

**energy
saving
trust**

Go Electric!

EV mythbusting for Plymouth & District Advanced Motorists

Mark Smith

20/11/23



Agenda

- **What is an EV?**
- **Why switch to an EV?**
- **Charging an EV**
- **Myth busting**
- **Q&A**



About Energy Saving Trust

- We are an independent organisation working to address the climate emergency
- We provide leadership and expertise to deliver a zero carbon society
- We work with individuals, businesses, communities and governments to save energy and reduce carbon emissions
- Established in 1992
- Offices in England, Scotland, Wales and Northern Ireland

Our transport team

- Our **Local Government Support Programme** offers advice on EV strategy, procurement and sustainable travel, and our **Fleet Team** advises fleet managers on reducing costs and emissions
- We manage the **OZEV on-street residential chargepoint scheme (ORCS)** and **Local Electric Vehicle Infrastructure scheme (LEVI)**

Impartial

Independent

Expert

Collaborative

Pragmatic

Supportive

Determined

Innovative

Before we start...

Who has driven an EV before?

Keep your hand up if...

You already own/lease/hire/have use of an EV?

If you don't...

Are you considering an EV for your next vehicle?

What are your biggest concerns about EVs?



What is an electric vehicle?



By Franz Haag - Elektroauto Forum, CC BY-SA 3.0,
<https://commons.wikimedia.org/w/index.php?curid=17176252>

BEV vs PHEV



Polestar 2



MG4

Tesla
Model Y



Battery electric vehicle (BEV)

- Also known as 100% or pure electric
- Range from 120–300+ miles
- Over 230 BEV models currently on the market
- Significant emission reductions

Mini Countryman
PHEV



Hyundai
IONIQ PHEV



Kia Sportage
PHEV



Plug in hybrid electric vehicle (PHEV)

- Internal combustion engine plus battery
- Electric range 20–50 miles
- 80+ models on the market
- New sales banned from 2035

Other forms of hybrid

Self-charging hybrid

- Also known as full hybrid or HEV
- Can be driven under electric power for short distances/ at low speeds
- Regenerative braking can recharge the battery
- Significant emission reductions
- New sales banned from 2035



Toyota Prius



Honda Jazz

Mild hybrid (MHEV)

- No electric-only range
- Engine provides power, with assistance from small electric motor and battery
- Better fuel efficiency & lower emissions (than ICE)
- Some available with manual gearbox
- New sales banned from 2035

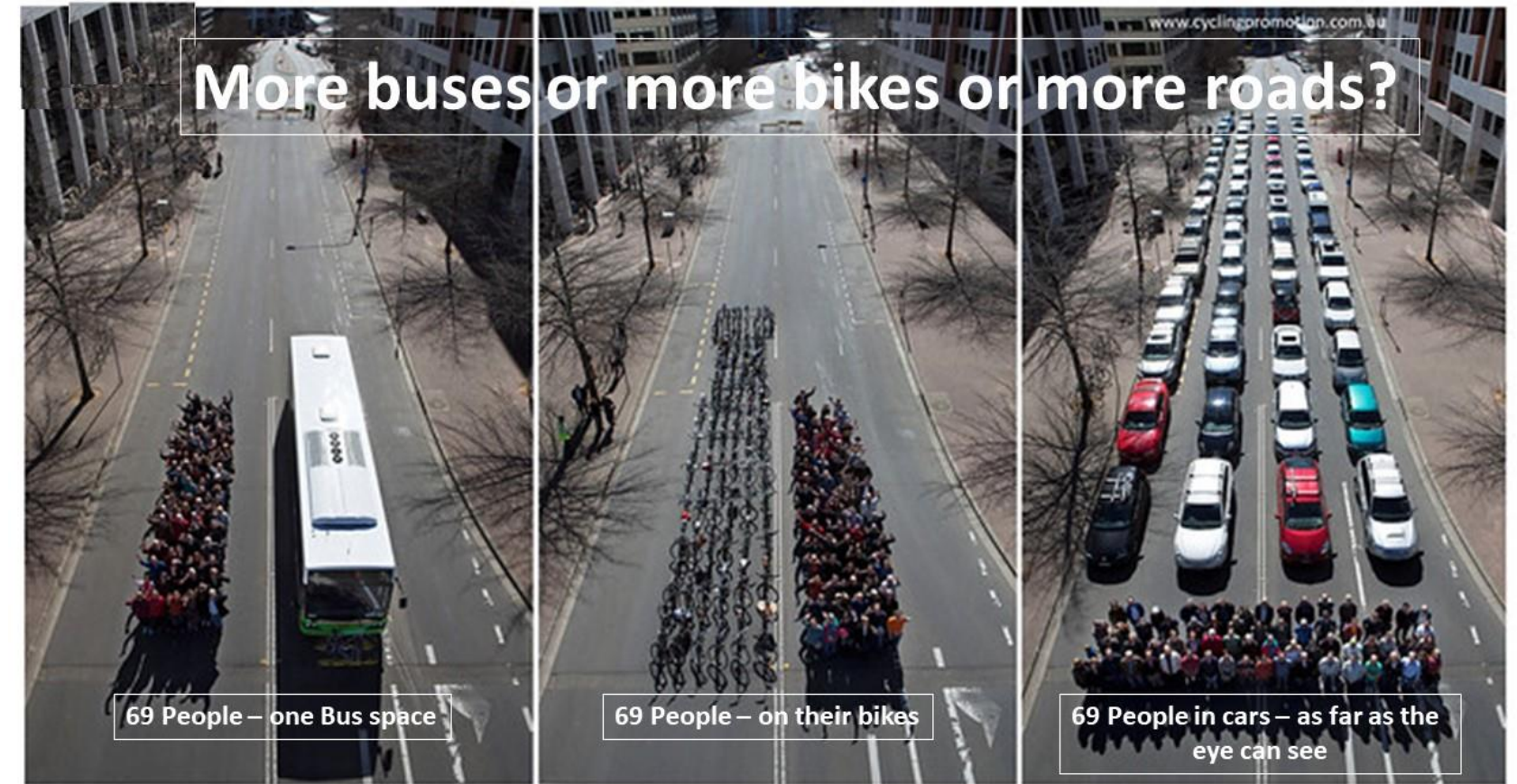
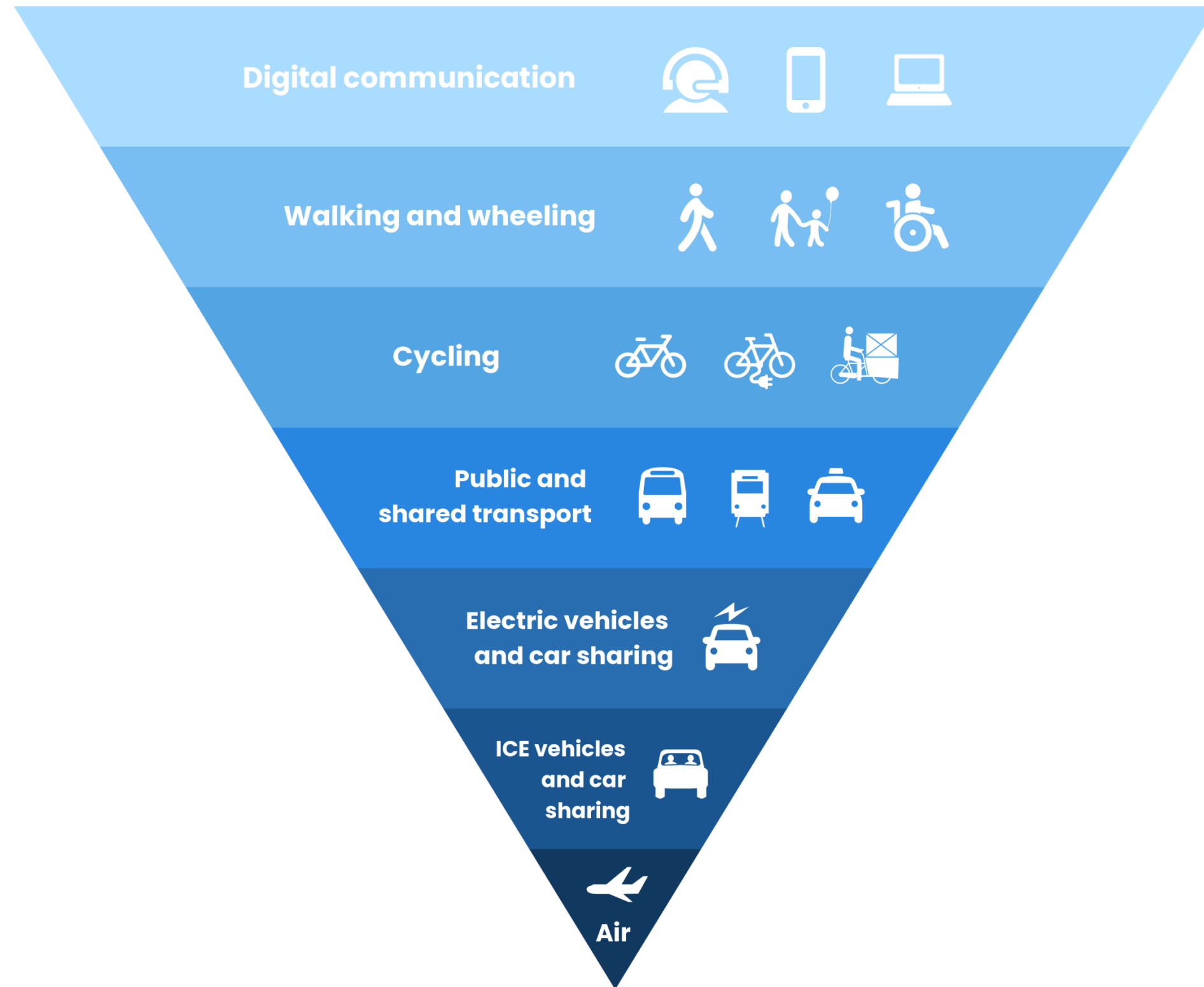


Ford Fiesta
mHEV



Nissan
Qashqai MHEV

EVs are not a silver bullet



Cycling Promotion Fund (CPF) of Australia <https://www.danielbowen.com/2012/09/19/road-space-photo/>



Why switch to an EV?

How is the market developing?

