Re-engineering the street: low-carbon pavements?

The materialities of EV charging infrastructuring

RGS 2021

Session: Repairing, Repurposing, Retreating: The Materialities of Climate Response

Outline of presentation

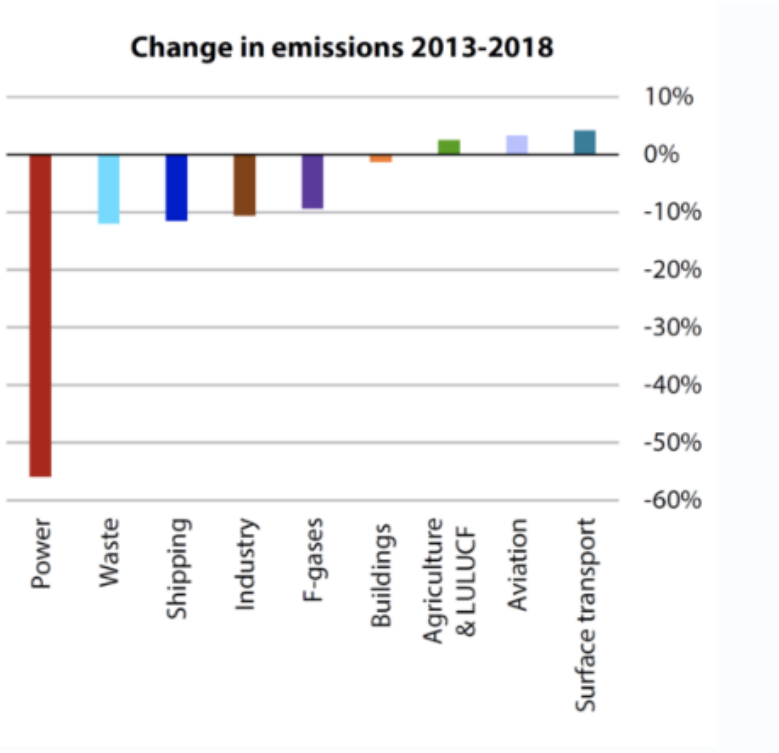
- Research context: decarbonisation of transport and EVs
- Project context: the STEP project
- Theoretical contexts:
  - Materialities and theory – material turn
  - Infrastructures and theory – the infrastructural turn
  - Energy transition and theory – transition critiques
- Data
- Discussion
- Conclusion

