

The role of consumers

Innovation and governance of the power sector to
enable a high penetration of EVs
12th June 2018, Chatham House

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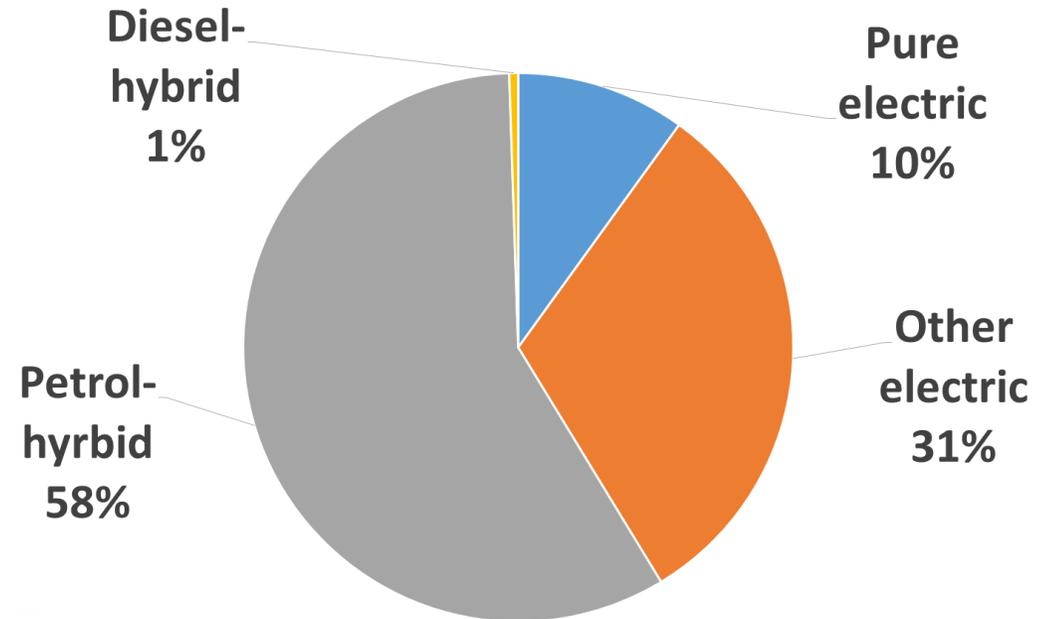
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Market Transformation?

- PHEV registrations are up 28% year to date
- Pure EV registrations are DOWN -9%

Electric Car Registrations April 2018 (UK)



Vehicle category		April 2018	April 2017	% change	YTD 2018	YTD 2017	% change
Plug-in	Pure electric	929	668	39.1	4,823	5,302	-9.0
Plug-in	Other electric	2,929	2,153	36.2	13,196	10,308	28.0
Hybrid	Petrol-electric	5,433	3,412	59.2	27,823	23,750	17.1
Hybrid	Diesel-electric	49	41	19.5	190	299	-36.5
<i>Cars eligible for the Plug-In Car Grant</i>		3,645	2,486	46.6	16,470	13,784	19.5
<i>Total new cars registered</i>		167,911	152,076	10.4	886,400	972,092	-8.8

Table courtesy of SMMT

Top 10 Ultra-low emission vehicle (ULEV) registrations by model (UK) 2014-2017



PHEVs are popular

SOURCE: DfT VEHICLE LICENCING STATISTICS
ANALYSIS: NEXT GREEN CAR, DECEMBER 2017

A ban on petrol and diesel sales?

Careful! It is a ban on *conventional* ICEs. This leaves the door open for substantial fossil fuels to be burnt in PHEVs

Secretary of State for Transport (C.Grayling)
evidence to Transport Select Committee

Chris Grayling: The timetable planning has been done. Test runs have been operating. A bi-mode train operating on the Great Western network today to South Wales was operating at just under 125 mph, which is what you expect from traditional diesel trains.

Q85 **Chair:** What does it say about your commitment to air quality and sustainability? The decision to cancel electrification came at almost exactly the same time as you decided there would be no more petrol and diesel cars from 2040. What do you think it says to people who live close to a busy rail station?

Chris Grayling: My answer is that our strategy on cars on the roads is to encourage the purchase of hybrid cars, and our strategy on the trains is in some places to use hybrid trains. I think it is completely consistent.

Q86 **Chair:** Your strategy is to eliminate diesel and petrol vehicles from 2040.

Chris Grayling: Not hybrid vehicles.

Q87 **Chair:** Not to eliminate them?

Chris Grayling: It is to try to make sure that we use low emission when it is possible to do so. My guess is that technology will change dramatically by then anyway. I was talking about hydrogen. Having been in the first hydrogen cars to appear in the country, I am very impressed by them. There is real potential for the future. I do not want us to be part of a Government who are biased in favour of one technology over another, but I would be very surprised if hydrogen, on both road and rail, did not become a fixture within a not massive number of years. It is impossible to anticipate what the technologies will be in 2040, but our strategy now is to move away from single-fuel vehicles—petrol and diesel—to the greater use of hybrid and electric in our city areas, and encourage the growth of new technologies that can take us further down the road to emission reduction.

It is the *combination* of running cost savings and range that is important



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- PHEVs emerge consistently as more popular than BEVs, even where running cost savings information is given
- This demonstrates the trade-off between range and running cost (tipping point around 250 mile range)
- Also lower perceived costs of battery replacement of PHEVs



ICEs are preferred, even when costs are the same



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- The disutility associated with the purchase price of an ICE is smaller than for an EV
- Even where optimistic cost and range parity is tested, ICEs are preferred
- Uncertainty and other cost factors are as important



It is not about TCO*

*Total Cost of Ownership



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Consumers have short pay-back periods. They:

- value up-front costs much more than running costs which they discount heavily
 - are looking for typical pay-back periods of 4 years
 - have additional non-financial concerns about the vehicles and low awareness of them
- This means that even if EVs make sense from an economic/lifetime perspective, consumers may not purchase EVs in this way
- But rapidly expanding leasing model is changing the decision making process



... it is also not about the environment

-
- Environmental issues have little direct effect on car purchasing decisions
 - Other issues are prioritised: vehicle price, size (+practicality, comfort), reliability, brand, appearance, performance, other costs signals
 - Fuel consumption (mpg) is a proxy for environmental impact but:
 - is ranked higher than environmental impact – i.e. it does not convey environmental information to consumers
 - is traded off against other factors (e.g. vehicle size)

... it also shouldn't be about range



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Analysis of UK National Travel Survey:

- The majority of trips are within the technical range of EVs: 50% of respondents did not exceed 40km on any day of the diary week.
- The average daily driving distance is 40-50 km.
- Certain trip purposes dominated by short trips, e.g. over 90% of food shopping trips are less than 16km.
- Commuting is the most *frequent* trip destination and the work place is where cars are parked the longest (after home) – but only accounts for 16% of mileage

The top five factors which influence current EV ownership:



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Identity	the degree to which people feel they associate with 'typical' EV owners
Anxiety	perceived suitability of these vehicles particularly in relation to range
Parking Difficulty	perceived ease of being able to charge a vehicle at home
Willingness to pay	willingness to pay more for plug-in technology and/or environmental benefits
Symbolic motives	capture the perceived status, social acceptability and embarrassment or otherwise of owning an EV.