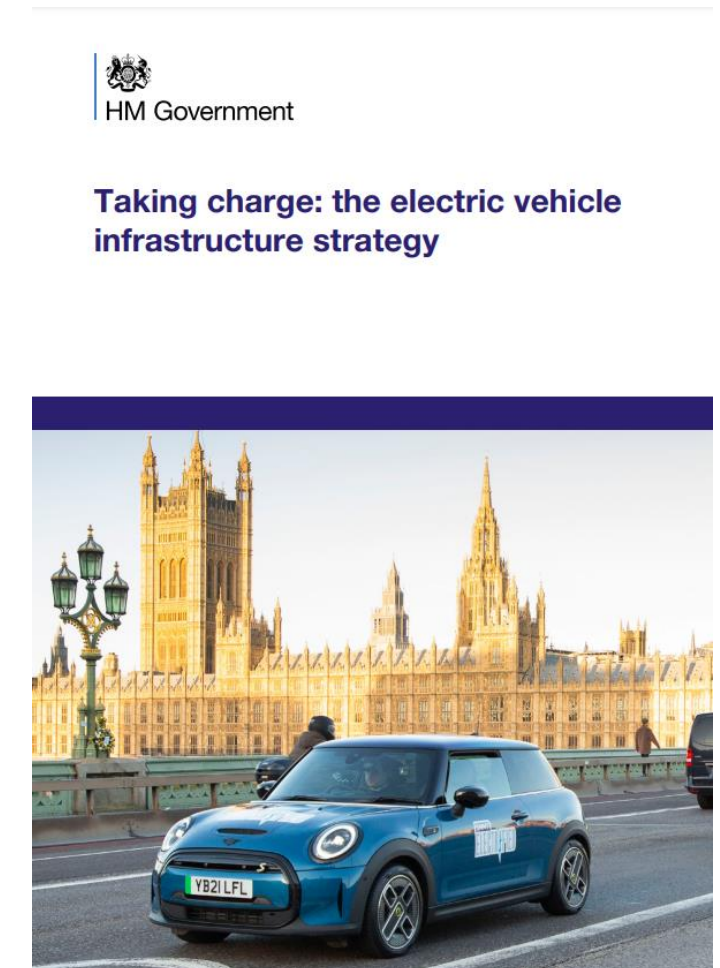
Why the push for electric vehicles?

By law, the UK's emissions must be net zero by 2050

UK Government has committed to ending the sales of new petrol and diesel cars by 2035

This is part of a move towards:

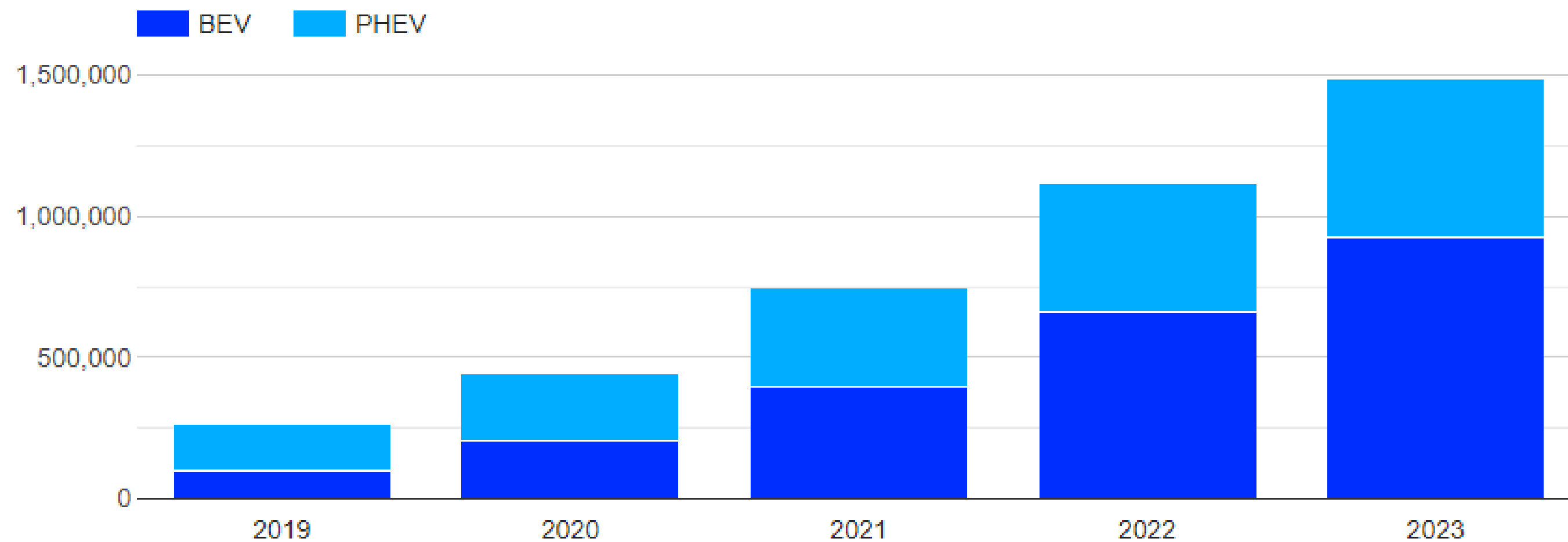
- establishing a carbon-free travel and transport network
- mitigating climate change
- reducing pollution
- growing the green economy



ZEV Mandate	2025	2030	2035
Cars	28%	80%	100%
Vans	16%	70%	100%

How many EVs are there on the roads?

Cumulative number of plug-in cars registered in the UK (2019 to date)



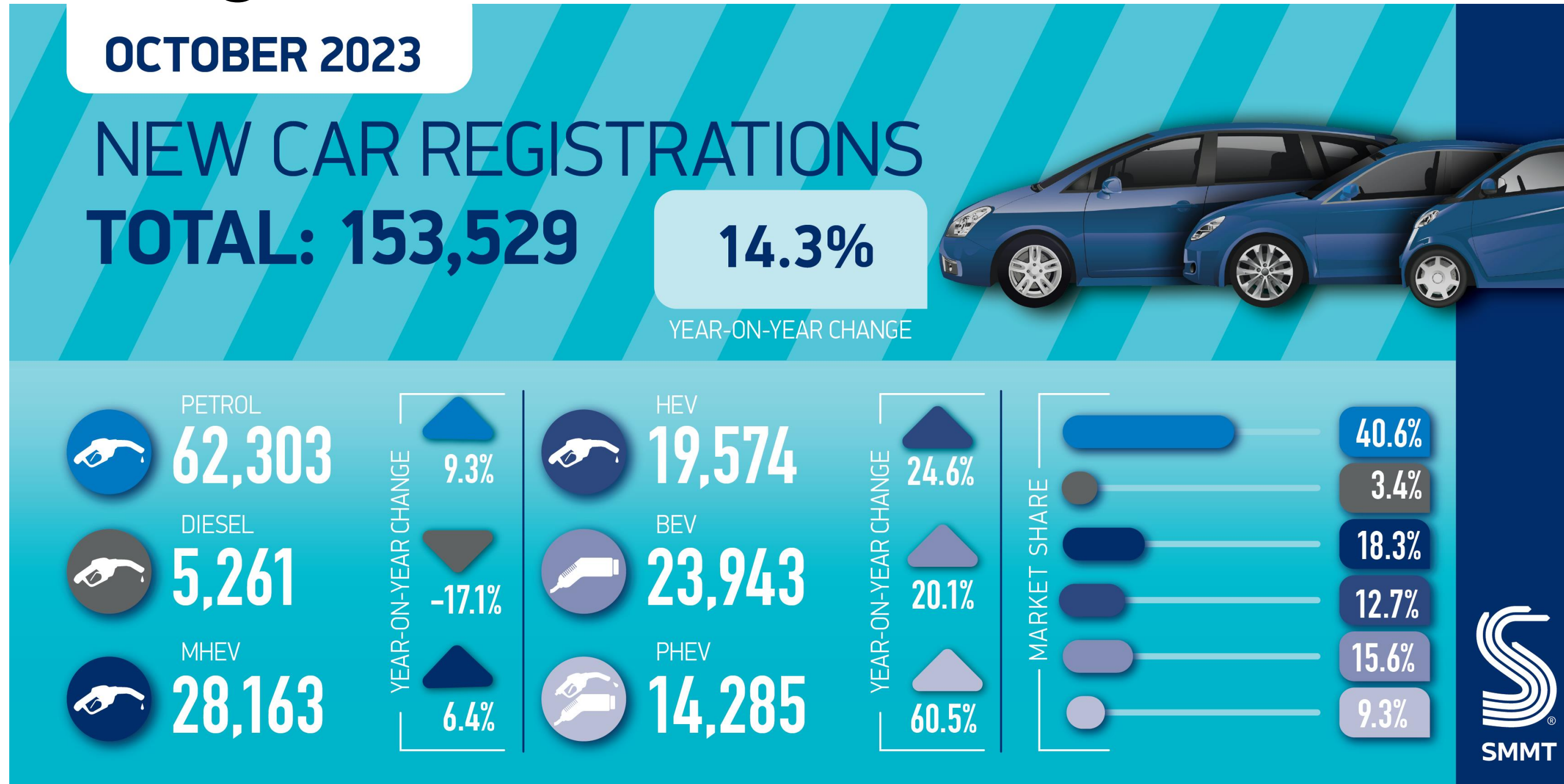
- **1,489,000 plug-in cars on the road**
- **920,000 BEVs**
- **560,000 PHEVs**
- **24.9% of all new registrations in October had a plug**

Source: SMMT, October 2023



Source: <https://www.zap-map.com/ev-stats/ev-market>

Latest EV figures



“EV share of the market has been growing for 42 consecutive months”

“As fleet uptake flourishes, particularly for EVs, sustained success depends on encouraging all consumers to invest in the latest zero emission vehicles.” – SMMT October 2023

