicles work

## CHARGER TYPES AND CHARGING

You can charge an electric vehicle either by plugging it into a socket to take electricity from the grid or by plugging into a charging unit. There's plenty of charging stations around the UK to stay fully charged while you're out and about.







THREE PIN PLUG A standard three-pin plugged that you can connect to any 13 amp socket.

FAST

SOCKETED A charge point where you can connect either, a Type 1 or Type 2 catrle.

TETHERED A charge point with a cable attached with either a Type 1 or Type 2 connector.

8-10

HOURS

\$ 0 8



Typically rated at either 7kW or 22kW lend to be installed in ser parks, super-markets, leisure centres and houses with off street parking.

RAPID Typically cated from 43kW. Only compatible with EVs with repid-charging capability.

#### CHARGING UP IN CHANGING SEASONS

The weather affects how much energy your electric car consumes. You have a larger range in the summer and a smaller range in winter.



SOURCES http://www.lap-nap.com/damp-painto/convertors-speeds http://www.lap-nap.com/damp-points http://www.lap-nap.com/damins CHARGING ON THE GO

NEW DEVICES ADDED TO THE ZAP-MAP DATABASE

OVER THE LAST 30 DAYS"

30-60

Don't forget to download the Zap-Map app to find the review change station when you're out and about.

3-4

HOURS

9,69

LOCATION OVER THE LAST YEAR (SEPT 18 - SEPT 19)\* \*27/09/2019 ZapMap stats

### Chargers – Tethered or Socketed?



- Has a long cable attached to the charging station
- Available with either Type 1 or Type 2 connector
- Most newly manufactured EVs in the UK come with a Type 2 connector
- Disadvantage limited to vehicles with the same connector Type



#### Socketed charge point

- No cable attachment so essentially a dedicated charging station fitted with necessary safety devices to protect the user, the car and the home's main fuse board
- All EVs with a fast charging cable can be accommodated so not limited to vehicles with a particular connector type

## EV Batteries I



How Electric Vehicles work

Kilowatts (kW) is a unit of power (how much energy a device needs to work). A kilowatt-hour (kWh) is a unit of energy (it shows how much energy has been used).



For example: A 100 watt light bulb uses 0.1 kilowatts each hour.

What's the annual energy consumption of an average household vs. the annual energy consumption to charge an EV at home?





#### START. STOP. START. STOP.

The kinetic energy caused by braking usually goes to waste. However, regenerative braking converts and stores thermal energy from the brake pads and tyre's heat friction and reuses it to power the car.



SDURCES.

http://www.uwennenergy.com/wwmrg-owter/pol/the-kilo-watt-tp:-for-understanding-your-electricity-usage/ http://wecteek.co/2018/04/24/regeneratue-braking-how-th-works.

## EV Batteries II

- A Lithium-ion (Li-ion) battery is rechargeable and used in EVs as well as several portable electronic devices
- Li-ion batteries have a higher energy density than lead acid or nickel-cadmium rechargeable batteries so minimising the battery pack size
- Li-ion batteries are safer than many alternatives eg there are safety features to protect batteries during repeated rapid charging sessions in a short period of time
- EV specific batteries will last for many years Nissan warrants their batteries will last 8 years or 100,000 miles and Tesla offer a similar guarantee
- However current prediction is that an EV battery will last 10-20 years before needing replacement
- Unlike Li-ion mobile phone batteries which typically have a life of a few years, EV batteries:
  - are 'buffered' so that the full amount of stored power cannot be used so reducing the number of cycles the battery goes through
  - have cooling systems



## EV Batteries III

- Once an EV battery has lost its capacity to power an EV it can be repurposed to:
  - Pair with a renewable energy source such as wind or solar
  - Power a home by contributing to a battery storage system
  - Power a business use such as fresh food counters and fridges in stores or provide back up cover to an events stadium eg Amsterdam ArenA for Ajax FC
- Replacement costs:
  - In the unfortunate event that a battery fails then beyond the warranty cover the prediction is that prices will fall to below \$100/kWh by 2030
- Recycling at the end of a battery's working life:
  - Separating out valuable materials eg cobalt & lithium salts, stainless steel, copper, aluminium & plastic



## Public Charging Networks I

- Some public charging examples:
  - Tesla Supercharger Network
    - Free for older vehicles
    - Vehicles bought after 1<sup>st</sup> January 2017 – 24p per kWh OR
    - Vehicles bought after 1<sup>st</sup> January 2017 – billed per minute of charging
  - Non Tesla owners need to register and subscribe to alternative networks
- Zap-Map & Open Charge help identify which charging network charging points are nearby
- Over 38,000 public charging points at 13,900 locations (22<sup>nd</sup> February 2021)