We need: To understand non-economically rational consumer motivations



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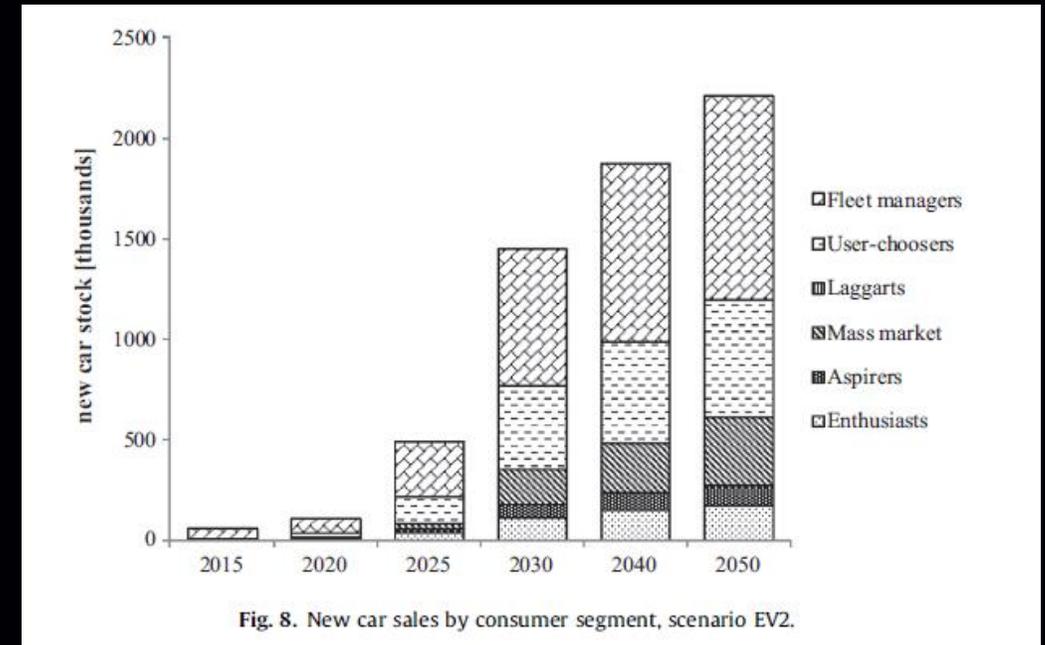
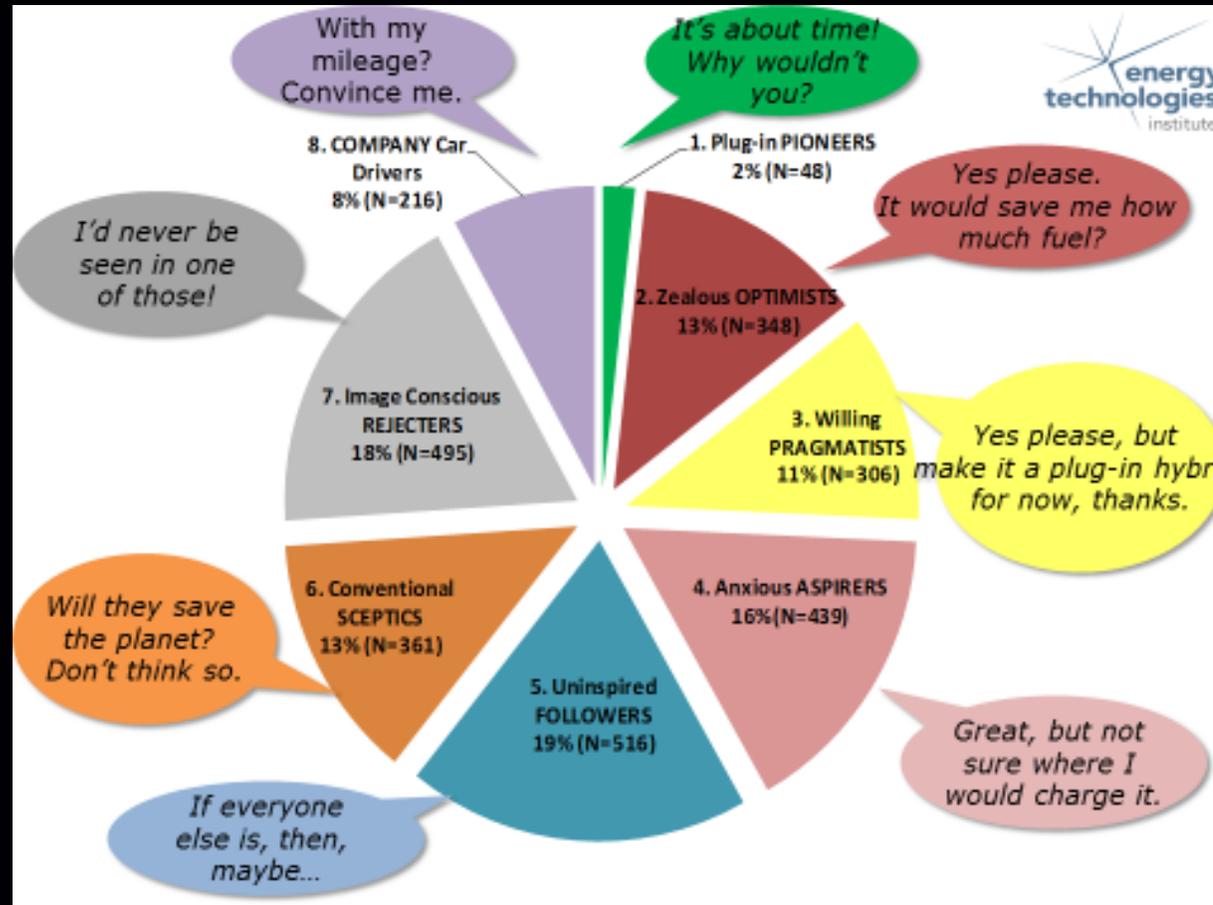
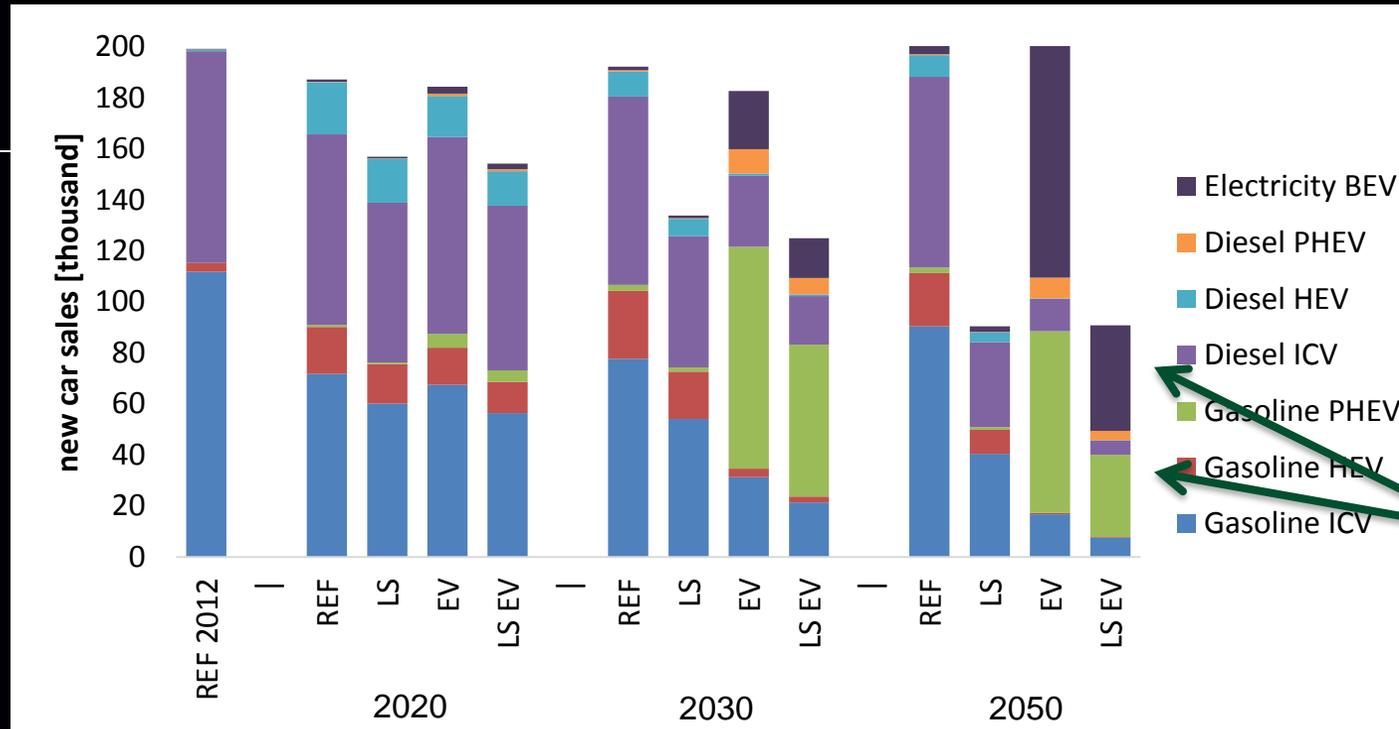


