





EVs will soon be the norm...

- UK to stop selling new non plug-in petrol & diesel car & van sales from 2030
- Plug-in hybrids will be allowed until 2035
- France, Germany, Ireland, Netherlands, Norway, & Ireland all plan similar bans 2025 (Norway) to 2040
- Pressure for an EU-wide ban

Recent manufacturer announcements

- Mercedes to go all-electric by 2030; all new models EV only from 2025
- Audi to go all-electric for new models from 2025
- DS to go all-electric for new models from 2024
- Ford expects 40% of its global sales to be all-electric by 2030
- Nissan to spend \$18bn on electrification in next 5 years: 15 new EV models & aiming for 65% reduction in battery costs









EV & PHEV sales – Dec 2021

- 1 in 4 cars sold in UK today is fully electric (26%, Dec 2021 sales data)
- Plug-in hybrids: 7% market share
- Diesels (inc micro-hybrid): 8% market share
- EU-wide, Oct 2021 EV & PHEV had combined 23% market share





Electric vehicles

- Battery and electric motor replace fuel tank and internal combustion engine (ICE).
- EVs rely entirely on electricity for fuel
- New technology? Land speed record 1899 (62mph)



Battery energy & power density	energy saving trust
10,000 8,000 8,000 8,000 8,000 8,000 8,000 8,000 8,000 8,000 8,000 9,0000 9,0000 9,000 9,000 9,000 9,000 9,000 9,000 9,000	

EV range increase over last decade							
			Niccon LEAE				
	2011	2013	2016	2018	2020	302	
	80 miles (WLTP*)	88 miles (WLTP*)	114 miles (WLTP*)	168 miles (WLTP)	239 (WLTP)	0	
	24kWh	24kWh	30kWh	40kWh	62kWh		
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EVs' urban range						
For urban driving, EV	cars achieve approximately :					
4+ miles per kWh in warm weather						
3.5 miles per kWh on cold winter day						
52kWh Zoe:	210+ miles summer; 180 miles w	inter				
58kWh VW ID3:	230+ miles summer; 205 miles w	inter				
64kWh Kona:	255+ miles summer; 225 miles w	rinter				





Battery life

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- All batteries lose capacity over time but for EVs the reduction is small & incremental
- ► Typically approx. 10% over 5 years
- Catastrophic battery failures very rare with EVs
 Wby? Good thermal management & power man
- Why? Good thermal management & power management when charging
- Strong battery warranties e.g. VW ID3: at least 70% of original capacity after 8 years /100k miles.











Why EVs?

- Lower overall CO₂
- Lower running costs:
 - Much cheaper fuel costs
 - Lower servicing & maintenance costs
 - Zero road tax (VED)
- Quieter, smoother driving experience
 Increasing choice of models suitable for ADIs



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EV CO₂

- EVs produce much less CO₂ even with today's electricity generation
- A 'meta-analysis' of 11 recent life-cycle analysis, shows across Europe EVs reduce CO₂ by approx 50%
- UK Government data show EVs reduce CO₂ by 60-66% in UK
- This CO₂ saving increases every year as electricity gets greener \sim CO₂ from UK electricity generation forecast to decrease 90% by 2050









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Other financial savings

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- Zero VED ('road tax')
- 1% Benefit in Kind (company car) tax
- 100% first year write-down allowance for EV cars
- Zero Clean Air Zone charges
- Lower servicing & maintenance costs

Servicing & maintenance costs

- EVs have greatly reduced servicing & maintenance costs relative to petrol or diesel
- Fewer moving parts, no oil changes, no clutch, no gearbox, much less brake wear etc
 - 50% reduction (Consumer Reports, USA)

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Selection of Current EVs (Jan 2021)							
	Nissan Leaf e+	Kia eNiro	MG ZS EV	VW ID3	VWID4	Renault Zoe	Tesla Model 3
Battery	62 kWh	64 kWh	73 kWh	58 or 77 kWh	77 kWh	52 kWh	82 kWh
WLTP range	239 miles	282 miles	273 miles	260 / 336 miles	310 miles	245 miles	382 miles
Price after PiCC	£32,945	£34,995	£29,495	£29,990	£42,020	£27,595	£46,490









UK Government grants for EVs

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- £1,500 grant for EV cars priced up to £32k
- £2,500 for small vans; £5,000 for large vans
- Plug-in hybrids not eligible
- The dealer applies for & receives the grant
- www.gov.uk/plug-in-car-van-grants







EVs & ADIs ADI's mileage typically hits the EV sweet-spot: High enough for the savings on running costs offset higher purchase prices But daily mileages are achievable by most current EVs EVs are highly efficient for urban driving Many options: Zoe, e-208, Corsa-e, MG-ZS, Leaf,Kia e-Niro, VW ID3 Demand for auto licences increasing (11% in 2018/19)





Efficient driving for EVs					
Anticipation	Maximise <u>regenerative</u> braking	Geors	Speed: a key factor		

Reg	Regenerative braking					
	Electric motors & generators are the same	thing				
-	Making good use of regen braking is key to driving EVs efficiently)				
•	Level of regen braking varies greatly – betw models and between modes	ween				





EV Energy Consumption vs. Acceleration Rates							
	2	018 Nissan Leaf; M	iles per kWh				
	Acceleration:	Gentle	Medium	Max			
	0-30mph	4.2	4.0	3.4			
	0-50mph	3.6	3.1	2.7			
	20-50mph	4.0	3.3	3.0			
	20	14 Nissan eNV200;	Miles per kWh				
		Gentle	Medium	Max			
	0-30mph	5.0	5.1	4.7			
	0-50mph	3.8	3.6	3.2			
	20-50mph	3.1	3.2	3.1	energy		
			EST data, /	Augyst 2018	saving trust		

Heating & air conditioning

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- Heating & A/c both have big effect on EV range
 - ▶ EVs have dedicated heaters. (ICEs use waste engine heat)
 - Heated seats /steering wheel: less energy than heating whole vehicle
 - Remote activation via app to use mains electricity while plugged in



EV charging – general principles

- Most EV car charging takes place at home, overnight
- Huge variation in charging speed
- Huge variation in cost: from <5p/kWh for overnight home-charging to 30p/kWh or more for motorway rapid charging

Home charging: "slow" charging (AC)

Domestic 3-pin plug

- Power: 2.3 kW
- Charge time for 40kWh: 17hrs
- Not recommended for regular use

Dedicated home chargepoint

- Power: Usually 7 kW
- Charge time for 40kWh: 6 hours



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"Rapid" charging (DC)

- Most in UK currently 50kW
- Charge time for 40kWh: 50 mins
- Found at all motorway services & some other locations

 Even faster 'ultra-rapids' now being installed: 90kW, 120kW even 350kW: 7 mins for 40kWh!



Recap: EV	energy saving trust			
	Slow	Fast	Rapid	Ultra Rapid
Power rating	2.3 kW	7 – 22 kW	Usually 50 kW	90-350 kW
Electrical supply type	AC	Usually AC,	Usually DC	DC
Charging time for a 40KWh charge	17 hours	2 - 6 hours	50 mins (80% max)	7-25 mins (80% max)
Best use	Home / Very long stay / street	Home; Workplace; Destinations	Service stations; Destinations	Service stations
EV compatibility	All	All, but charge speed limited by EV, usually to 7- 15kW	All new EVs	Many new EVs can charge at 80-100kW. Few currently at 350kW