Charging electric vehicles

Jargon Busting: kWh vs kW

kWh = kilowatt hour

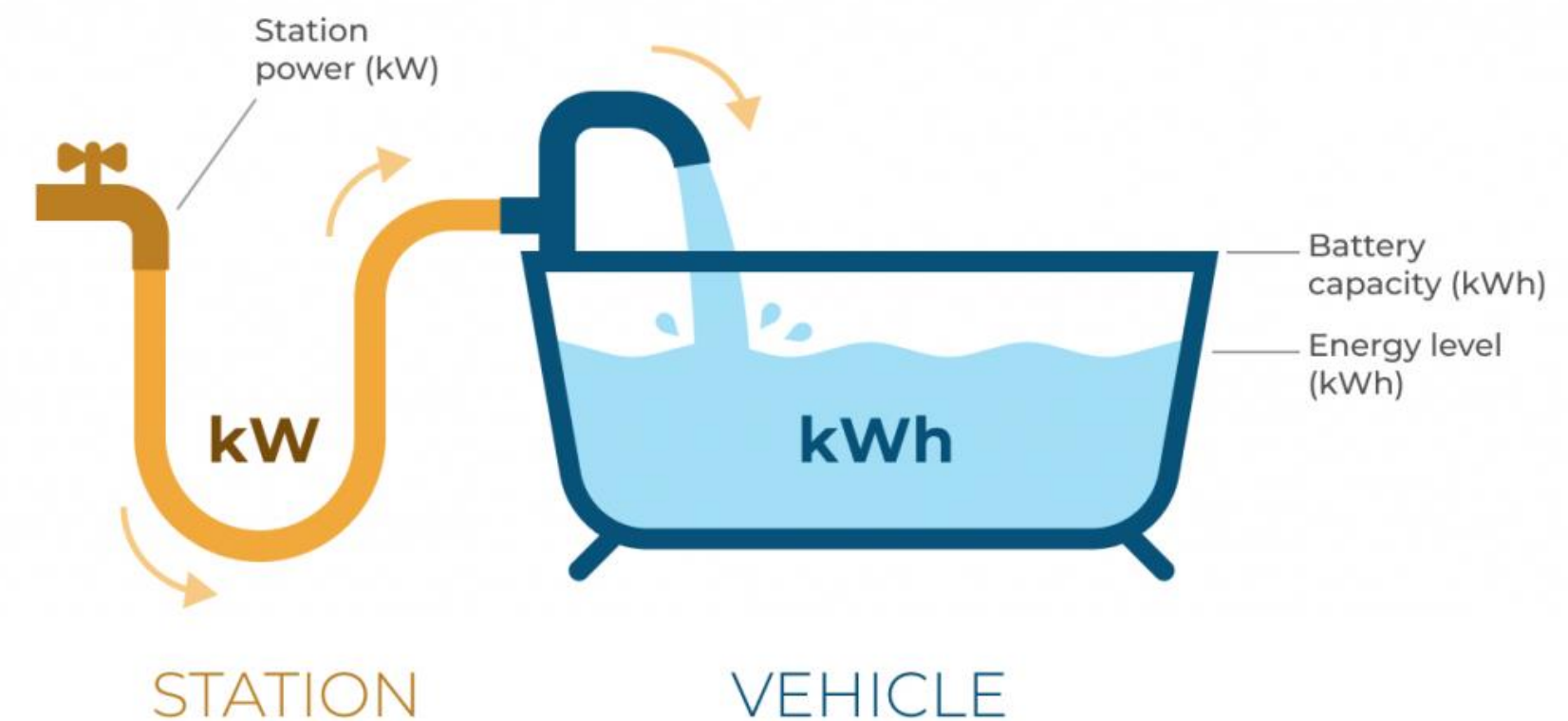
Measure of energy

- the amount of energy that a battery can store
- EV batteries are quoted in kWh
- the bigger the kWh, the longer the car's range
- comparable to fuel tank size in an ICE vehicle

kW = kilowatt

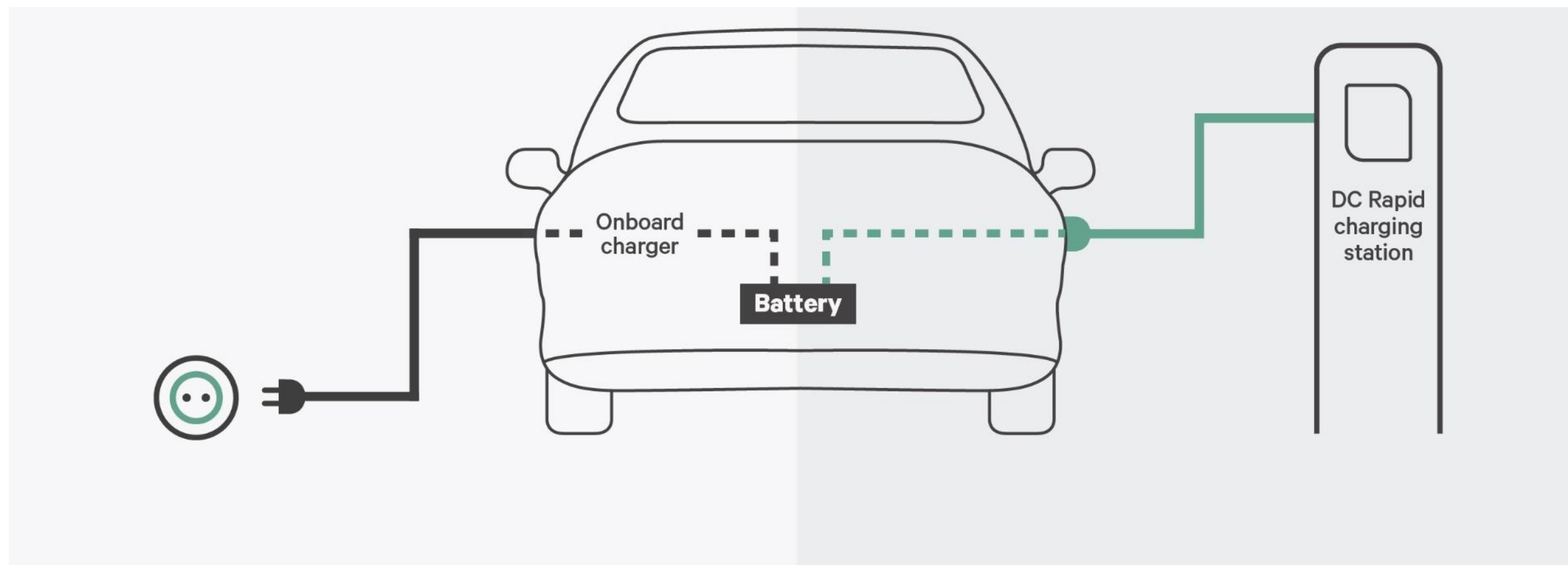
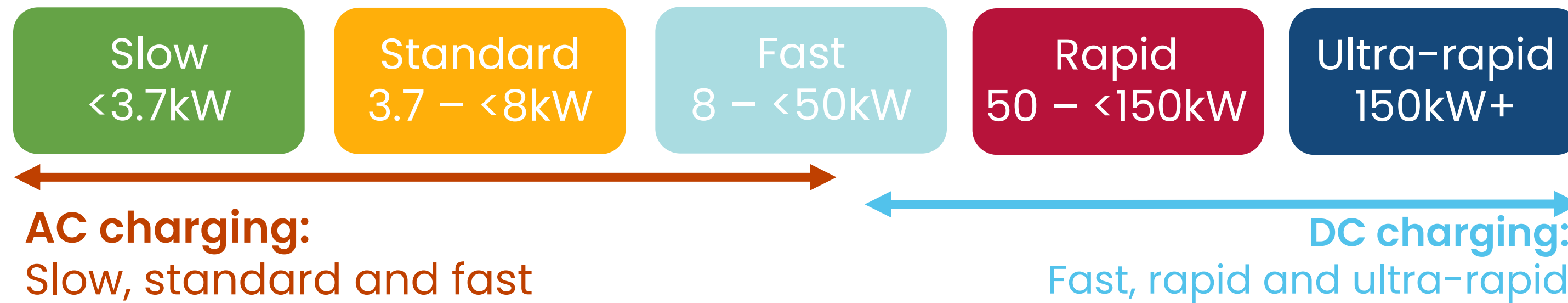
Measure of power

- chargepoints are always rated in kW
- higher kW = faster charge

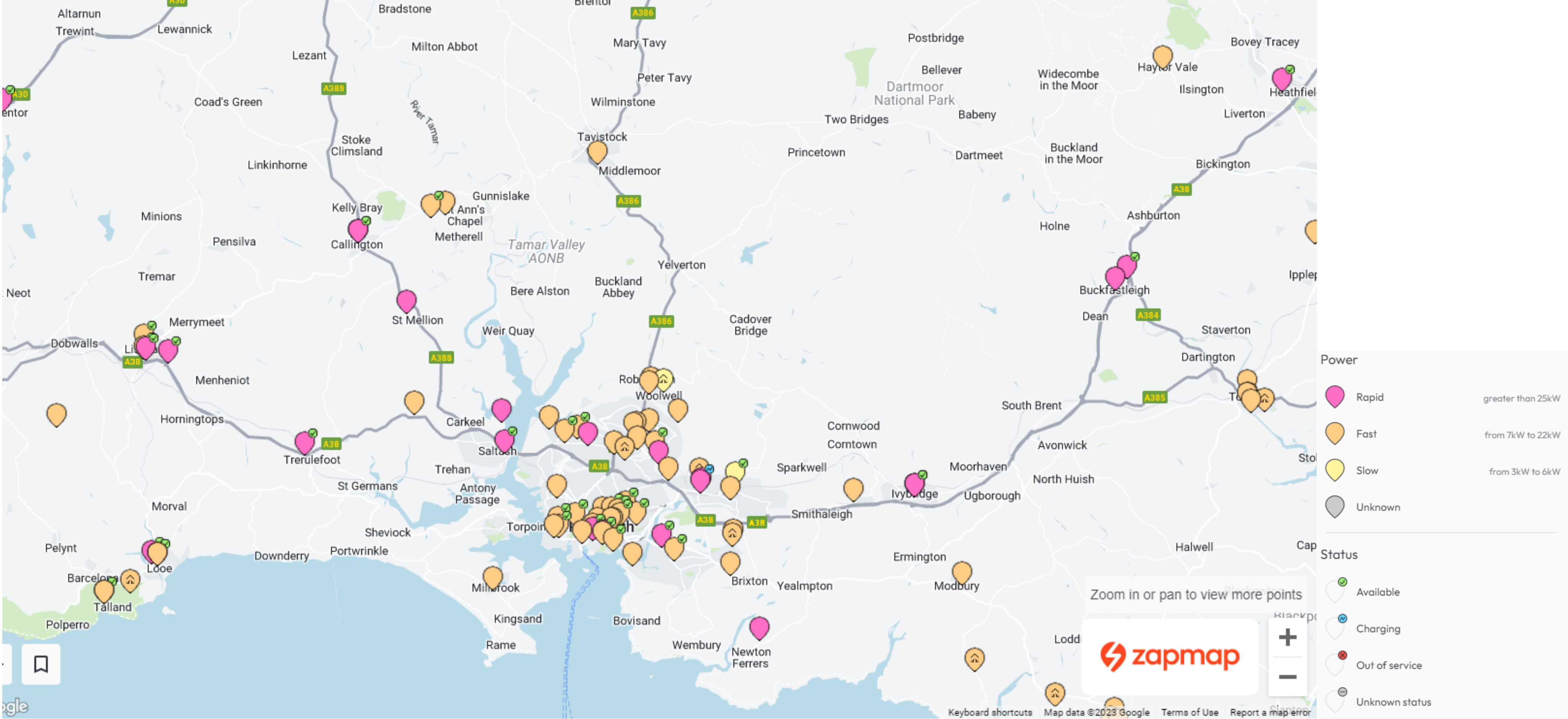


Chargemap

Jargon Busting: AC vs DC



Finding a chargepoint



Slow charging (<3.7kW)

