Modelling car purchasing behaviour: a disaggregated consumer segmentation approach

Christian Brand | University of Oxford, UK

Jillian Anable | University of Aberdeen, UK

Celine Cluzel | Element Energy, UK

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Transport behaviour change is not just about mode switch

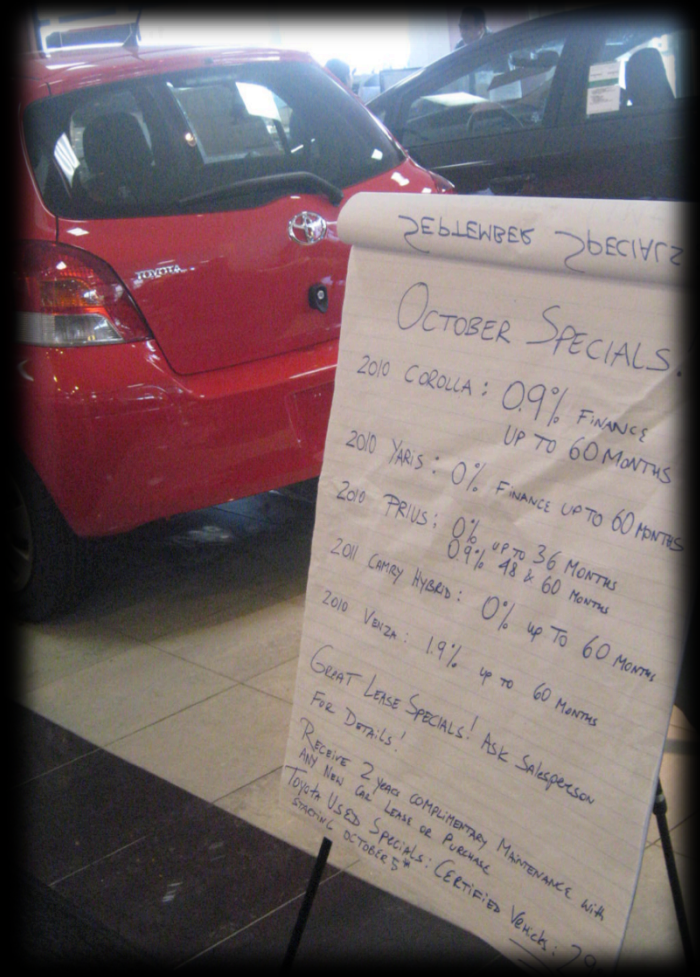
- **Purchasing** - *which* cars are bought, and *by whom*
- **Driving** - *how* cars are driven
- **Use** - *how much* cars are driven
  - Mode choice
  - Car occupancy
  - Timing
  - Route choice
  - Frequency
  - Trip-chaining
  - Destinations / distance
  - Parking
  - Residential location choice
  - Work location choice
  - Substitution (eg with ICT)

Focus for today: Purchasing

which cars are bought, and *by whom*

Starting point:

Psychology, Behavioural Economics, Sociology – have revealed a coherent view of the importance non-economically rational aspects of human [choice] behaviour