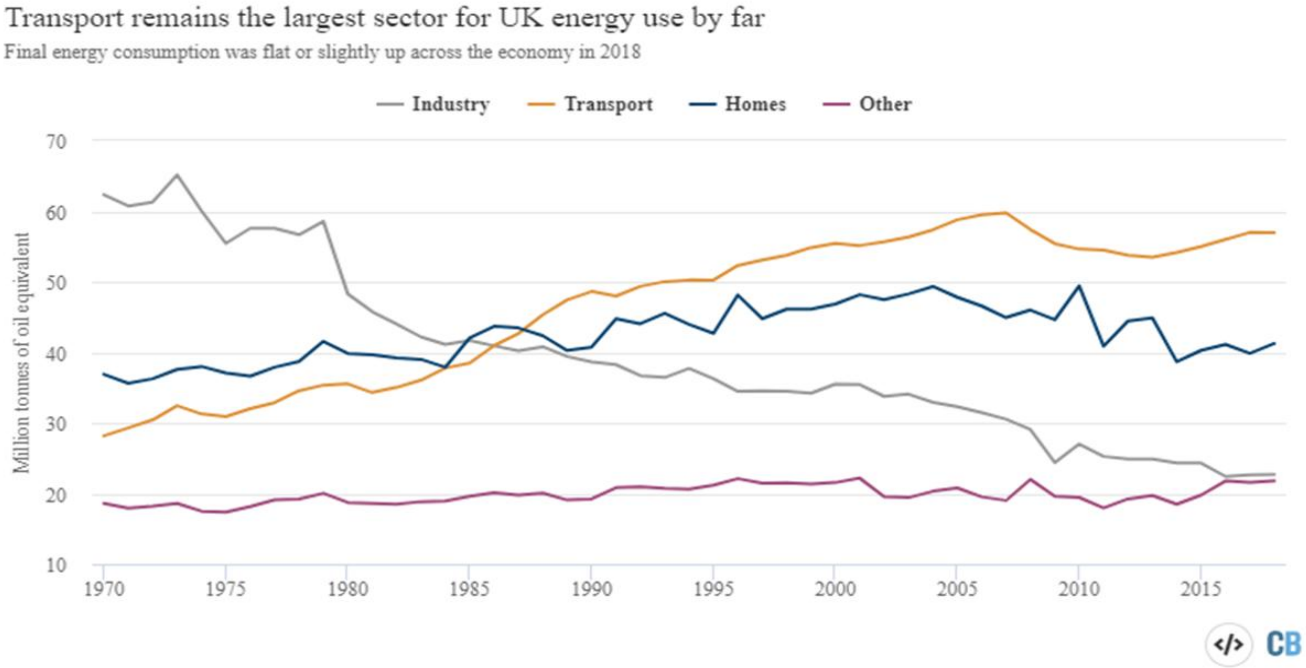
Research context

- Transport the only sector with growing emissions
- Surface transport a policy focus (ignores air and shipping)
- (Rapid) Decarbonisation of transport required
- Electrification as the main policy response (ignores other aspects of ‘sustainable transport paradigm’
- EVs not a ‘solution’ on their own (Brand and Anable?)
- Nevertheless, EV ownership and use growing (ignores Hybridgate)
- Inequalities in access to off-street space for charging