Fig. 8. New car sales by consumer segment, scenario EV2.

The electric vehicle (r)evolution



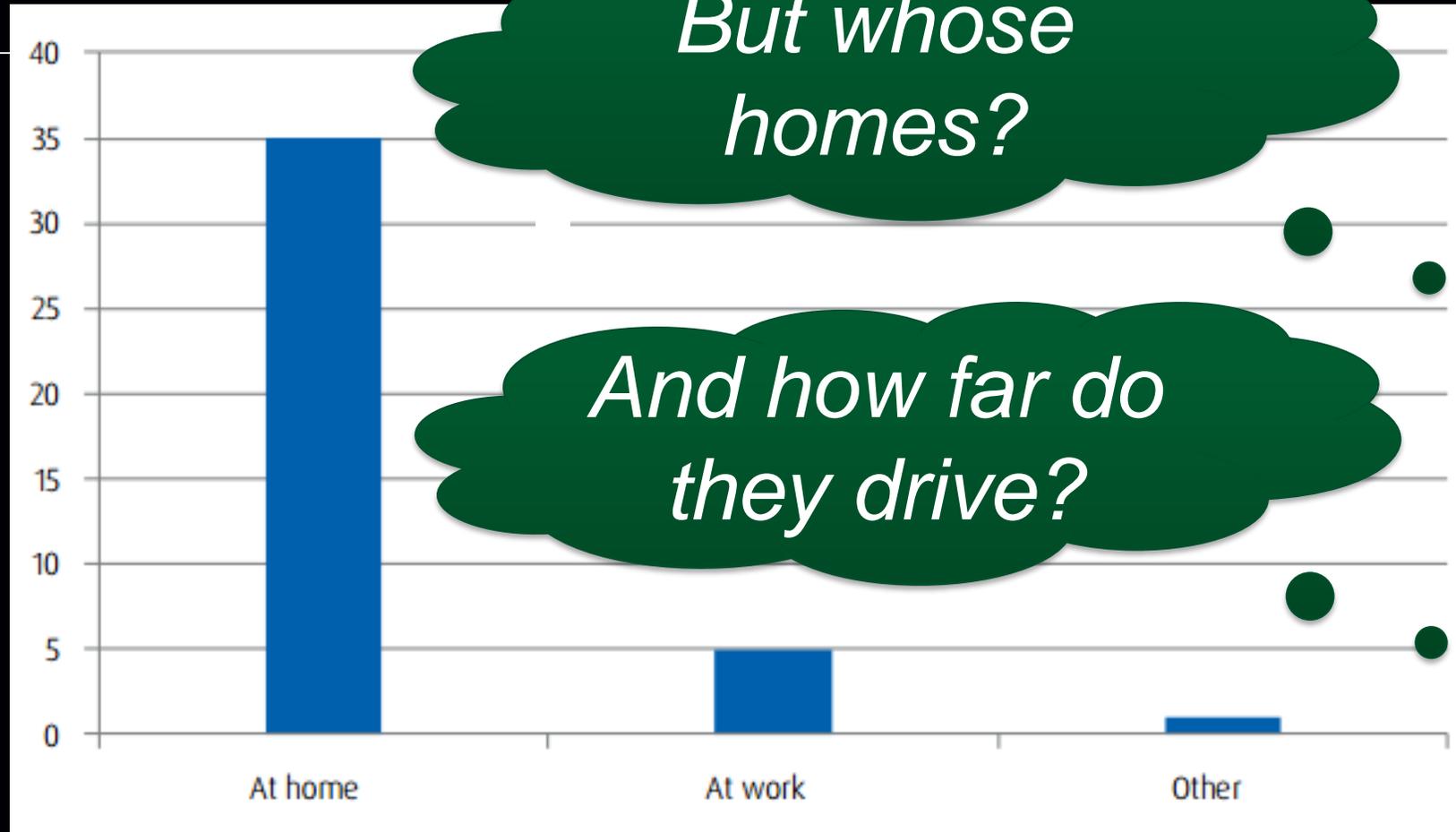
EV, LS EV: by 2030 63% of new cars are plug-in vehicles – by 2050, 85% of new cars are plug-in

‘High EV’: private, fleet and commercial buyers increasingly prefer electric vehicles over conventional internal combustion cars and vans

‘Lifestyle’: lower overall car ownership (and therefore sales) levels, reflecting the tendency towards less overall car use and the increased membership of car clubs for use of a variety of types of cars for longer distance journeys