### Public Charging Networks II



## Public Charging Networks III – A Closer Look



- UK wide
- Rapid Charging
- Zap-Pay & Contactless Card

### ecotricity

Shell

Recharae

TESLA

- Rapid Charging at motorway
   services with a smartphone app
- Free Fast Charging with a RFID Card



- Lamp post / Bollard Installations in streets & car parks
- PAYG Credit/Debit Card Payments
- London area
- PAYG RFID Card Payments

- Rapid Charging at petrol station forecourts
- Requires app but not RFID Card
- Rapid Charging on motorways & trunk roads
- Fast Charging at hotels
- No app or RFID Card

## Public Charging Networks IV

- Network Access via:
  - Individual accounts
  - Loyalty & Radio Frequency Identification (RFID) cards
  - Contactless payments now encouraged for rapid chargers
- Cross network agreements:







### bp pulse subscription

#### Keeping you moving, wherever you are in the UK.

Enjoy the freedom of the open road: charge at over 7,000 bp pulse points at our best value charging tariffs. You'll get an access card and 24/7 365 support- all for just £7.85 (incl. VAT) a month.

Free charging	~
3 months free for all new members	~
Charging speeds to suit you	×
Flexible access	×
Access 150kW charging at our best tariffs	^

We're installing a network of bp pulse150 chargers on bp forecourts.



## Public Charging Networks - bp pulse

#### bp pulse contactless

On our pulse50 (50kW) and our pulse150 (150kW) units it is possible to use your contactless bank card, Apple Pay or Google Pay to start, pay for and stop a charge.

You can also use our network on an anonymous basis. Just drive up to one of our charging points and click the button below.

Charge as a guest







## Public Charging Networks V

Number of public charging points by speed (2011-to date)



Total connectors: 38191, Updated: 22 February 2021



## Public Charging Networks VI

Market share of UK charging points by network









## Public Charging Networks VII

Number of rapid public charging points by type (2011-to date)



Total rapid connectors: 9651, Updated: 22 February 2021



### Public Charging Points - Zap-Map near Bookham

Slow chargers



Fast Chargers



Rapid chargers





## Charging at Home I

- Charging at home is the main option for most EV owners so it is important to be on the best home energy tariff for your needs
- The charging cost added to the electricity bill depends on the amount of charging, the type of charger and how much charging is supplemented using public charge points
- A home charging point can be installed for about £1000 but reduced by £350 with a government grant
- An electricity tariff with off-peak pricing could be very advantageous if the EV is frequently charged overnight at home



## Charging at Home II

- Charging unit selection depends on:
  - Desired charging duration
  - Available power into the home
- Up to 7.4 kW power demand is typical
- A lower power demand (eg 3.6 kW) is cheaper but slower
- A 22 kW power demand offers a fast charge solution but generally requires a 3 phase supply
- Whilst most of the UK is served by a 3 phase network, most homes are only provided with a single phase supply so that an upgrade to receive a 3 phase supply may be needed







# Charging at Home III

## How do I know if I can get a home car charging point installed?

To have a home charge point installed for your car you need to have:

Dedicated off-street parking,

- Wi-Fi connection at your property or a SIM router with a 3G or 4G SIM (for Pod Point home chargers),
- Permission from your landlord (if you're renting),



## Electricity Costs at Public Charge Points

- Network access and electricity costs vary:
  - Hotels & shopping centres range from FREE to £1.50 per hour
  - Motorway service station rapid charger - £3 to connect for 45 minutes plus 30p per kWh
  - Shell station rapid charger 39p per kWh
- Regular charger users should avoid 'pay-as-you-go' and instead pay a monthly network subscription
  - Speeds up access and generally offers free or cheaper charging



### Electricity Tariffs for Homes I



## Electricity Tariffs for Homes II

#### GoElectric

EDF now has a range of zero-carbon tariffs, designed specifically for electric car drivers. Please see the unit rates below