Research context

- Transport the only sector with growing energy and emissions

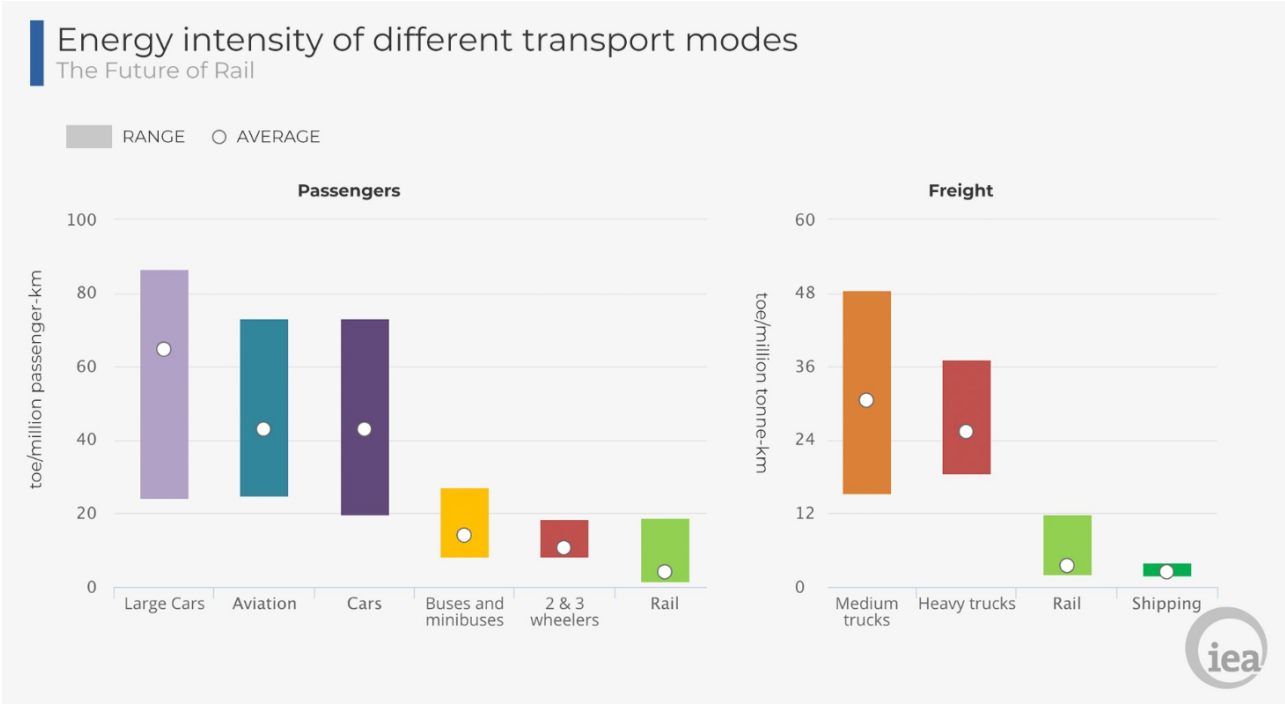


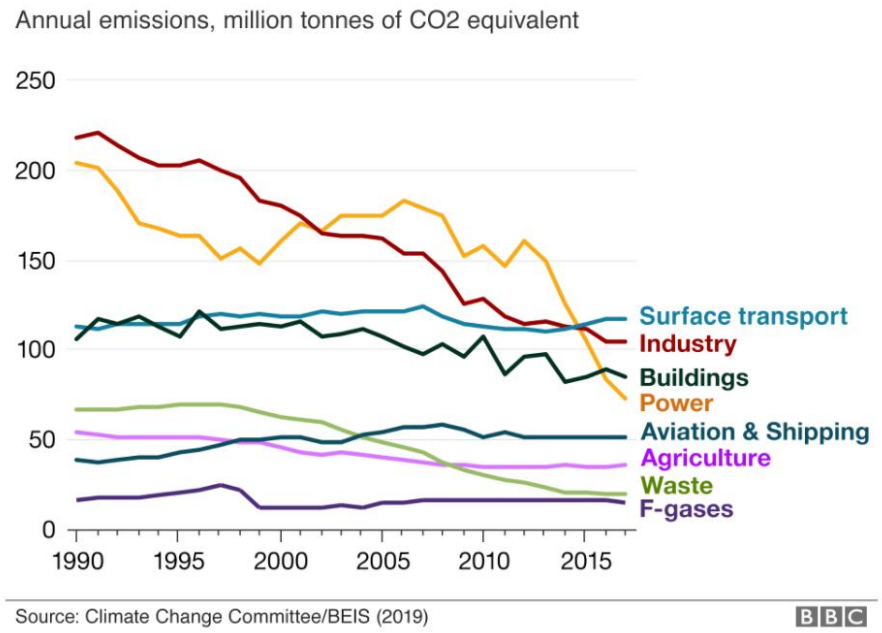


UK energy use by sector (Mtoe), 1970-2018. Source: DUKES 2019 Table 1.1.5. Chart by Carbon Brief using Highcharts.

Research context

- Transport the only sector with growing energy and emissions
- Surface transport a policy focus (ignores air and shipping)

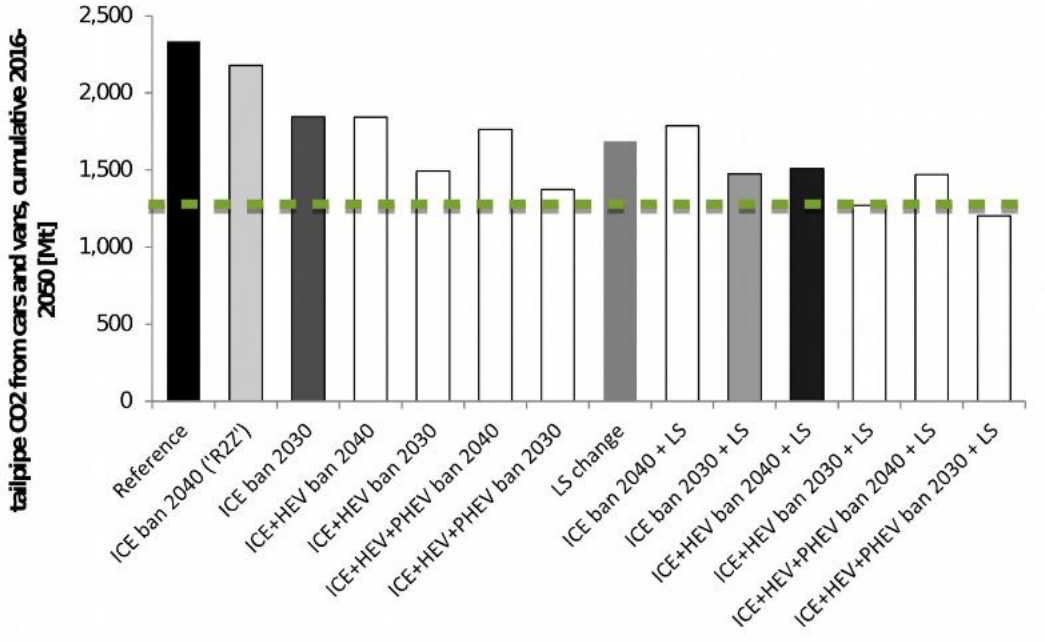




Research context

- Transport the only sector with growing energy and emissions
- Surface transport a policy focus (ignores air and shipping)
- (Rapid) Decarbonisation of transport required
- Electrification as the main policy response
- EVs not a ‘solution’ on their own (Brand et al. 2020)