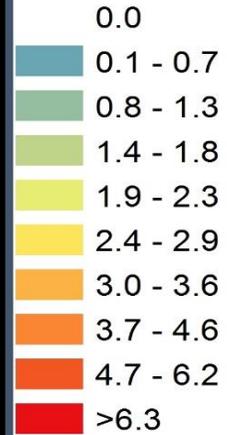


Spatial location of charging

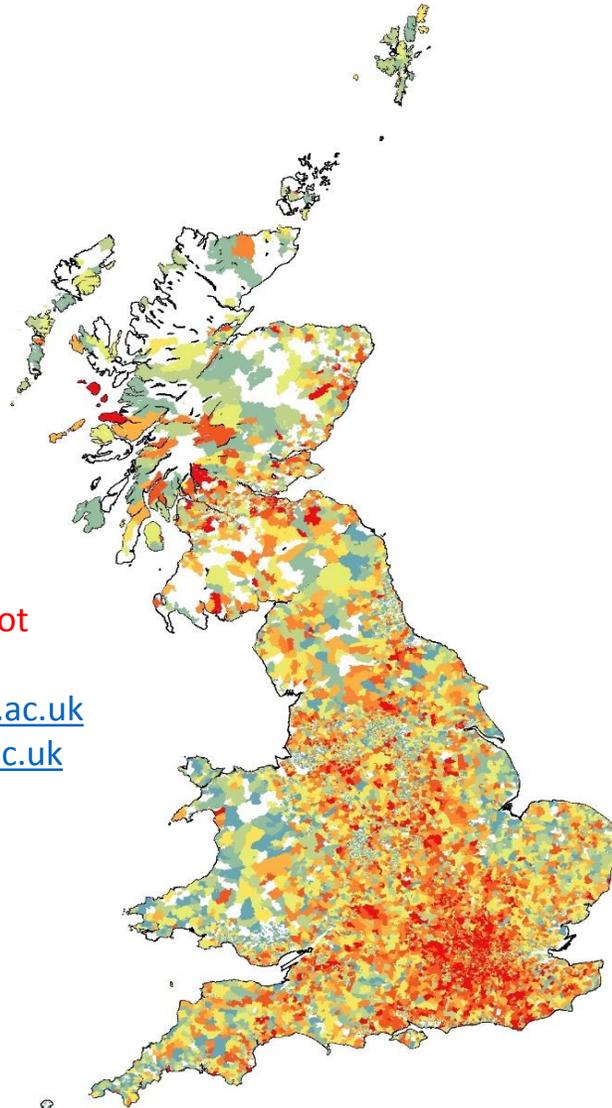


Hybrid/ EV per 1000 population (LSOA, 2016)

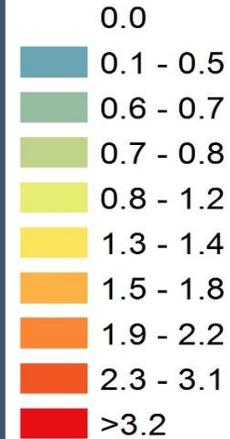
Hybrids per 1000 population
(2016, LSOAs)



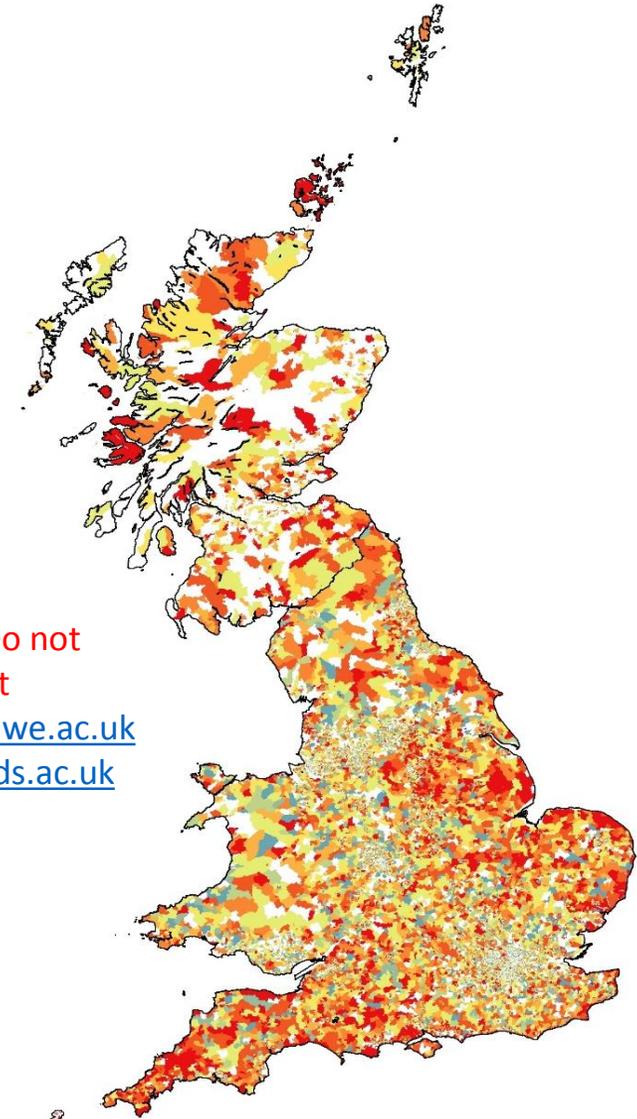
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EVs per 1000 population
(2016, LSOAs)



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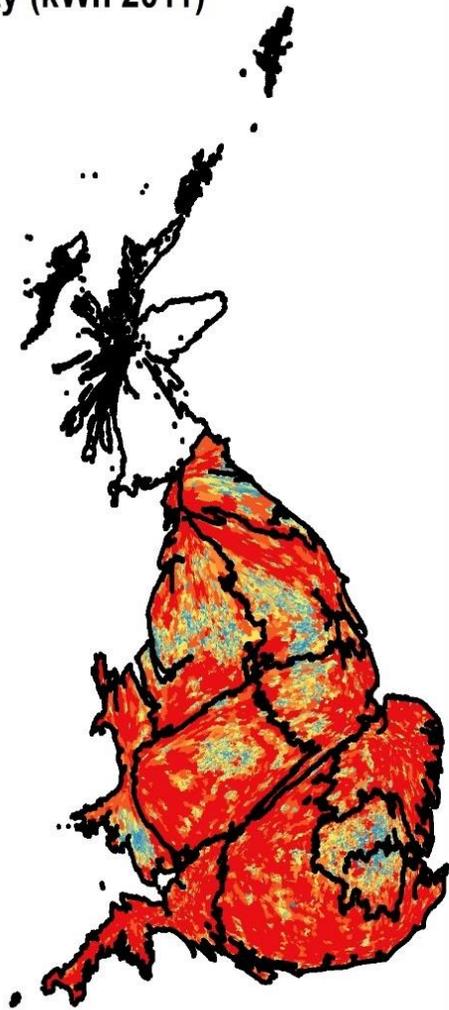