Home charging via a standard 3-pin plug

Power: approximately 2.3 kW AC

- **Rate:** Takes **26 hours** to fully recharge a 60kWh battery
- **Cost:** No installation cost, requires access to an external three pin socket

Not recommended for regular use



Public charging via lamp columns

Power: 3-5 kW AC

- **Rate:** Takes **20-12 hours** to fully recharge a 60kWh battery
- **Cost:** between 39p/kW (off peak) and 61p/kW (peak)



Standard charging (3.7- <8kW)

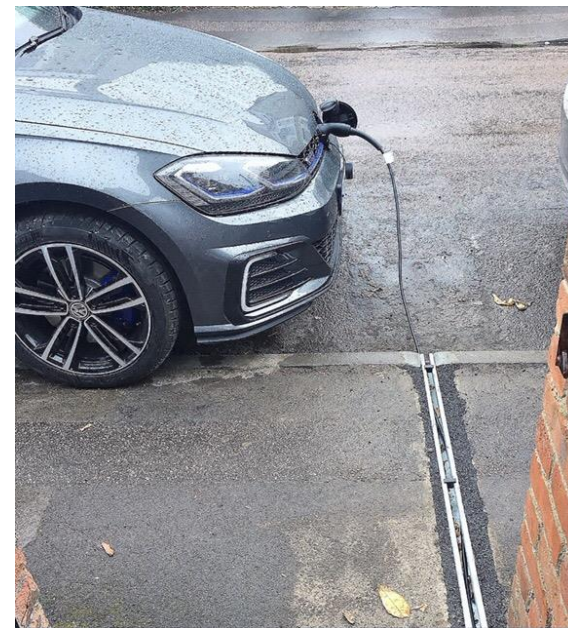
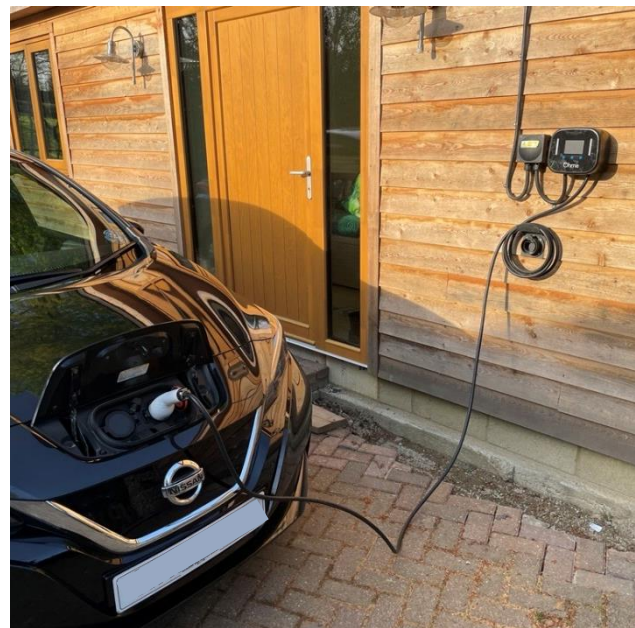


Dedicated home chargepoints:

- **Power:** up to 7 kW AC
- **Rate:** a 7 kw charger takes **8.5 hours** to fully recharge a 60kWh battery
- **Cost:** Typically, between **£800 -£1500** to install (can integrate with solar PV and batteries)

Public chargepoints

- **Power:** up to 7 kW AC
- **Rate:** a 7 kw charger takes **8.5 hours** to fully recharge a 60kWh battery
- **Cost:** varies by network, from 32p/kWh to 59p/kWh



Fast charging (8- < 50kW)

AC charging

- **Power:** 11, 22, or 43kW
- **Rate:** an 11 kW charger takes 6 hours to fully recharge a 60kWh battery
a 43 kW charger takes 1 hour 30 minutes to fully recharge a 60kWh battery
- **Cost:** varies by network, from 32p/kWh to 59p/kWh



Rapid and Ultra rapid charging

Rapid charging

- **Power:** 50–<150kW (DC)
- **Rate:** a **50kW** charger takes **1 hour 15 minutes** to fully recharge a 60kWh battery
a **90kW** charger takes **40 minutes** to fully recharge a 60kWh battery
- **Cost:** varies by network, from 59p/kWh to 85p/kWh

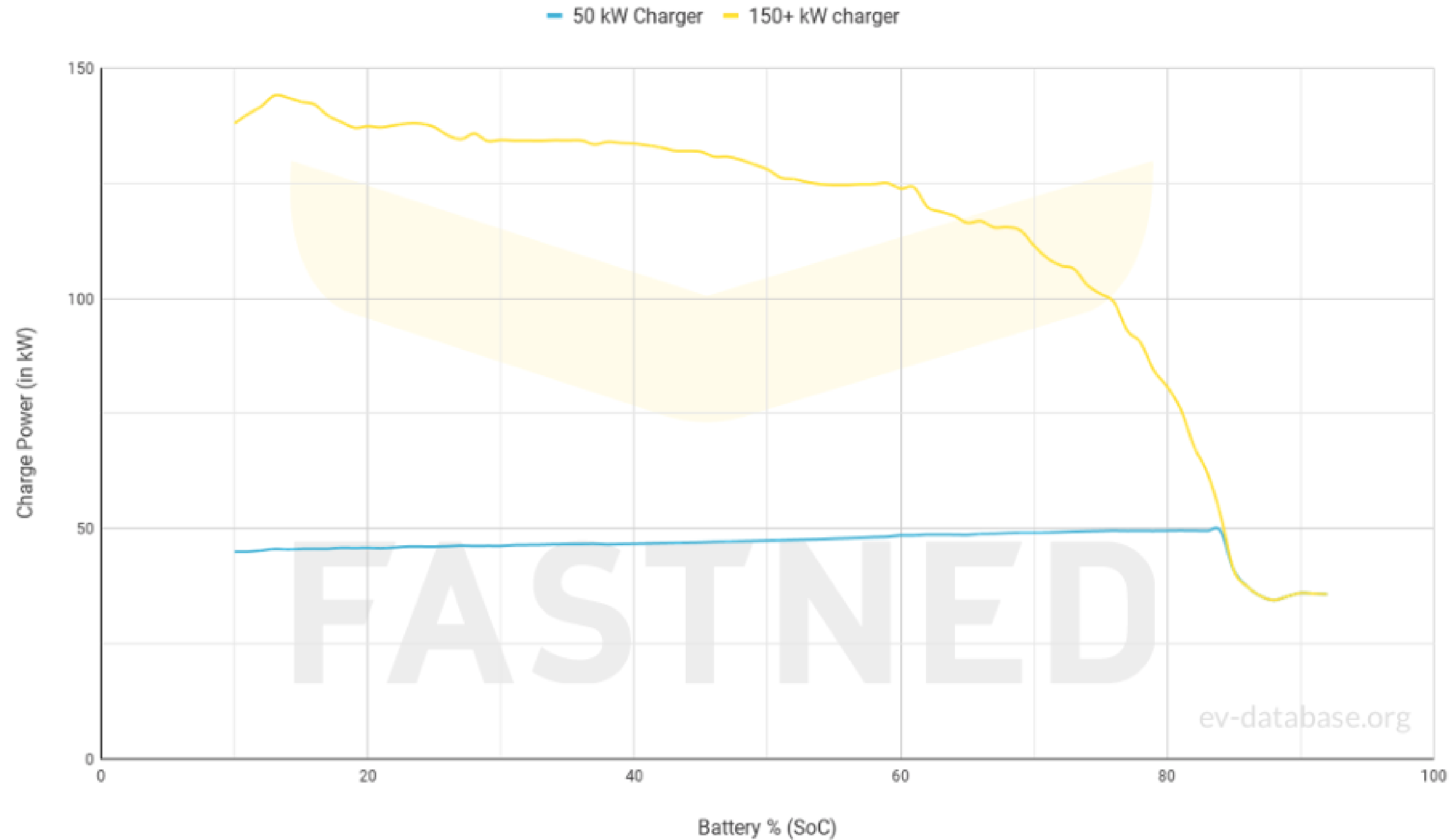


Ultra-rapid charging

- **Power:** 150kW+ (DC)
- **Rate:** a **150kW** charger takes **25 minutes** to fully recharge a 60kWh battery
a **350kW** charger takes **10 minutes** to fully recharge a 60kWh battery
- **Cost:** varies by network, from 69p/kWh to 85p/kWh



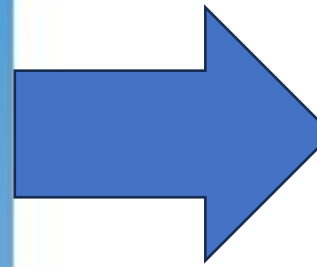
The 'charging curve'



Why can't we just have rapid chargepoints everywhere?

A small gas heated development of 25 Flats flats will have a maximum demand of 50KVA

1 x 50kW rapid charger could have the same impact on the network as 25 flats



EV myths, busted

They're just as expensive to run

	2018 Vauxhall Corsa (Petrol)		Vauxhall e-Corsa (50kWh)	
Average efficiency	53.3	mpg	3.6	miles/ kWh
Annual fuel cost	£1,309		£760	
Tailpipe CO₂ emissions	115 g/km		0 g/km	
1st year VED	£210		£0	
1st year costs (fuel +VED)	£1,519		£760	
1st year cost saving	£759			