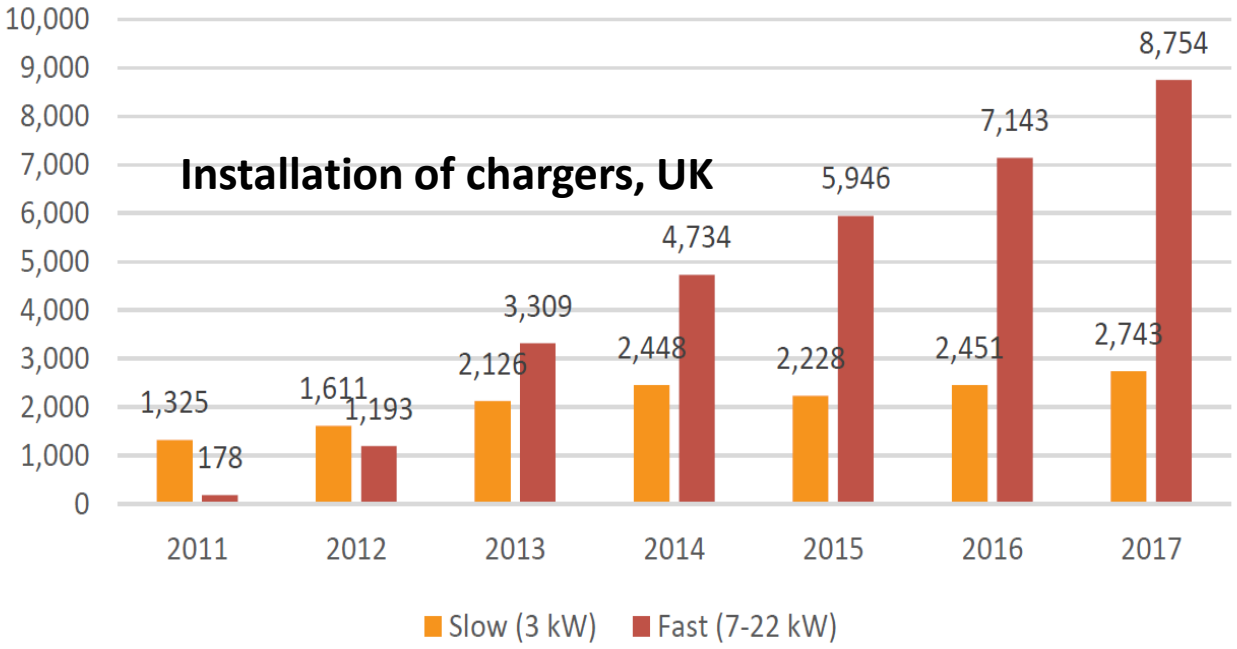
Figure 3: Cumulative CO_2 tailpipe emissions from cars and vans, 2016-2050 period