#### Fixed pricing until January 2022

Direct Debit Rate Card	Electricity Unit Rates				Gas Uni	t rates						
GoElectric Jan22	GoElect	tric single-rate		GoElectric 9	98		GoElectric 35		Stand	lard		
Regions	Standing charge	Unit charge	Standing charge	Peak unit rate	Off peak unit rate	Standing charge	Peak unit rate	Off peak unit rate	Standing charge	Unit charge		
Eastern	28.70	14.21	28.70	19.52	9.00	31.85	17.42	4.50	26.07	2.917	GoElectric 35	GoElectric 98
East Midlands	27.09	14.61	27.09	20.77	9.00	30.24	18.67	4.50	26.07	2.862		
London	27.91	13.75	27.91	18.06	9.00	31.06	15.96	4.50	26.07	3.094	5 hours of cheaper off-peak charging every day	Half-price electricity on weekday evenings and
North Wales	26.84	14.85	26.84	21.55	9.00	29.99	19.45	4.50	26.07	2.999		all weekend
West Midlands	28.55	14.25	28.55	19.65	9.00	31.70	17.55	4.50	26.07	2.957		
North East	30.70	14.23	30.70	19.59	9.00	33.85	17.49	4.50	26.07	2.902	<ul> <li>Great for charging your car at night</li> </ul>	
North West	27.71	14.06	27.71	19.07	9.00	30.86	16.97	4.50	26.07	2.984	Pay just 4.5p per kWh during off-peak (12 am to 5 am	More flexibility for charging your car. Enjoy 98 hours of
South East	28.70	14.56	28.70	20.62	9.00	31.85	18.52	4.50	26.07	3.078	GMT every day) and from 15.96p per kWh during peak	off-peak charging every week - more off-peak hours than
Southern	27.27	14.13	27.27	19.25	9.00	30.42	17.15	4.50	26.07	3.115	hours	any other tariff
South Wales	28.22	14.83	28.22	21.48	9.00	31.37	19.38	4.50	26.07	2.946	Vou need to have a compatible smart mater	✓ Pay just 9p per kWh during off-peak (9 pm to 7 am GMT
South West	28.79	14.85	28.79	21.53	9.00	31.94	19.43	4.50	26.07	3.080	V Tou need to have a compatible smart meter.	Monday to Friday and all weekend) and from 18.06p per
Yorkshire	30.82	14.09	30.82	19.14	9.00	33.97	17.04	4.50	26.07	2.891		kWh during peak hours
North Scotland	30.73	14.09	30.73	19.14	9.00	33.88	17.04	4.50	26.07	3.007		You need to have a compatible smart meter.
South Scotland	28.14	14.18	28.14	19.42	9.00	31.29	17.32	4.50	26.07	3.007		
Description	The GoElect offers a comp all da	ric single-rate tariff petitive flat unit-rate iy, every day	The GoEle amount o 7am every	ctric 98 tariff o f off-peak hou weekday (GM the weeken	ffers the largest rs from 9pm to T) and all day at ds	GoElectric off-peal 12am to 5ai	35 tariff offers c price, every n m (GMT), sever	s our lowest ight from n days a week	GoElectric gas alongside all Go	s is available bElectric tariffs		



## Electricity Tariffs for Homes III

Tariff	Standing Charge	Unit Charge	Standing Charge	Unit Charge
Easy Online Renewal	24.50p	17.37p	26.08p	2.824p
Standard Variable	24.50p	17.67p	26.08p	3.089p
GoElectric 98	28.70p (+17%)	20.62p (+19%) / 9.00p (-48%)	26.07p (+0%)	3.078p (+9%)





## EV Charging Tips

- EV Charging Tips
  - Use a good home charger
  - Get a good electricity deal
  - Plan ahead with Zap Map or Open Charge
  - Check for a good mobile signal and use a smartphone for Network specific apps
  - Be polite and move off a charging point if there is enough charge to get to the destination



## How far can an EV go on a single charge?

- Depends on:
  - The car the more you spend the further you'll go!
  - How it is driven the faster you go the shorter the distance
  - The weather hot or cold puts extra stress on the battery
  - Using headlights
  - Using internal heating or AC
- Some approximate ranges:
  - Renault Zoe 394km (245 miles)
  - Hyundai IONIQ 310km (193 miles)
  - Nissan Leaf e+ 384km (239 miles)
  - Kia e Niro 453km (281 miles)
  - BMW i3 120Ah 293km (182 miles)
  - Tesla Model 3 SR+ 409km (254 miles)
  - Tesla Model 3 LR 560km (348 miles)
  - Jaguar I-Pace 470km (292 miles)
  - Honda e 201km (125 miles)
  - Vauxhall Corsa e- 336km (209 miles)

#### • EV range is increasing as battery technology improves





## Incentives



Government Incentives

- Electric Vehicle Homecharge Scheme (EVHS)
  - £350 off the cost of buying and installing an electric charger
- Workplace Charging Scheme (WCS)
  - A voucher based scheme offsetting the up front cost up to a maximum of £350 per socket
- On-street Residential Chargepoint Scheme (ORCS)
  - Provides a grant run by the Energy Saving Trust to local authorities towards the cost of installing on-street residential electric car chargers
- Plug In Car Grant
  - Up to £3,000 off the price of a zero emission car
- Vehicle Excise Duty
  - Zero



## A Changing World

#### Electric cars will leave hole in tax revenues, says Treasury

By Roger Harrabin BBC environment analyst

O 10 hours ago





Taxes must increase or services be cut to compensate for the loss of fuel tax income thanks to the advent of electric cars, the Treasury has admitted.