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Average Household Energy Consumption from Electricity (kWh 2011)

- <3,267
- 3,268 - 3,478
- 3,479 - 3,639
- 3,640 - 3,772
- 3,773 - 3,912
- 3,913 - 4,062
- 4,063 - 4,255
- 4,256 - 4,563
- 4,564 - 5,231
- >5,232



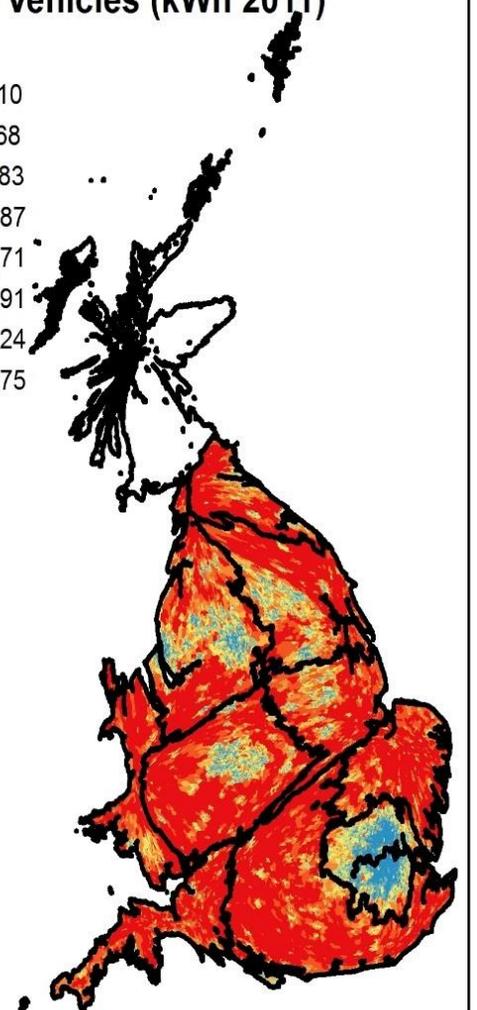
Average Household Energy Consumption from Gas (kWh 2011)

- <10,693
- 10,694 - 11,706
- 11,707 - 12,452
- 12,453 - 13,153
- 13,154 - 13,856
- 13,857 - 14,587
- 14,588 - 15,443
- 15,444 - 16,592
- 16,593 - 18,526
- >18,527



Average Household Energy Consumption from Private Vehicles (kWh 2011)

- <10,114
- 10,115 - 11,010
- 11,011 - 11,668
- 11,669 - 12,283
- 12,284 - 12,887
- 12,888 - 13,571
- 13,572 - 14,391
- 14,392 - 15,524
- 15,525 - 17,375
- >17,376



Relative consumption from gas, electricity and car use



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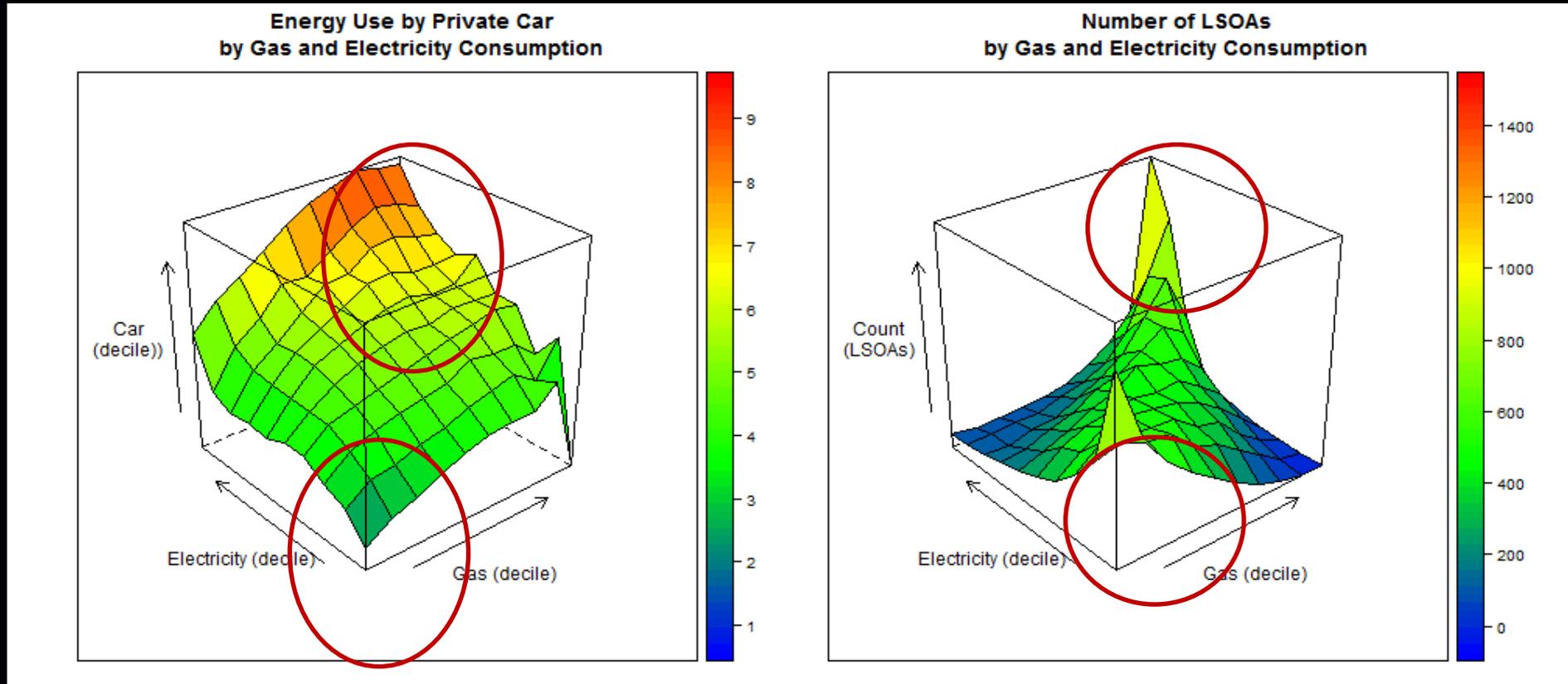
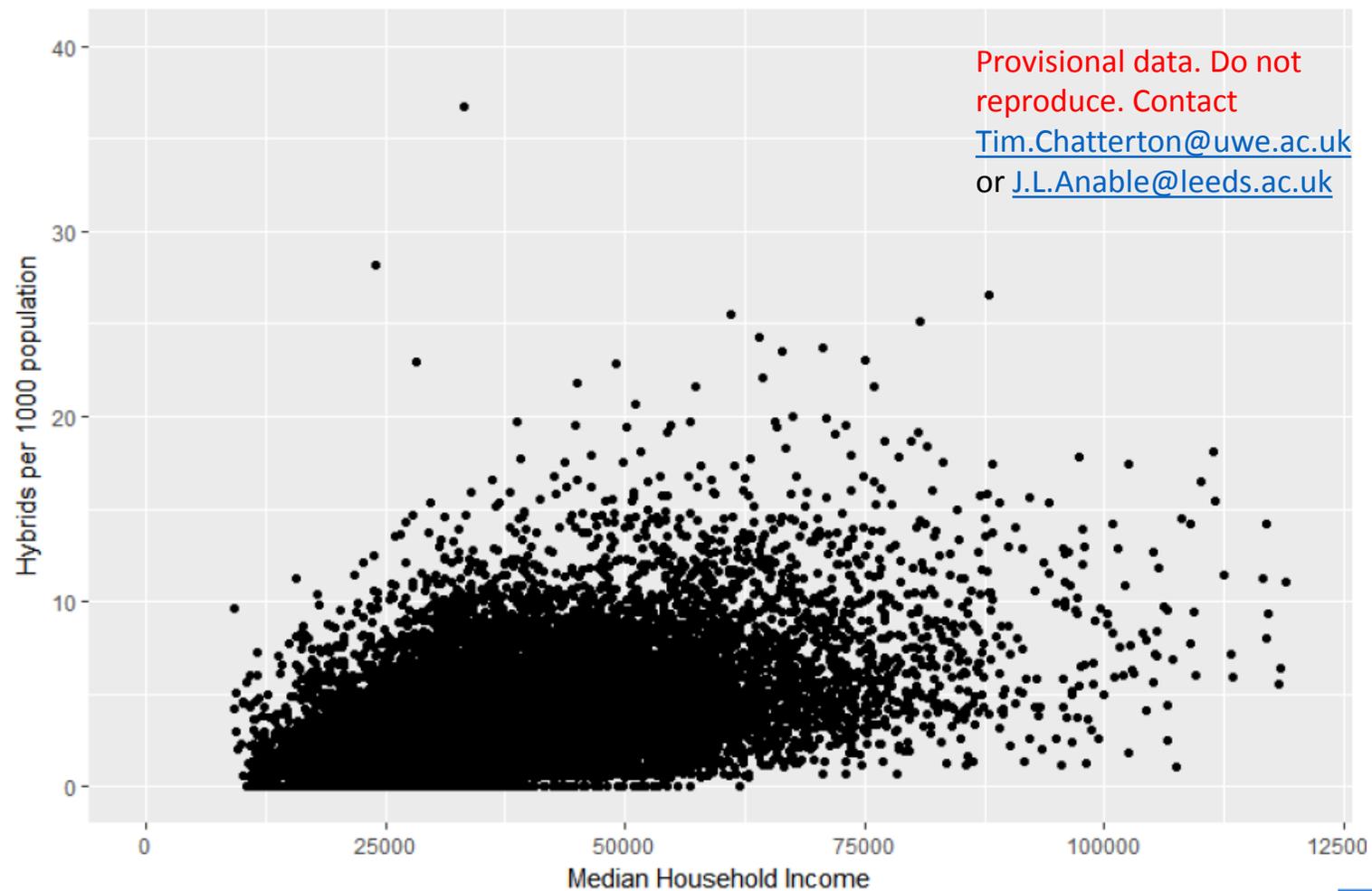