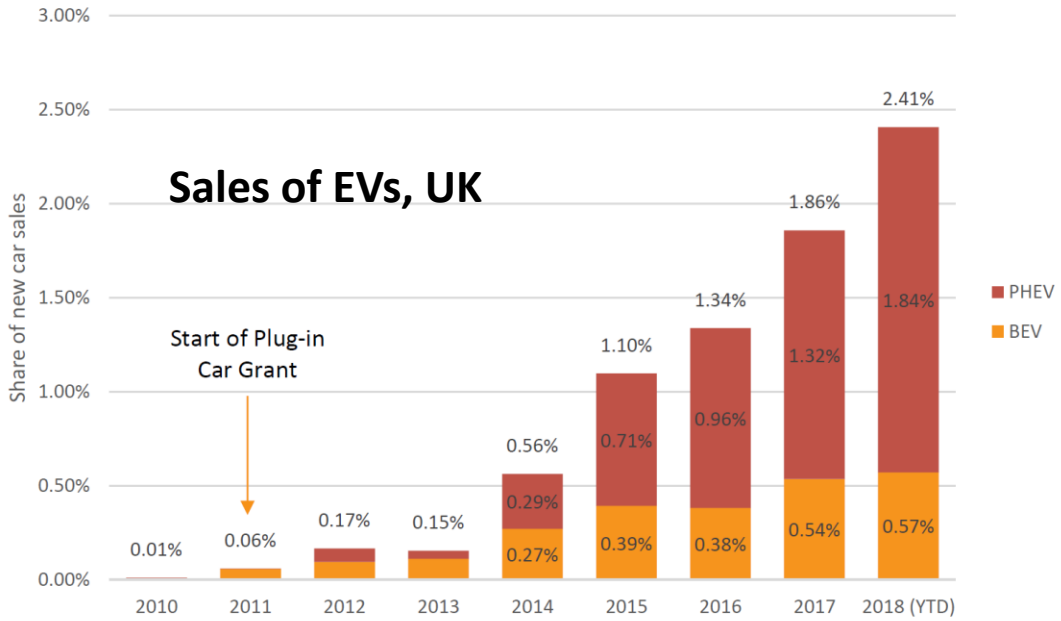


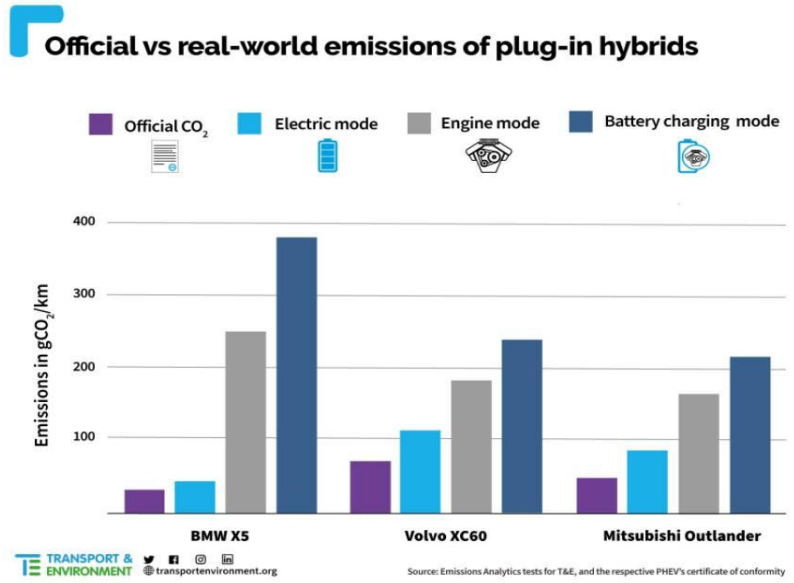
Green dotted line shows Paris-compliant UK transport carbon budget

Research context

- Nevertheless, EV ownership and use growing (ignores Hybridgate)