Officials have been long concerned about the future loss of more than £30bn in revenue from drivers.

In a **new review** the Treasury has acknowledged the problem in a way that will spark a debate about how driving should be taxed in the future.

One idea would be to charge motorists for every mile they drive.

But the AA says such road pricing will be tough to sell politically.

Instead, the motoring organisation is proposing a system of "Road Miles" in which motorists are allowed to drive free of charge for 3,000 miles (4,000 in rural areas) before they start paying.

## Just when you thought you knew the costs ...

### Public Charging Networks Review February 2021

10-80% charge for a BMW IX3 with an 80kWh b	attery (74kWh usable	capacity)		
Network and tariff	Monthly tee	Fee per charge	Cost per unit	Total cost
Source London Flexi (7.4kW)*	na	na	7.3p/min	\$40.66
Source London Flexi (22kW)*	na	na	13.3p/min	£38.79
Ionity (350kW)	na	na	69p/kWh	£35.74
Source London PAYG (7.4kW)	na	na	8.4p/min	\$35.28
Source London Full (7.4kW)	£4.00	na	5p/min	£25.00
Source London PAYG (22kW)	na	na	15.7p/min	\$22.18
BP Pulse subscription (150kW)	£7.85	na	27p/kWh	£21.84
BP Pulse PAYG (150kW)	na	na	42p/kWh	\$21.76
BP Pulse PAYG contactiess (150kW)	na	na	42p/kWh	£21.76
Shell Recharge (43kW, 50kW)	na	na	39p/kWh	\$20.20
ESB subscription London (50kW)	\$4.99	na	28p/kWh	£19.49
Source London Full (22kW)	£4.00	na	10.9p/min	£19.40
Osprey (22kW to 50kW)	na	na	36p/kWh	\$18.65
Instavolt (50kW)	na	na	35p/kWh	£18.13
Genlepoint London (43kW, 50kW)	na	£1.80	30p/kWh	£17.34
Char.gy PAYG (7kW)	na	na	33p/kWh	£17.09
Ubitricity SmartCable Membership (7.4kW)	\$7.99	19p	16p/kWh	£16.57
Genlepoint (43kW, 50kW)	na	£1.00	30p/kWh	£16.54
ESB contactiess London (50kW)	na	50p	30p/kWh	£16.04
Genle Point (7kW, 22kW)	na	50p	30p/kWh	£16.04
BP Pulse subscription (50kW)	£7.85	na	15p/kWh	£15.62
BP Pulse PAYG contactless (50kW)	na	na	30p/kWh	£15.54
Ecotricity (43kW, 50kW)	na	na	30p/kWh	£15.54
ESB PAYG London (50kW)	na	na	30p/kWh	£15.54
BP Pulse subscription (7kW)	£7.85	na	12p/kWh	£14.07
BP Pulse PAYG (50kW)	na	na	25p/kWh	£12.95
Ubitricity PAYG (7.4kW)	na	na	24p/kWh	£12.43
Pod Point (43kW, 50kW)	na	na	23p/kWh	£11.91
BP Pulse PAYG (7kW)	na	na	18p/kWh	\$9.32

EV Network	Rank	Overall Rating*	Star Rating**	Rank 2019
Tesla <sup>+</sup>	1	4.8	*****	1
InstaVolt	2	4.4	*****	2
Osprey (formerly Engenie)	3	4.1	****	8
Pod Point	4	3.7	*****	3
Swarco E.connect	5	3.6	*****	n/a
Shell Recharge	6	3.5	*****	5
ESB EV Solutions	7	3.4	*****	n/a
NewMotion	8	3.3	*****	4
ChargePlace Scotland	9	3.2	*****	7
Engie	Joint 10	3.1	*****	n/a
IONITY	Joint 10	3.1	*****	n/a
GeniePoint	12	3.0	*****	10
bp pulse (formerly BP Chargemaster/ Polar)	13	2.9	***	5
Source London	14	2.7	****	n/a
Charge Your Car (CYC)	15	2.6	<b>★★☆☆☆</b>	n/a
Electric Highway (Ecotricity)	16	2.0	*********	n/a

\*\$10 sign-up fee, 7.4kW charging copped at four hours



# UK Government White Paper

ENERGY WHITE PAPER

### Powering our Net Zero Future