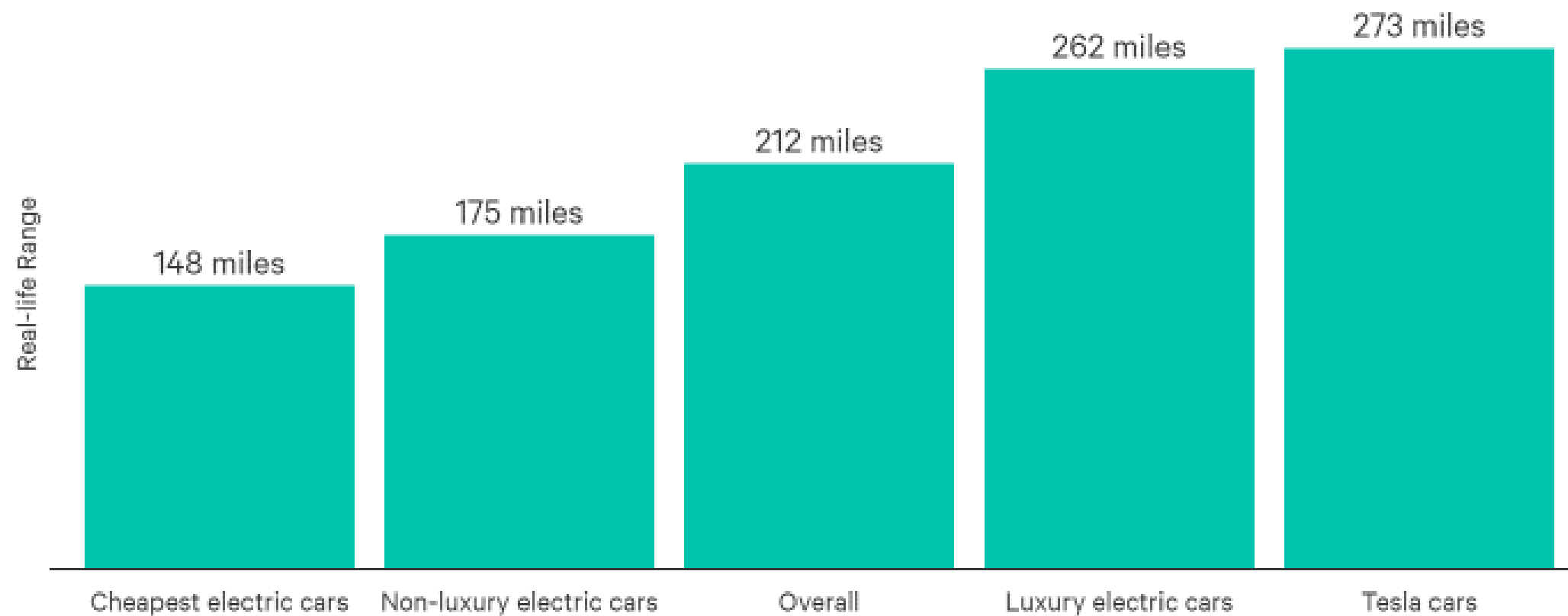


- Calculated based on both vehicles completing 10,000 miles per year
- On 7 November 2023, average UK petrol price was 153.46p/litre ([RAC Fuel Watch](#))
- EV fuel cost based on [current average cost of electricity](#) per kWh of 28.72p/kWh (assuming all charging at home)

I can't drive far enough!

Average Electric Car Range in the UK

Luxury cars typically have larger batteries, providing longer range



 NimbleFins

The average electric car range in the UK is around 193 miles.

Longest range EVs available in the UK

- Mercedes EQS 450+ **395 miles**
- Tesla Model S Dual Motor **355 miles**

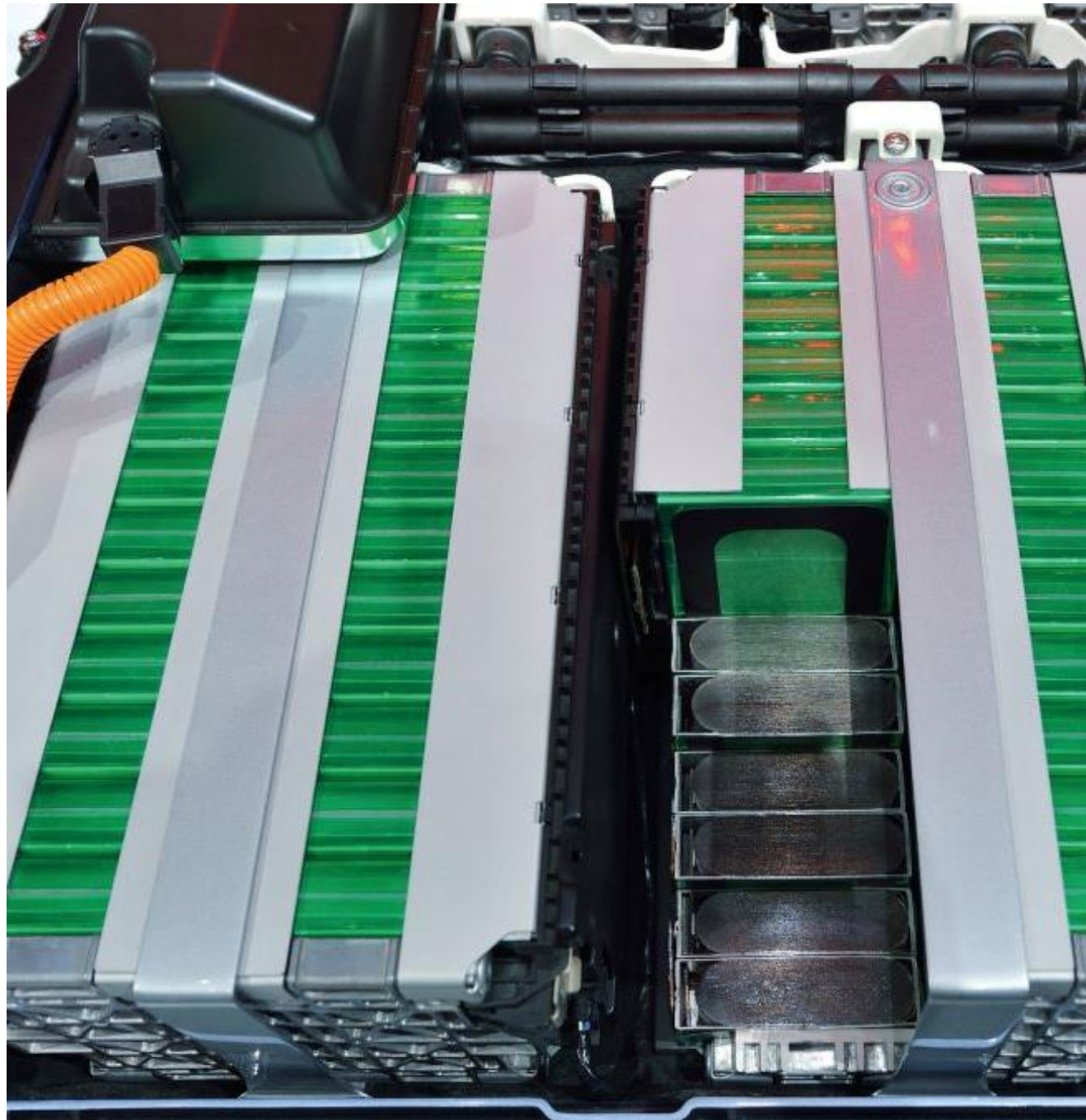
Range of affordable (new) EVs

- MG4 (50kWh) **185 miles**
- Vauxhall Corsa-e **175 miles**
- Nissan Leaf (40kWh) **145 miles**

Range of second-hand EVs

- Nissan Leaf 2012 (24kWh) **109 miles**
- Peugeot iOn 2012 (16kWh) **93 miles**
- Renault Zoe 2019 (45kWh) **186 miles**

The battery degrades quickly, and production is unsustainable



- Rarely need to replace a whole battery
- Estimates of battery degradation are around 1-2% per year
- Manufacturers warranties cover battery performance and degradation
- End of life EV batteries can be used for energy storage
- Growing industry focused on battery repurposing and recycling
- Manufacturers are increasingly cautious about their supply chains
- Reducing manufacturing emissions, mainly through streamlining processes

EV emissions

- The life cycle emissions associated with a BEV is **half that** of an ICE vehicle