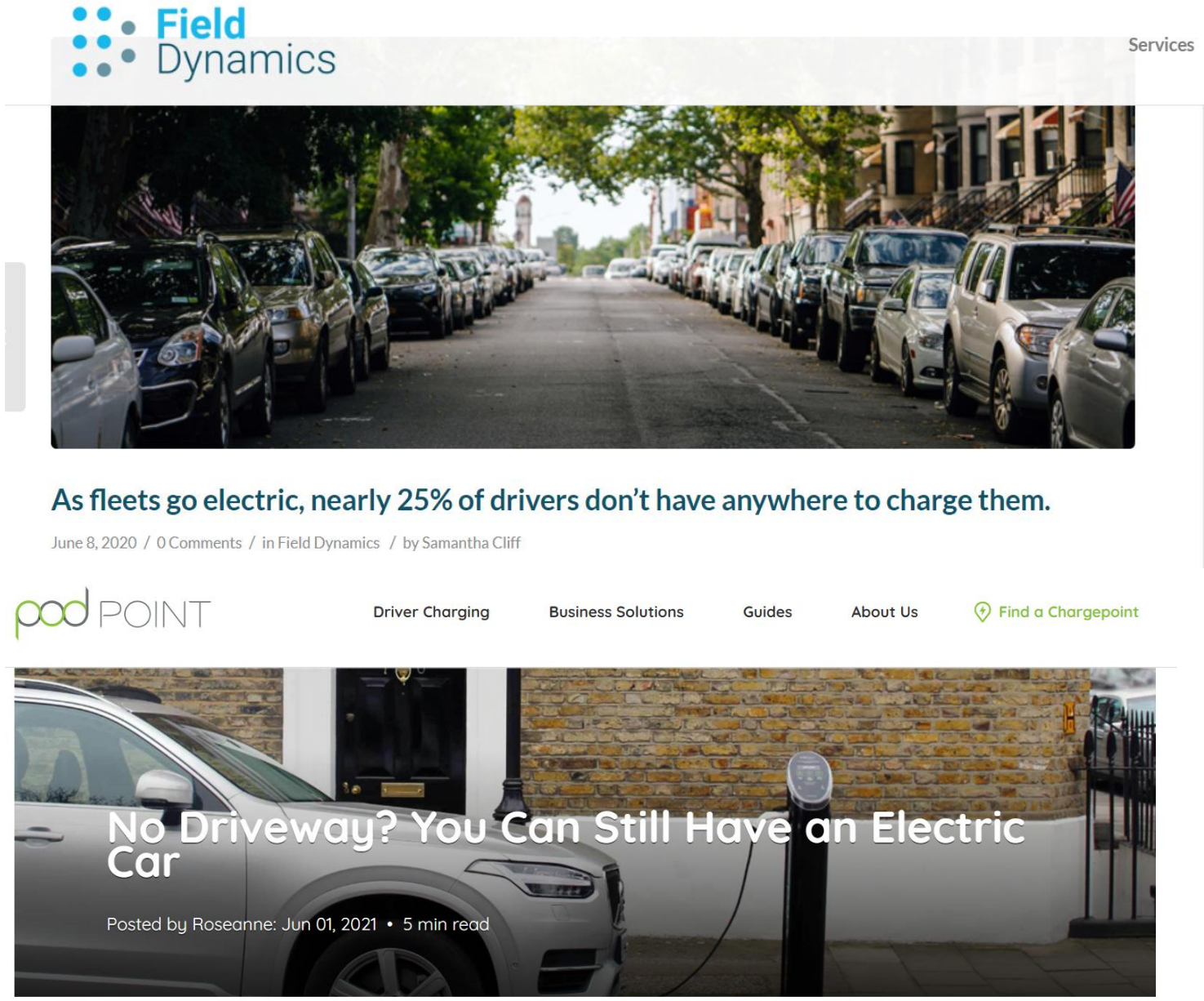






Research context

- Lack of, and inequalities in access to off-street space for charging
- 25% of UK households have no off-street parking
- 6,642,000 households



The STEP project – Subsurface Technology for Electric Pathways

- University of Leeds as conducting user/consumer research
- Consortium of Trojan Energy, Element Energy, Octopus Energy, Brent and Camden Borough Councils, UKPN
- Funded by Innovate UK, one of 13 EV charging projects
- Others include induction (wireless) charging, taxi charging, ‘last mile’ fleets, ‘electric forecourt’ (i.e. garage), battery storage and load balancing

Demonstrator Name
AMiCc
Clean Streets EV Infrastructure Toolkit: Demonstrator
Demonstrator for UK's First Solar Electric Forecourt
EnSmartEV - Entrust Smart EV Charging System for Public Spaces
EV Network Extender (EV NetX 2)
On-street Residential Induction Charging (OSRIC)
Park and Charge Pilot
Scaling On Street Charging Infrastructure (SOSCI) Phase 2
Subsurface Technology for Electric Pathways (STEP)
Virgin Park and Charge 2
Wireless Charging in Micro-Fulfilment Centres for Last Mile Delivery
Wireless charging of electric taxis (WiCET)
Zapinamo StreetHubz Real World Demonstrator for EV Charging in Exeter & Environs

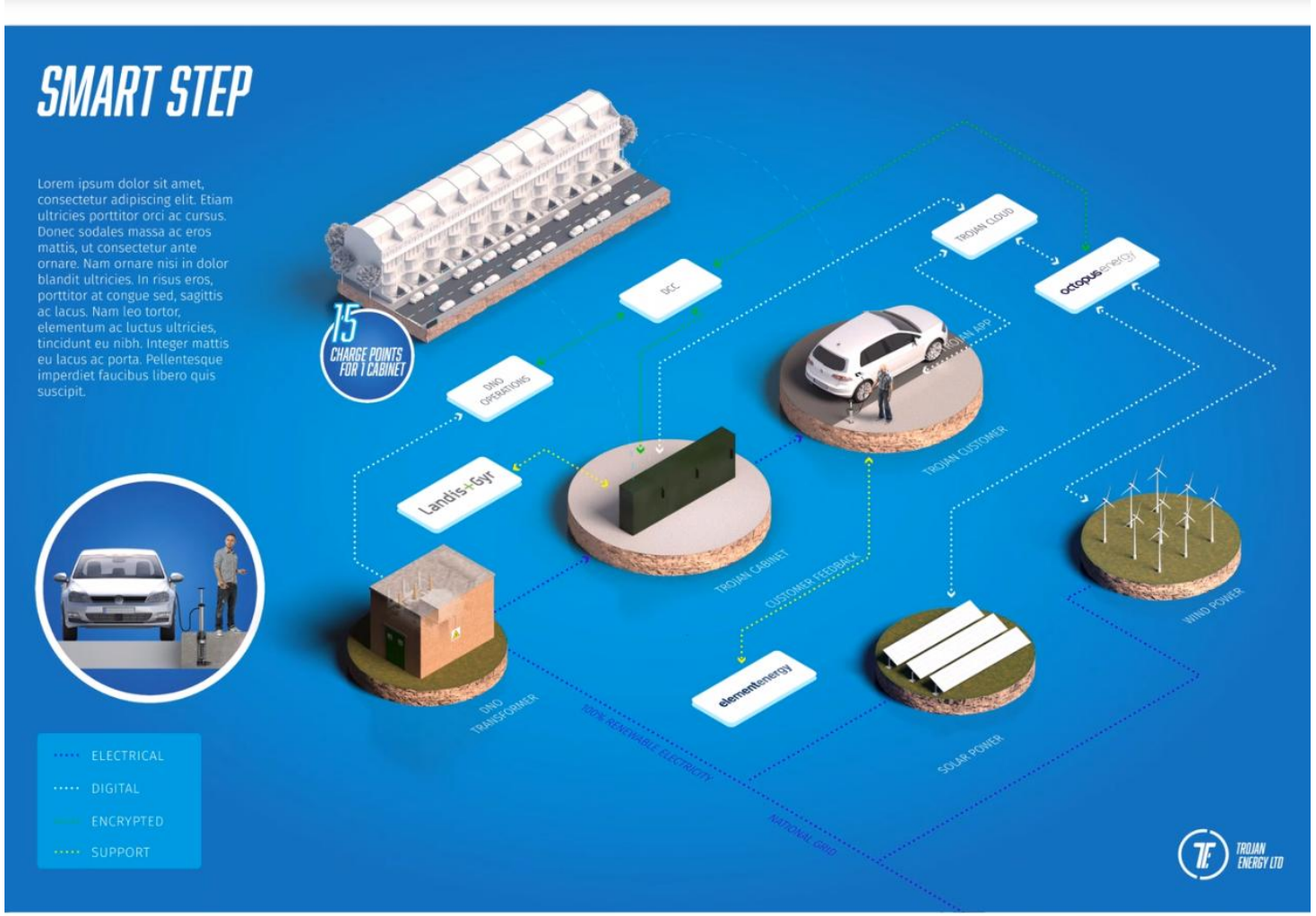
The STEP project – Subsurface Technology for Electric Pathways