Fig. 3. Relationship between domestic (gas and electricity) consumption and energy use by private car in England and Wales.

Fig. 4. Number of LSOAs in England and Wales in each combination of gas and electricity consumption decile.



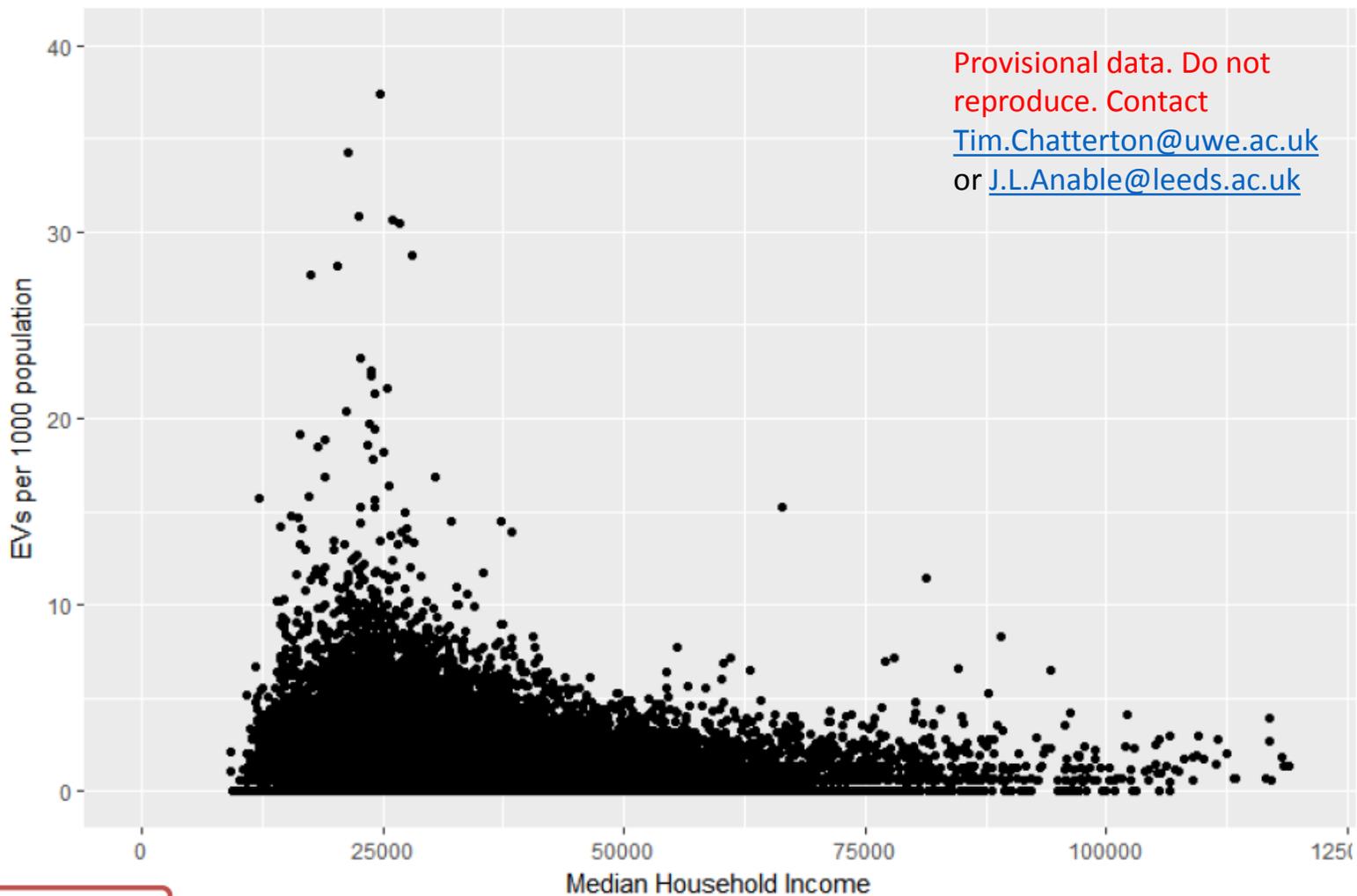
Hybrid ownership by income (UK LSOA, 2016)