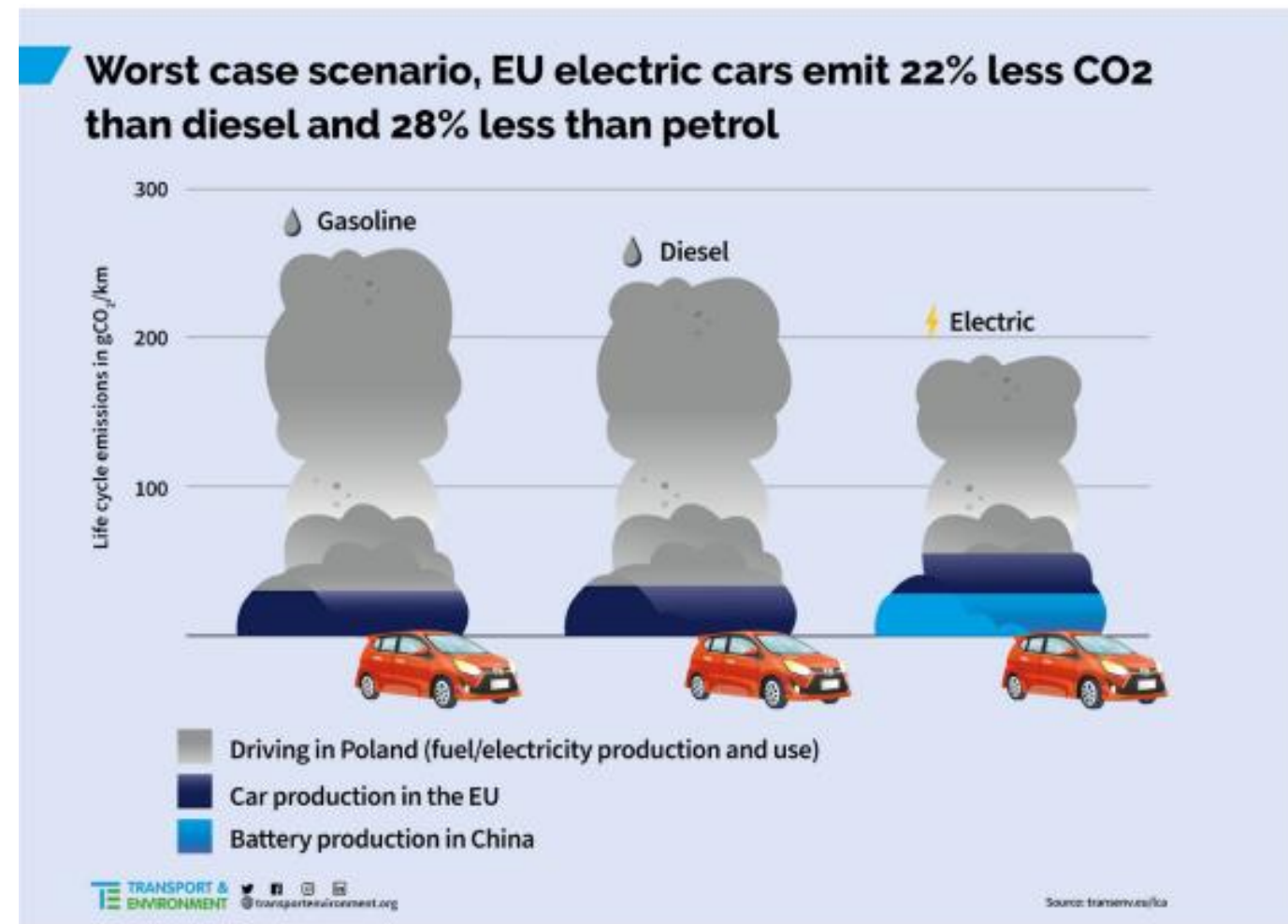


Figure 3: Lifetime CO₂ emission savings from EVs in the worst case scenario

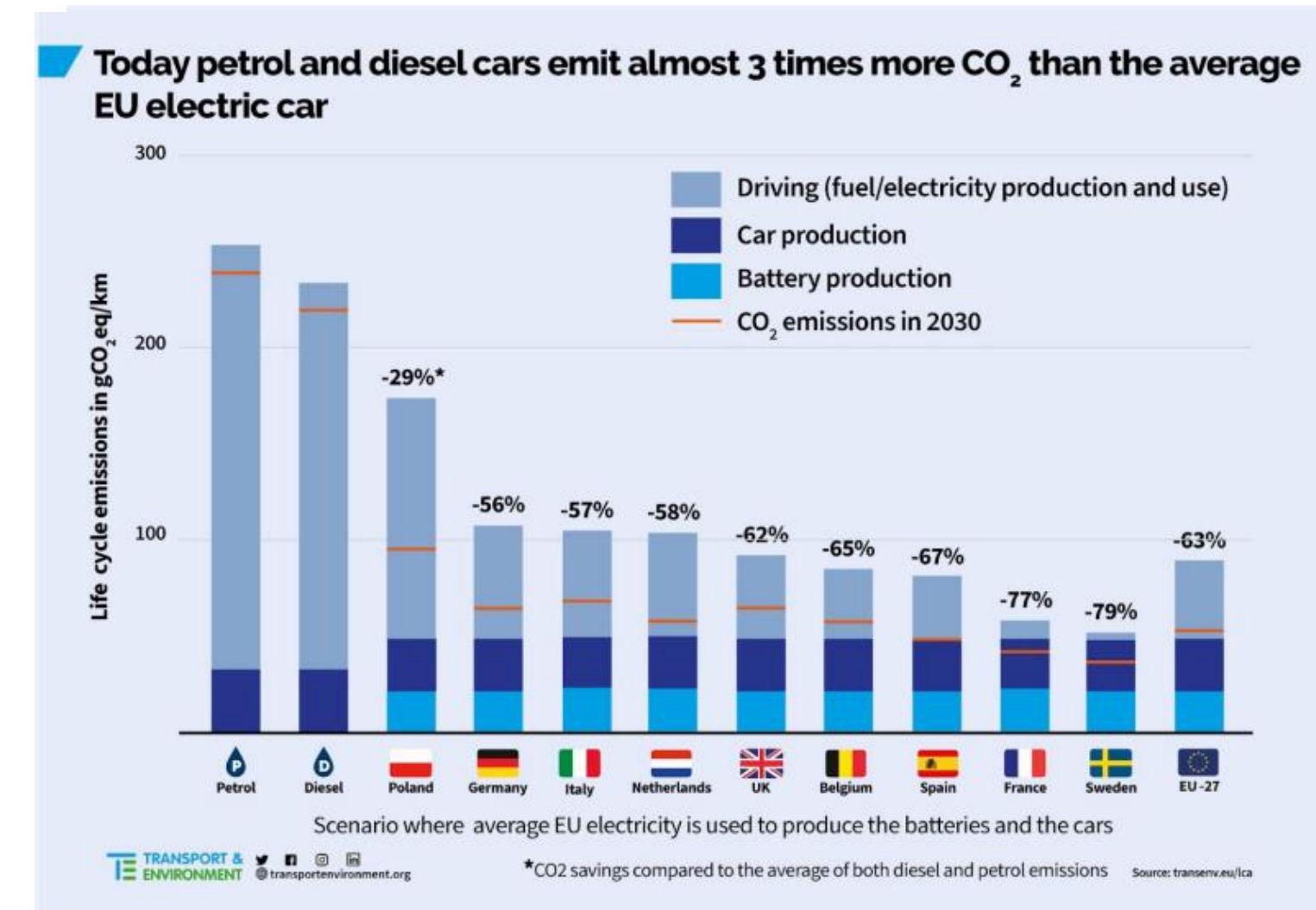
- As renewable electricity generation increases, emissions from manufacture and refuelling will fall



Figure 6: Evolution of lifetime CO₂ emissions of an average and clean EV

- The [RAC](#) have found that EVs emit less brake dust than ICE vehicles due to regenerative braking

Graphs from [Transport & Environment research](#)



EV fire risk

20 November 2023

Do electric cars pose a greater fire risk than petrol or diesel vehicles?

EVs are up to **11 times less likely** to have a fire than other vehicle types.

However, national & global research data is incomplete

- Was the EV charging?
- Cause of the fire?
- Was the battery pack involved?

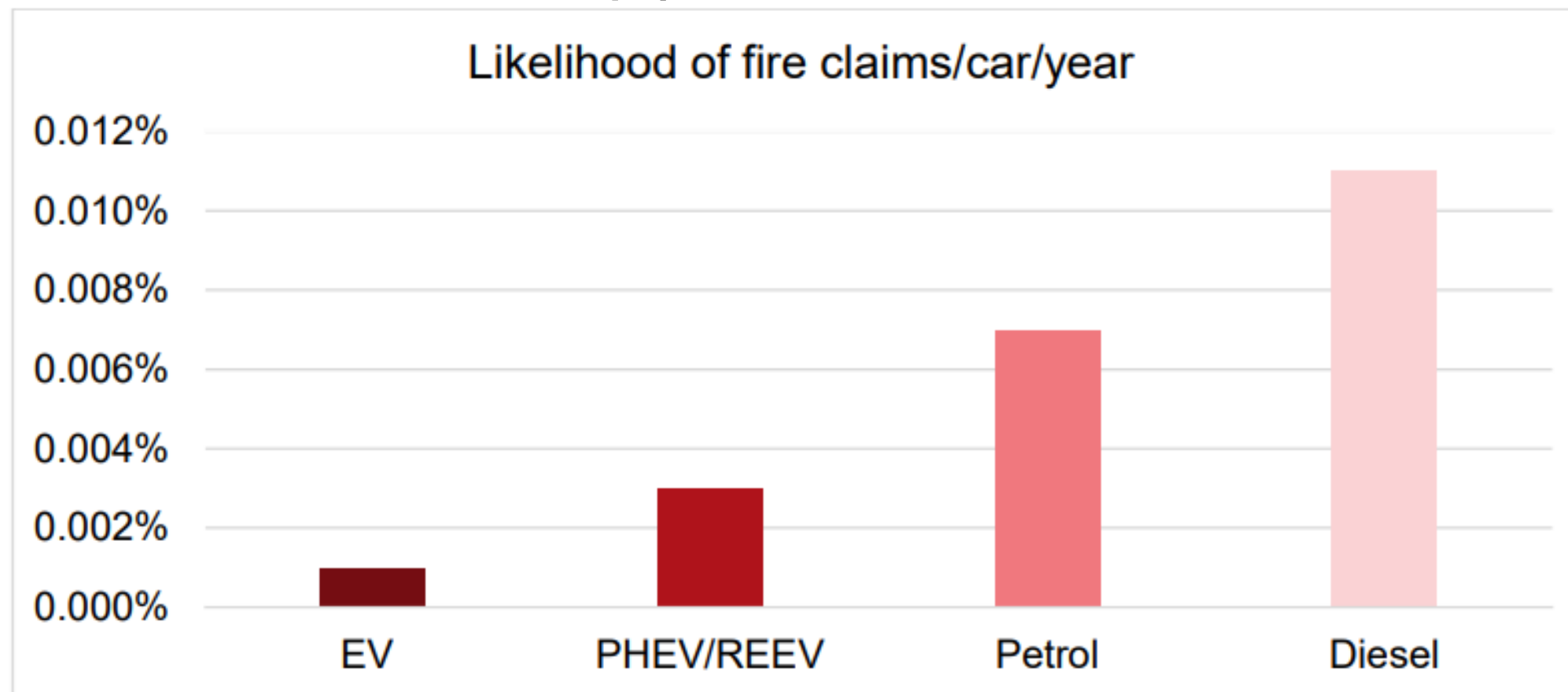


Figure 7: Illustration of likelihood of fire claims per car per year, sorted by propulsion type [10]



It was not an EV. This was a diesel powered vehicle.”

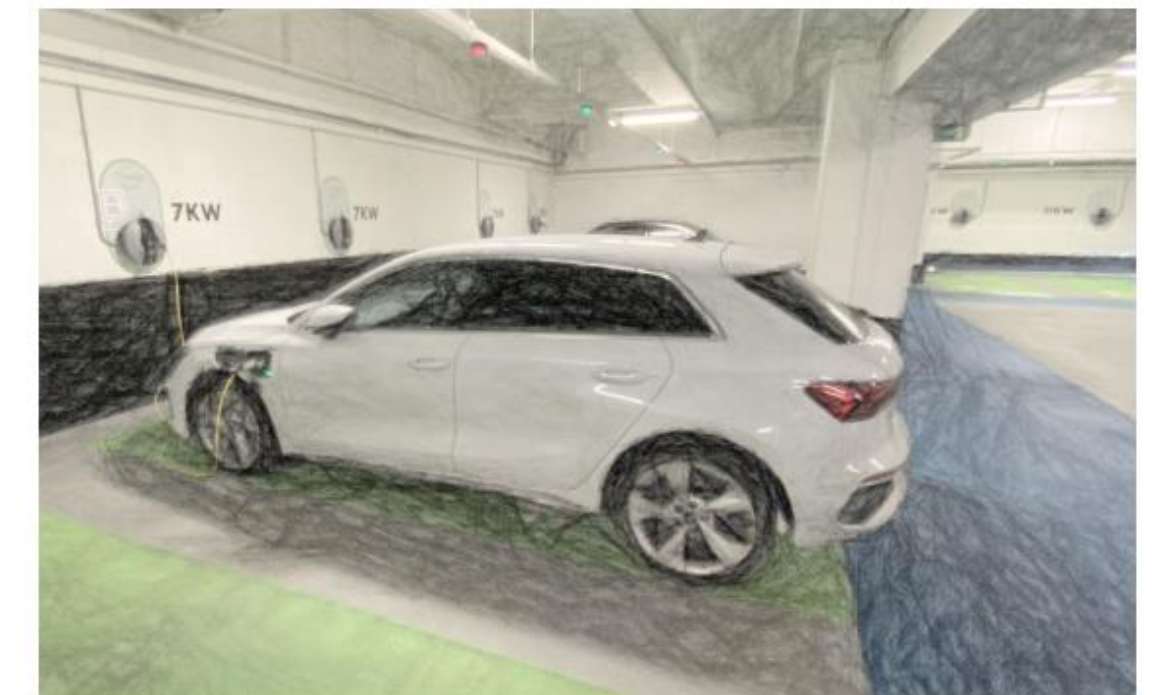
ARUP

Office for Zero Emission Vehicles (OZEV)