- Trojan Energy technology flush to pavement, lance and cable
- 15 chargers per cabinet where electricity is metered/connected
- 1/3 charger points and cabinets installed

- Connector – flush socket inserted into the ground
- Lance – connects the connector with the car
- App – allows customers to control their charging
- Box – control centre for up to 20 connectors

The STEP project – Subsurface Technology for Electric Pathways

- Further plans – Smart-charging, taking over the currently installed infrastructure
- Commercialisation, scale-up and roll-out all pending.
- De-ICEing technology to avoid competition with ICE cars



Summary

- TE technology/infrastructure is part of broader ‘energy transition’ replacing ICEs with Evs.
- It overlaps with other electricity and digital infrastructures and devices (meters, smart meters, data centres, electricity transmission)
- It overlaps with existing street/pavement scapes and materialities
- Its main ‘USPs’ are seen as:
  - Invisibility out of use (heritage)
  - Multiple chargers, one connection (availability, cheap/simple for DNO/scale-up)
  - No street furniture (accessibility)
  - HOWEVER this = lance required in car/house, large cabinet

Theoretical contexts: Materialities

- Assemblages, actants, delegation (ANT and STS)
- Obduracy (Hommels 2005): *"The fundamentally networked character of modern urbanism . . . is perhaps its single dominant characteristic"* (Graham and Marvin 2001, 10)
- SPT and materiality: 'practice-arrangement' nexuses, where material arrangements "channel, prefigure, and facilitate practices" (Schatzki 2010, 4); Matters of practice (Shove 2017) – infrastructures, devices, resources.

Theoretical contexts: Infrastructures

- STS: *"infrastructure is a fundamentally relational concept. It becomes infrastructure in relation to organized practices"* (Star and Ruhleder, 1996: 113)
- Electric and other 'large technical systems' (e.g. Hughes 1993), socio-technical and political (reflect power)
- Socio-technical systems: infrastructures + devices + institutions + rules
- Infrastructures as 'boring things', invisible, forgotten in action
- *"Writing of this kind tends to consider infrastructures-in-the-(re)making as distinct from infrastructures-in-use. This is intriguing and also ironic."* (Shove 2017: 3)

Theoretical contexts: Infrastructures

- *“Embeddedness.*
- *Transparency.*
- *Reach or scope.*
- *Learned as part of membership.*
- *Links with conventions of practice.*
- *Embodiment of standards.*
- *Built on an installed base.*
- *Becomes visible upon breakdown.”* (Star and Ruhleder 1996: 5)

Theoretical contexts: Energy transitions and critiques

- Various ‘transitions’ involved:
  - Sustainability transition
  - Energy transitions
  - Transition Management
  - Decarbonisation and ‘net zero’
- TM and MLP: linear, gradualist, substitutional, co-evolutionary, stable, niches
- Critiques:
  - Cass, Shove and Schwanen 2018 *Infrastructures, intersections and societal transformations*
  - Temenos et al. 2017 *Theorising Mobility Transitions - An Interdisciplinary Conversation*