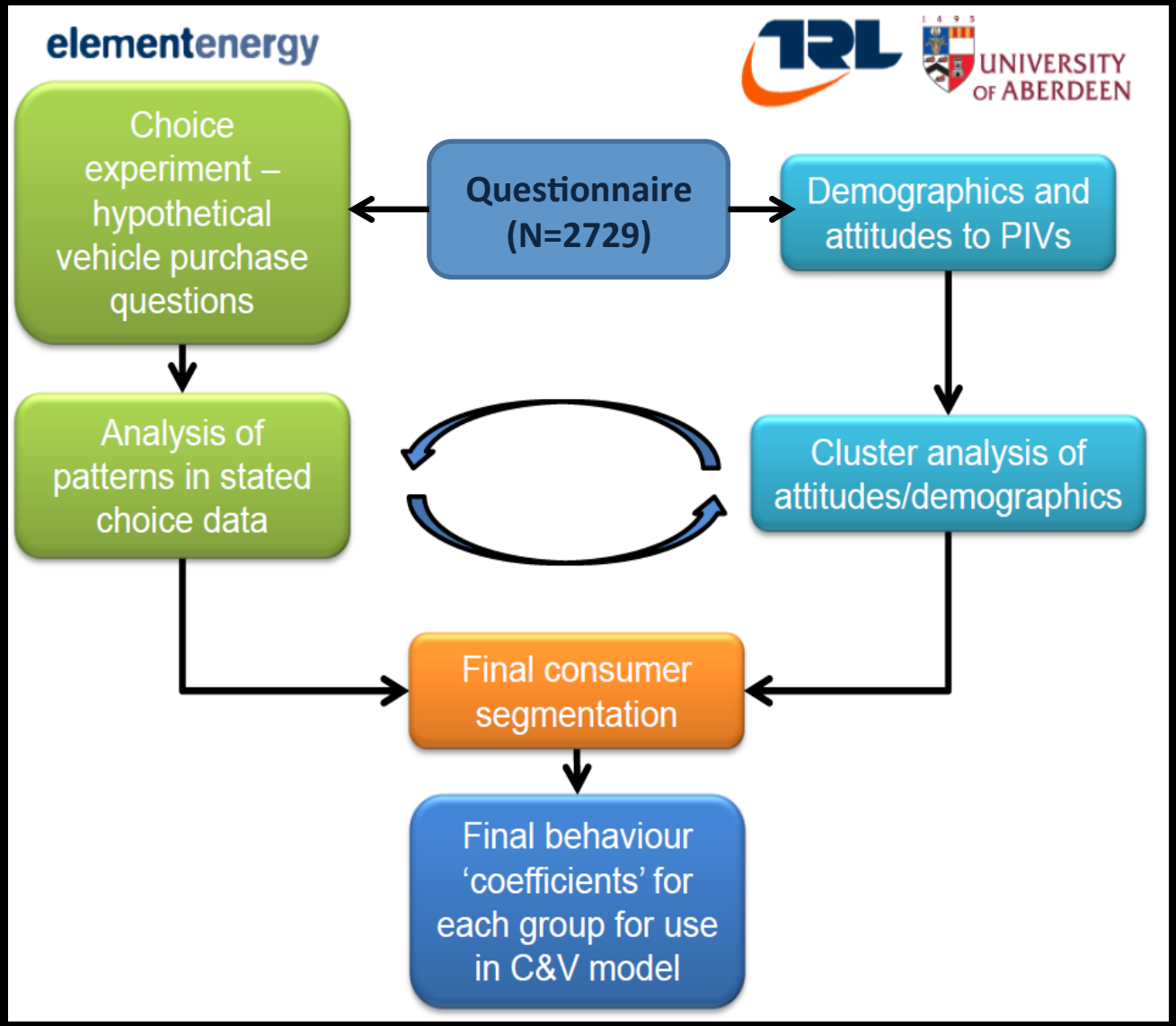


Too many determinants to model…

INDIVIDUAL SUBJECTIVE	INDIVIDUAL OBJECTIVE
• Affective motives (fun, comfort) • Instrumental motives • Symbolic meanings • Values • Moral norms • Sense of responsibility • Perceived control • Self efficacy / agency • Denial • Identity and status • Heuristics	• Knowledge • Habit • Personal capabilities • Actual resource constraints (cost, time)
COLLECTIVE SUBJECTIVE	**COLLECTIVE OBJECTIVE**
• Group cultures/ shared norms • Trust in others and in government	• Physical surroundings • Infrastructure/ technology • Contextual/ situational factors • The media

Anable, J. et al. (2006) An Evidence Base Review of Attitudes to Climate Change and Transport. For the DfT (updated table)

…but there is some good empirical work out there on modelling private car purchasing behaviour