T0194 – Covered car parks - fire safety guidance for electric vehicles

Interim guidance to support parking and/or charging of electric vehicles and the installation of electric vehicle chargepoints in covered car parks

Issue | July 2023



EV fire risk

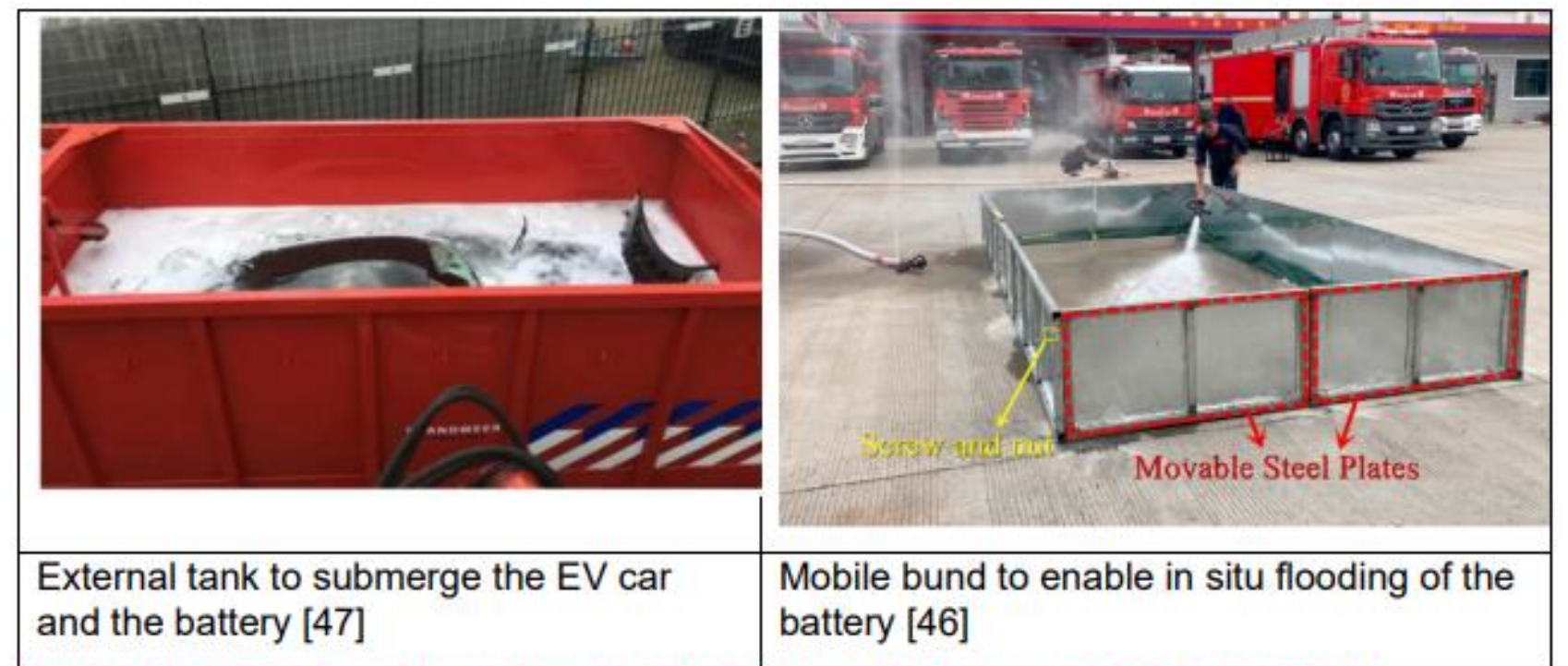
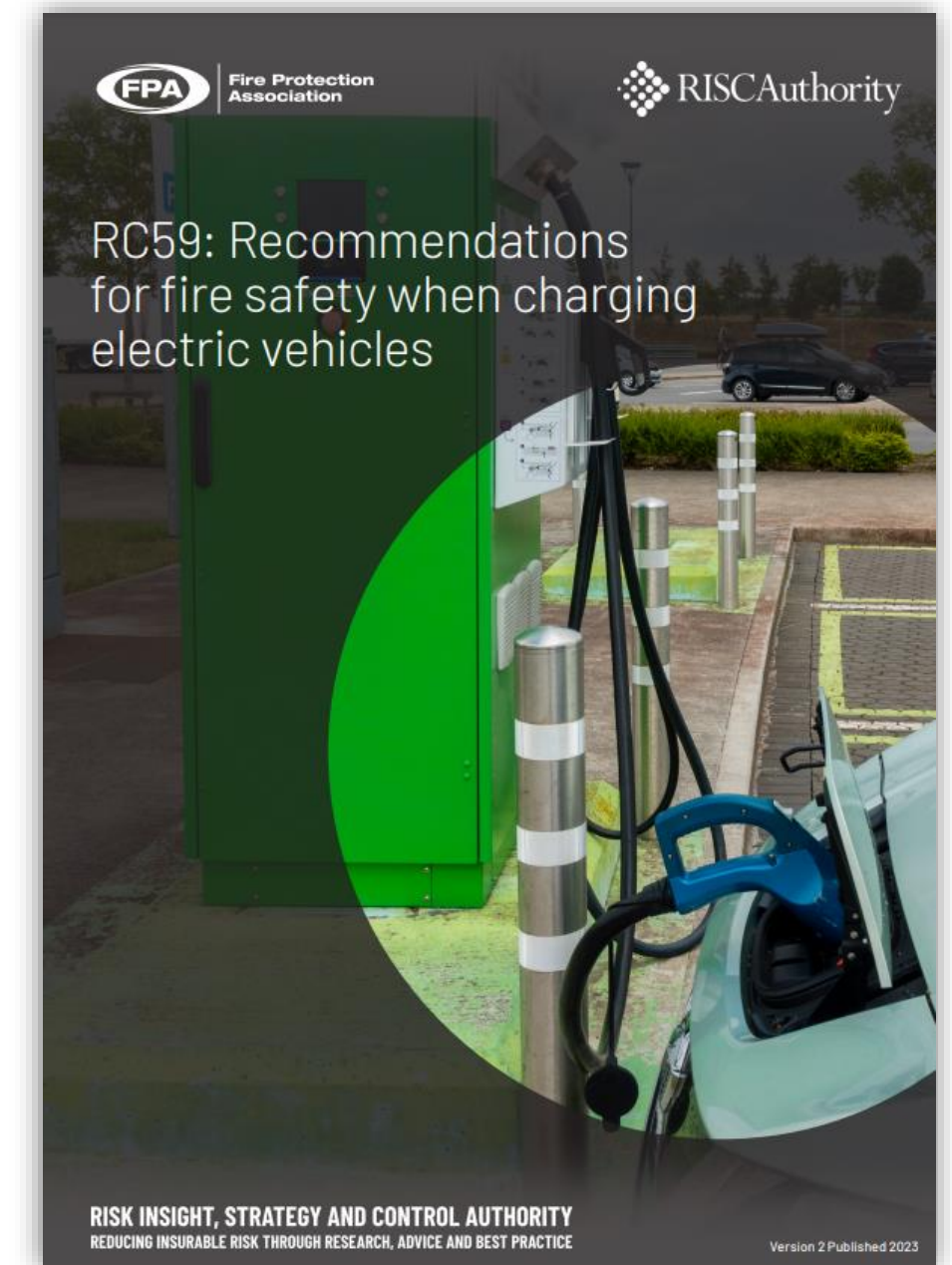


Figure 6: Firefighting tools developed to control EV battery fires [47] & [46]

FPA findings

- EV Li-Ion battery fires are rare
- When an EV Li-Ion battery catches fire then they can release gases that are flammable, toxic, asphyxiant, corrosive, explosive
- Reignition of a battery fire is possible though not common
- Special equipment are needed to ensure full and safe extinguishment of an EV Li-Ion battery fire
- The degree of hazard from an EV car fire vs an ICE car fire are about the same

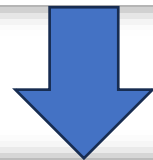


The impact of increased vehicle weight

On roads

Pothole damage from electric cars is double that of petrol, Telegraph data show

Excessive weight could exacerbate problem on already damaged residential roads that are not designed to cope



Hidden cost of road maintenance due to the increased weight of battery and hydrogen trucks and buses – a perspective

John Low*, Robert Stuart Haszeldine, Gareth Harrison



We find 20–40% additional road wear associated with battery vehicles compared to ICE vehicles; hydrogen leads to a 6% increase.

On car parks

Ageing multi-storey car parks 'could collapse' under the weight of heavier electric vehicles, experts warn

Even though the largest modern EVs are much heavier than cars produced when MSCPs were first built, a car park full of laden EVs (of about 3.5 tonnes each) will not exceed the design load commonly used for most car parks, although there will be an associated reduction of design safety factors.



Do EVs need special tyres? Do tyres and brakes wear out faster?

Yes, EVs need special tyres:

- **Different tread patterns** to minimise rolling resistance
- **Different rubber** to improve grip and stability
- **Stronger traction** to deal with increased torque
- Able to take **heavier weight** due to battery size
- **Noise reduction** as there is no engine noise
- Some brands are updating their entire range to be suitable for EVs
- Tyre wear for EVs is comparable to ICEV

Do components wear out faster?

Tyre wear may be quicker:

- Some fleets have found that tyres on EVs wear out ~6000 miles before tyres on ICEVs
- Others have found comparable wear
- But sample sizes are small

Brake wear is significantly reduced:

- Use of regenerative braking reduces use of brake pads (and release of PM₁₀ & PM_{2.5})
- Dundee taxi firm has seen brake lifespan of 80-100,000 miles and changed due to warping

Do EVs have a handbrake?

Sort of...