Theoretical contexts: Energy transitions and critiques

- Cass, Shove and Schwanen 2018 Infrastructures, intersections and societal transformations
  - *“instead of highlighting processes of zero-sum competition, strong path dependencies and transition pathways unfolding in relatively uniform ways, we underline the **indeterminacy** that is a feature of situations in which multiple infrastructures intersect.”*
  - *“distinctive forms of intersection amongst infrastructures, practices and institutions. The forms we consider include relations of **co-constitution**; **adaptation** and ‘threading through’; historical **layering**; and **co-existing configurations** of infrastructural systems.”*

Methods

- Nvivo analysis of:
  - Meeting slides
  - Meeting notes
  - Press releases, website, public engagement letters
- Semi-structured interviews with:
  - Developer (Trojan Energy)
  - Borough Council (and highway authority) (Brent)
  - UK Power Networks (DNO)
  - Oxford Council (UK on-street charging trials)
  - Oxford trial academics

Data/findings

- Content analysis of meeting slides and notes:

Name	Files	References
Benches	3	3
Cabinets		
-Aesthetics	2	4
-Location	5	7
-Size	1	1
Cables	15	27
Connectors	1	1
Lighting	6	8
-Location	2	2
Heritage or conservation area	15	31
Lamp-posts	3	4
Lance	17	32
-Numbers and timing	19	49
-Testing	10	24
-Training	3	5
Parking	33	61
Streets	2	2
-Number of streets	1	1
Pavements	7	8
-Flush	7	8
-Pavement materials	7	12
-Pavement width	7	9
Trip hazard	2	3
Underground		
-Basements	2	2
-Ground radar	15	30
-Tree Roots	10	11
-Utilities	11	23
Wheelchairs	6	8

Data/findings: interviews

- Brent (Council): Emphasise trial nature, uncertainties, discovering by doing, (describe themselves as having no standards for things, in responsive mode). Cable length and trailing a key concern. Victim of own success issue with parking. Would prefer e-bikes and car-sharing. Hierarchy of 'trad' utilities and new ones. Based on priorities of practices? *"Broadband was a newcomer, is now seen as more established. If EV charging is to go ahead then it may similarly become seen as the Next Utility, which people have a 'right' to access."*

Data/findings: interviews

- Trojan (developer): Want it to be invisible *“the materiality of it is that we we want it to be as obscure in everyday use as possible”*, claims fits with council drives for less street furniture and clutter for accessibility and visuals, no clash with parking infrastructure, heritage area concerns but lighting is very customisable, digging reinstated, cabinets ‘invisible’ because *“I even walked past the, the massive cabinet that we've installed and didn't notice it … the cabinet has kind of shocked people in terms of the size, when they've seen it here in the workshop environment … I mean, there's no getting around it's a big unit six and a half meters by two meters tall, but … painted green cabinet colour that everyone was used to seeing. Yeah, it almost becomes invisible.”*
- SmartSTEP: *“what they're trying to do with the smart meters is very much square peg round hole kind of stuff … it's been an awful money with smart meter network and I think they're just trying to find additional ways to justify that … so the problem is with trying to shove the square peg into a round hole leads to really really bad design decisions and engineering decisions”*
- *“so smart for the DNO essentially it's, it's, it's, it gives them flexibility rather than smart … that consumer may not see it as a benefit but if it if it prevents in the future rolling blackouts … there's a benefit for the individual selfish consumer”*

Data/findings: interviews

- UKPN (DNO): Hybrid nature of ‘natural monopoly’ distributor, public good, rights of access (‘duty to supply’), but private company, resolved through regulation, hierarchy of utilities reflected in depth/location underground – fibre optic shallowest as newest, other systems were possible and more appropriate for collective provision, but don’t fit ‘capturing customers’, TE preferred for single connection, not 15, ‘victim of own success’ problem – competition with ICE (parking) and each other (charging availability) will increase with popularity, *“build it and they will come. Haven’t really been able to do that investment model. But it is needed for EVs.”*

Discussion

- Oxford trials: *“new techniques and procedures were adapted to existing streetscapes and designed to minimise competition with other forms of road usage … prevent a cluttering of sidewalks with street furniture … smartness’ simultaneously legitimises their introduction, and enables new installations to function as more than isolated pieces of equipment. The result is an infrastructure that is networked within itself, with pre-existing charging installations in public spaces in Oxford and beyond, and with an existing infrastructure of roads, homes and pavements.”* (Cass, Schwanen and Shove 2018: 163), TM, experimentation, upscaling successful ‘species’,