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EV ownership by income (UK LSOA, 2016)



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How car use affects the share of diesel cars



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- In 2011: 24% of the private car fleet was diesel, responsible for 31% of the mileage
- The share of mileage driven by diesels is much greater in rural towns villages (~45%) than urban areas (~30%)

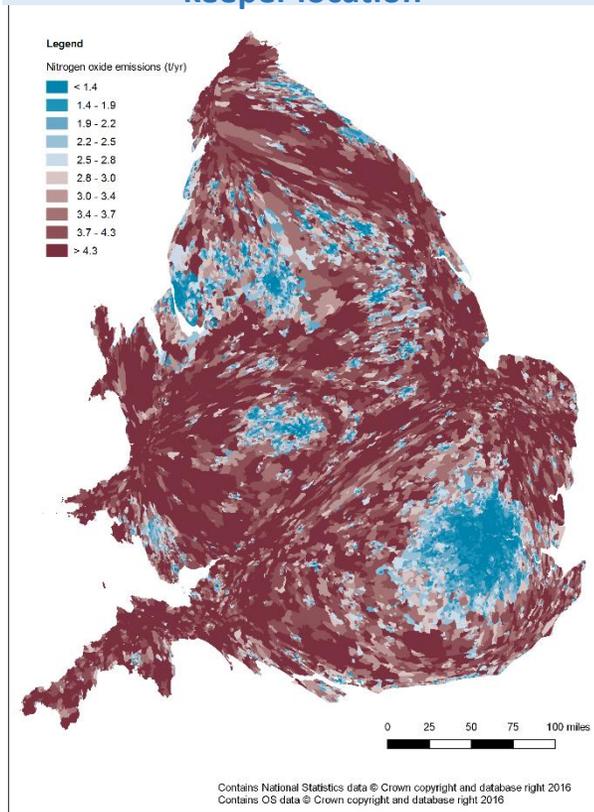
Mileage category	Percentage that are diesel-fuelled
Private cars doing less than 5,000 miles per year	11
Private cars doing between 5,000 and less than 12,000 miles per year	25
Private cars doing 12,000+ miles p.a.	49

Cairns, S., Anable, J., Chatterton, T., Wilson, R.E. & Morton, C. (2017) [MOToring along: The lives of cars seen through licensing and test data](#). Report for the RAC Foundation.

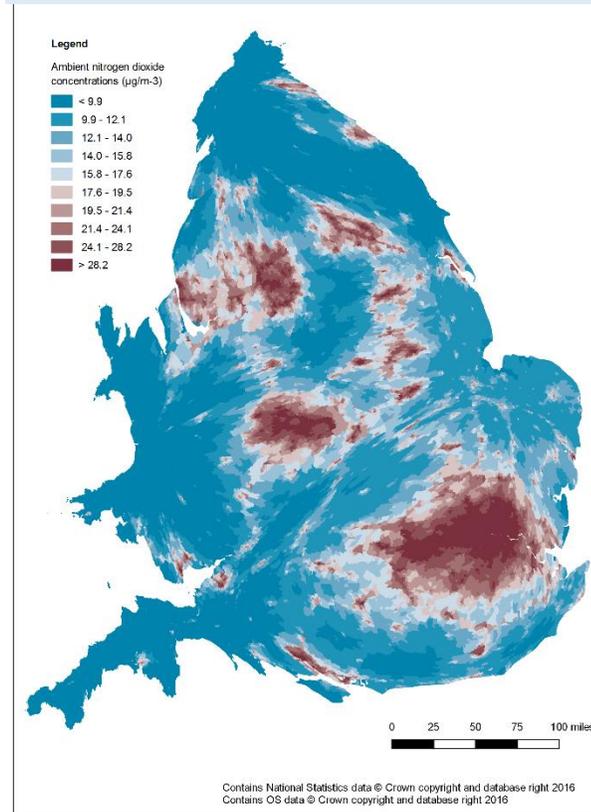
The polluted vs the polluters

The *polluters* (those responsible for emitting high amounts of pollutants from vehicles) are generally not co-located with the *polluted* (those exposed to high ambient concentrations of pollution).

Emissions of nitrogen oxides from all private vehicles by registered keeper location



Ambient concentrations of nitrogen dioxide (from all sources)



Where mean ambient NO₂ concentrations are higher, the:

- mean age of vehicles is higher
- proportion of **diesels** is lower
- Average NO_x emissions factor is lower
- Average **distance per vehicle** is lower



Automotive industry

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Tue 5 Jun 2018 10:37 BST



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Sales of hybrid cars soar as diesels plunge by nearly a quarter

Drivers continue to shun diesel in the face of environmental and tax concerns



▲ Sales of plug-in hybrid cars such as the Mitsubishi Outlander PHEV rose by nearly three-quarters in May. Photograph: Alamy

Sales of plug-in hybrid cars soared by nearly three-quarters year on year in May, dramatically outstripping the 3.4% overall growth in new car registrations.

Nearly 4,000 plug-in hybrids, which typically run for about 30 miles on a battery before a combustion engine kicks in, were bought last month, up

most viewed



Live Trump-Kim summit: North Korea commits to 'work towards complete denuclearisation' - live



Giant African baobab trees die suddenly after thousands of years



A meeting of equals: what we learned from the Trump and Kim handshake



Dennis Rodman cries as he hails Trump-Kim summit: 'I'm so happy'