EV breakdowns

- Increasing number of breakdown/recovery technicians are high voltage trained
- Some providers can deliver a small charge at the roadside
- Or they will recover you to the nearest EV chargepoint
- However, EVs are generally less likely to break down as they have fewer moving parts
- Proportion of EV breakdowns attended by the AA in the first half of 2023 was 2.86%
- In 2022, the proportion of 'out of charge' EV breakdowns was 4%
- January to May 2023, it was 2.1% of EV breakdowns



Running out of fuel on motorways

The highway code

4. Before setting off

Rule 97 covers license, insurance, vehicle roadworthiness, driving breaks and time for delays and fuel:

You SHOULD ensure that you have sufficient fuel or charge for your journey, especially if it includes motorway driving



The law

Permits stopping on the hard shoulder:

"by reason of a breakdown or mechanical defect or lack of fuel, oil or water, required for the vehicle"

But you can be issued a fixed penalty & points (£100/ 3 points) if deemed to be:

- driving without due care and attention, or
- reasonable consideration for other road users

Loss of tax revenue

Vehicle tax

Current situation:

- Vehicles registered between 2001 and April 2017 pay based on vehicle CO₂ emissions
- Cars registered after April 2017 pay based on CO₂ emissions for year 1, and then:
 - Annual £170–180 payment PLUS
 - Additional £390/year for 5 years for vehicles with a list price of over £40,000.
- EVs are exempt from all vehicle tax

From April 2025:

- All vehicles registered after April 2017 will pay based on emissions for year 1 (currently £10)
- From year 2, all vehicles registered after April 2017 will pay a flat rate (currently £180) PLUS
- 'expensive car payment' will also apply to new EVs with a list price above £40,000 for the first 5 years

Fuel duty

Current situation:

- 52.95p per litre +20% VAT on petrol or diesel
- 20% VAT on electricity at public chargepoints
- 5% VAT on electricity at home chargepoints

'No viable alternative': UK must introduce road pricing, MPs say

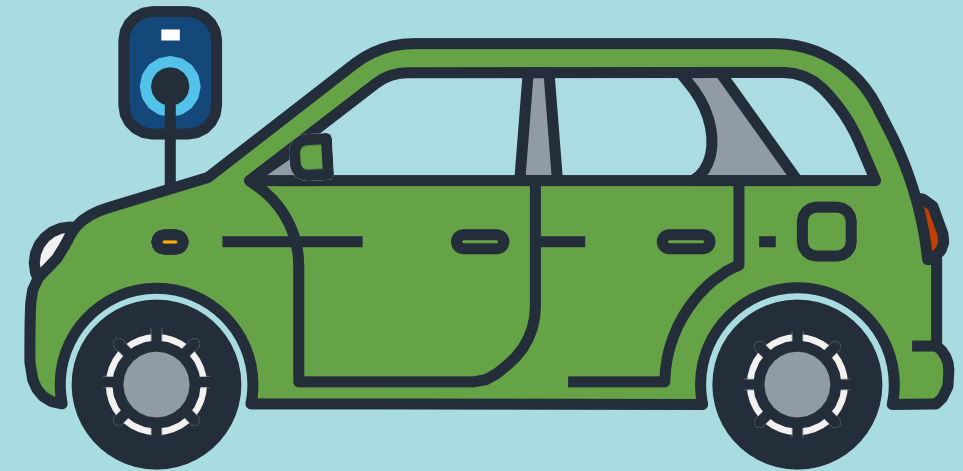
Transport committee concludes that drop in fuel-duty revenues from shift to electric requires urgent action

The future

- No clear plans as yet
- Road user pricing per mile seems likely, but how to implement it & ensure equity?
- MOT odometer readings?
- Telematics?
- Insurance?

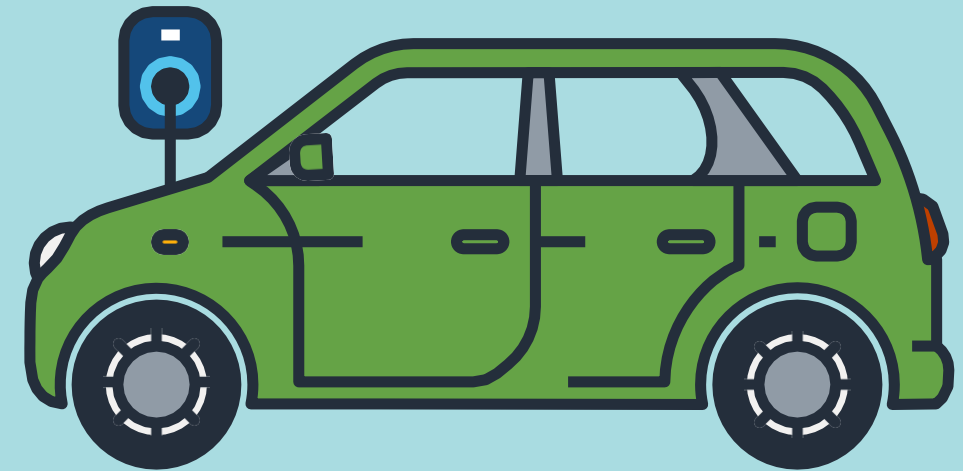
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Q&A



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Thank you



Glossary

Source: <https://pod-point.com/guides/driver/ev-dictionary>

Battery Electric Vehicle (BEV)

A car that runs purely on electric power, stored in an on-board battery that is charged from mains electricity (typically at a dedicated chargepoint).

Plug-in hybrid electric vehicle (PHEV)

A car with a combination of a traditional internal combustion engine and a rechargeable battery, allowing for either electric driving or extended range from a combination of petrol engine and electric motor.

Plug-in vehicle (PiV)

A blanket term for any vehicle with a plug socket, including BEVs, PHEVs, HEVs and mHEVs.

Ultra Low Emission Vehicle (ULEV)

A car that has official tailpipe carbon dioxide emissions of less than 75g/km, and is therefore eligible for grants and benefits from the UK government.

Self-Charging/ Mild Hybrid vehicle

A small battery is charged through regenerative braking, but the car's power comes from petrol. The electric motor can only power the car for short periods at low speeds.

Kilowatt

A measure of one thousand watts of electrical power.

Kilowatt hour (kWh)

A unit of energy equivalent to the energy transferred in one hour by one thousand watts of power. 1 kilowatt hour is typically 3-4 miles of range in a BEV.

Smart charging

A catch-all term for a series of functions that a Wi-Fi connected chargepoint can perform. Most commonly refers to the ability to shift charging away from periods of high grid demand or low supply to periods of low demand or high grid supply.

References & further information

Sustainable Transport Hierarchy: <https://energysavingtrust.org.uk/an-introduction-to-the-sustainable-travel-hierarchy/>

Transport Decarbonisation Plan: <https://www.gov.uk/government/publications/transport-decarbonisation-plan>

Taking Charge, National EV strategy: <https://www.gov.uk/government/publications/uk-electric-vehicle-infrastructure-strategy>

Zero Emissions Vehicle (ZEV) mandate: <https://www.gov.uk/government/news/government-sets-out-path-to-zero-emission-vehicles-by-2035>

Zap Map: <https://www.zap-map.com>

Zap Map statistics: <https://www.zap-map.com/ev-stats/ev-market>

SMMT vehicle market figures: <https://www.smmt.co.uk/vehicle-data/car-registrations/>

EV database: <https://ev-database.org>

RAC fuelwatch (for running cost comparison): <https://www.rac.co.uk/drive/advice/fuel-watch/>

Domestic electricity cost (for running cost comparison): <https://www.nimblefins.co.uk/average-cost-electricity-kwh-uk>

EV ranges: [EV database](#) and <https://www.nimblefins.co.uk/average-electric-car-range#nogo>

References & further information

Transport & Environment research: <https://www.transportenvironment.org/discover/how-clean-are-electric-cars/>

Do electric vehicles produce more tyre and brake pollution than their petrol and diesel equivalents?:
<https://www.rac.co.uk/drive/electric-cars/running/do-electric-vehicles-produce-more-tyre-and-brake-pollution-than-petrol-and/>

ARUP Fire risk guidance:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1168956/covered-car-parks-fire-safety-guidance-for-electric-vehicles.pdf

Guardian EV fire risk article: <https://www.theguardian.com/business/2023/nov/20/do-electric-cars-pose-a-greater-fire-risk-than-petrol-or-diesel-vehicles>

FPA EV fire risk document: <https://www.thefpa.co.uk/advice-and-guidance/free-documents?q=RC59>

The hidden cost of road maintenance due to the increased weight of battery and hydrogen trucks and buses – a perspective: <https://link.springer.com/article/10.1007/s10098-022-02433-8>

ISTRUCTE Car Park Design guide: <https://itboa.org/istructe-car-park-design-guide>

Will greater EV use affect my multi-storey car park? <https://linkeng.co.uk/how-we-work/you-ask-we-answer/will-greater-electric-vehicle-use-affect-my-multi-storey-carpark/>

References & further information

Quantifying the change of brake wear particulate matter emissions through powertrain electrification in passenger vehicles: <https://www.sciencedirect.com/science/article/pii/S0269749123014021>

The best EV tyres 2023: <https://electriccarguide.co.uk/the-best-ev-tyres/>

EV tyres: which electric car tyres are best?: <https://www.carmagazine.co.uk/electric/best-tyres-for-electric-cars/>

RAC EV breakdown cover: <https://www.rac.co.uk/breakdown-cover/electric-car-breakdown-cover>

More than 70% drop in EV Out of Charge breakdowns: <https://www.theaa.com/about-us/newsroom/evs-out-of-charge-breakdowns-fall>

The Highway Code (rule 97): <https://www.gov.uk/guidance/the-highway-code/rules-for-drivers-and-motorcyclists-89-to-102>

Is it against the law to run out of fuel on the motorway?: <https://www.motoringresearch.com/advice/illegal-run-out-fuel-motorway/>

AA warns drivers of low fuel gamble: <https://www.theaa.com/about-us/newsroom/aa-warns-drivers-of-low-fuel-gamble#:~:text=Whilst%20running%20out%20of%20fuel,in%20careless%20or%20dangerous%20driving>

The Motorways Traffic (England and Wales) Regulations 1982: <https://www.legislation.gov.uk/uksi/1982/1163/contents/made>

References & further information

'No viable alternative': UK must introduce road pricing, MPs say: <https://www.theguardian.com/politics/2022/feb/04/uk-road-pricing-transport-committee-mps-electric-shift>

Fuel Duty Rates 2022-23: <https://www.gov.uk/government/publications/changes-to-fuel-duty-rates/fuel-duty-rates-2022-23>

Will electronic road pricing replace car tax in the UK? <https://www.electrifying.com/blog/article/electronic-road-pricing-could-replace-car-tax-in-the-uk>

Electric car drivers must pay tax from 2025: <https://www.bbc.co.uk/news/business-63660321>

Introduction of Vehicle Excise Duty for zero emission cars, vans and motorcycles from 2025: <https://www.gov.uk/government/publications/introduction-of-vehicle-excise-duty-for-zero-emission-cars-vans-and-motorcycles-from-2025/introduction-of-vehicle-excise-duty-for-zero-emission-cars-vans-and-motorcycles-from-2025>