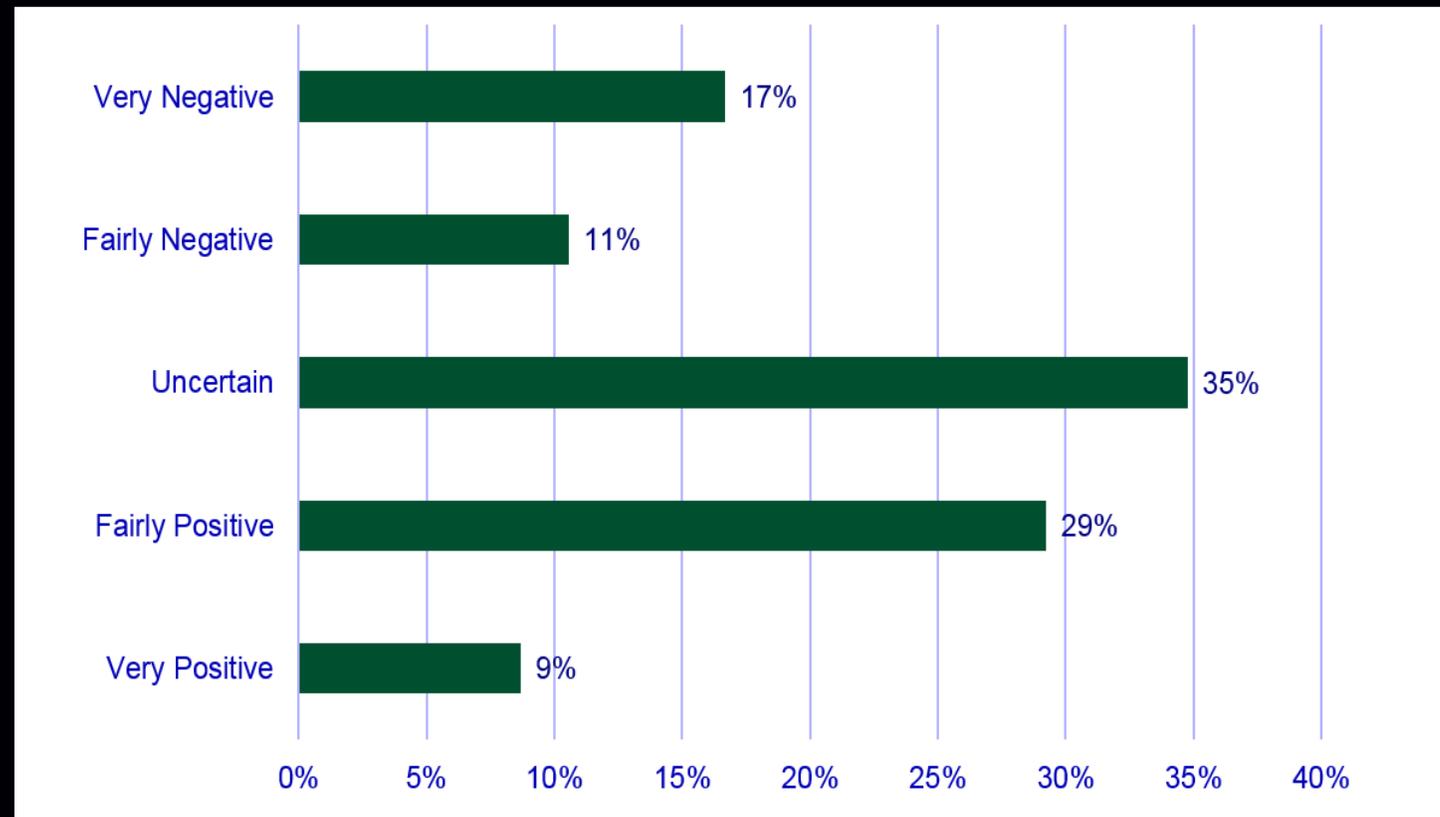
New top 10 of heritage sites maps out the history of England

Overall acceptance of demand control



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Overall, how do you feel about your electricity supplier controlling some of your appliances for the purposes of avoiding peaks in electricity demand but where there will be a financial benefit for you?

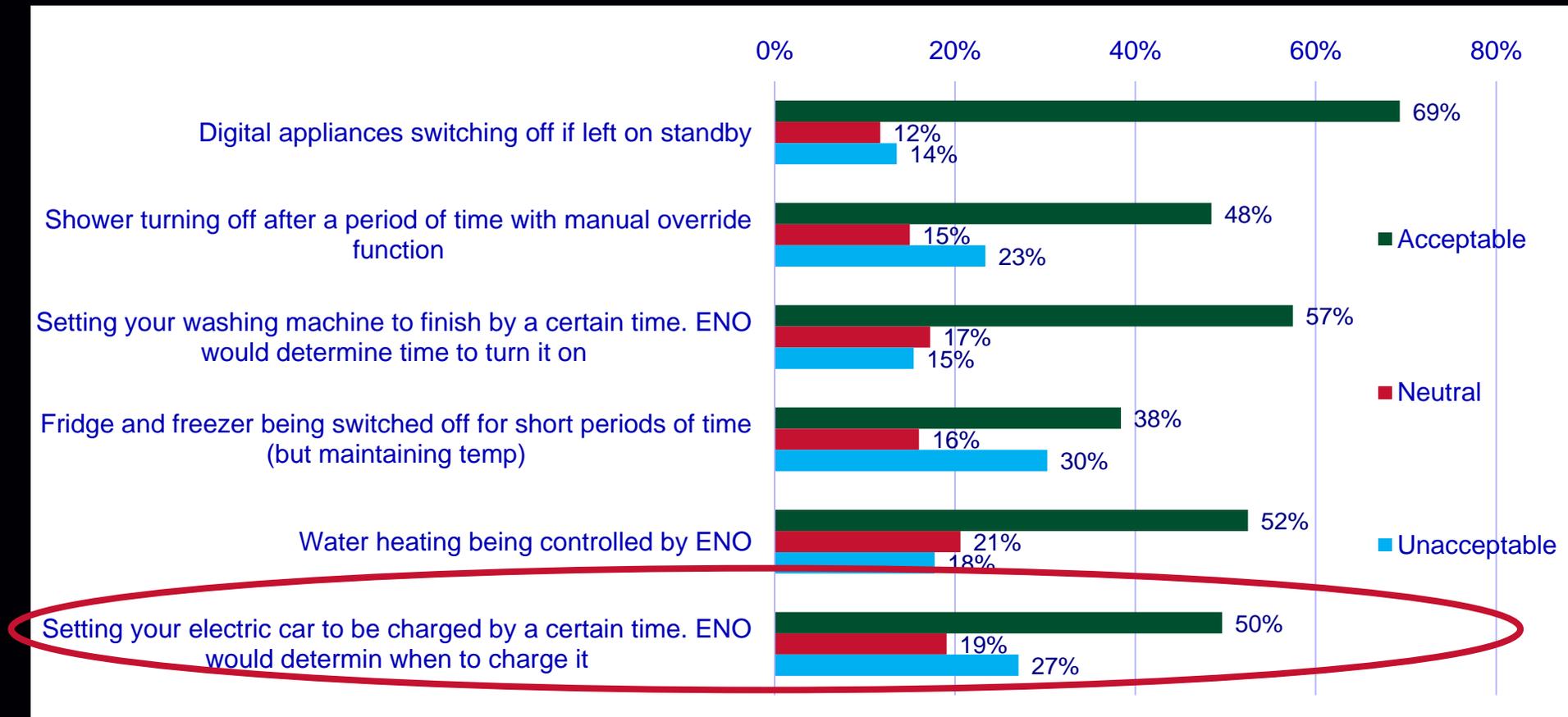


Acceptance of demand control



Demand control is more acceptable for EVs than for fridges/ freezers & showers

How acceptable would it be for the following restrictions on energy use to be put in place in order for peaks in energy demand (e.g. in the mornings and evenings) to be avoided?





An electric car is STILL a car



- *Accidents
- *Parking pressures
- *Road user conflicts
- *Congestion
- *Mineral extraction
- *Energy supply & emissions
- *Disposal
- *Subsidy