energy technologies institute

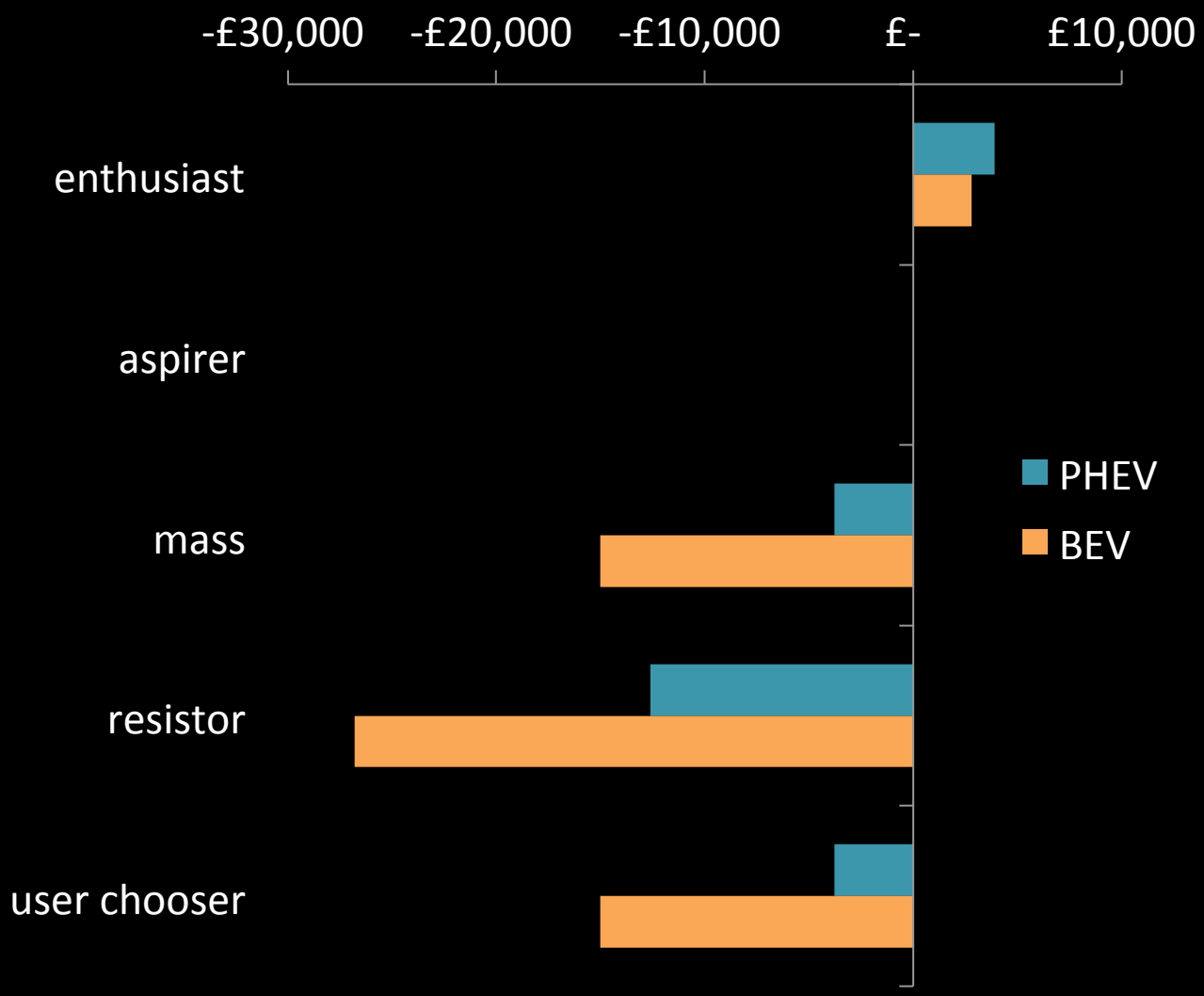
Energy Technology Institute: Plug-in Vehicle Programme - Consumer study (2009-2010)


With my mileage? Convince me.
It's about time! Why wouldn't you?
8. COMPANY Car Drivers 8% (N=216)
1. Plug-in PIONEERS 2% (N=48)
Yes please. It would save me how much fuel?
I'd never be seen in one of those!
2. Zealous OPTIMISTS 13% (N=348)
7. Image Conscious REJECTERS 18% (N=495)
3. Willing PRAGMATISTS 11% (N=306)
Yes please, but make it a plug-in hybrid for now, thanks.
Will they save the planet? Don't think so.
6. Conventional SCEPTICS 13% (N=361)
4. Anxious ASPIRERS 16%(N=439)
5. Uninspired FOLLOWERS 19% (N=516)
Great, but not sure where I would charge it.
If everyone else is, then, maybe…

The top factors that distinguish groups relate to barriers to/enablers of plug-in vehicle uptake:

- PIVs generally have lower running costs
- PIVs have a high price premium over non-PIVs
- Supply of PIV models is limited, in terms of vehicle segments (eg supermini, small family) and brands
- Limited availability of charging infrastructure (at home, public)
- Consumers are concerned by PIVs' shorter range …
- … and longer charging times
- The majority of private vehicle buyers are not currently receptive to PIVs (acceptance)…
- …or not aware of them or any incentives (awareness)
- NB: mainstream attitudes to PHEVs are very positive, but most have strong reservations about pure BEV

Preferences for/against plug-in vehicles shows substantial variation across consumer segments.



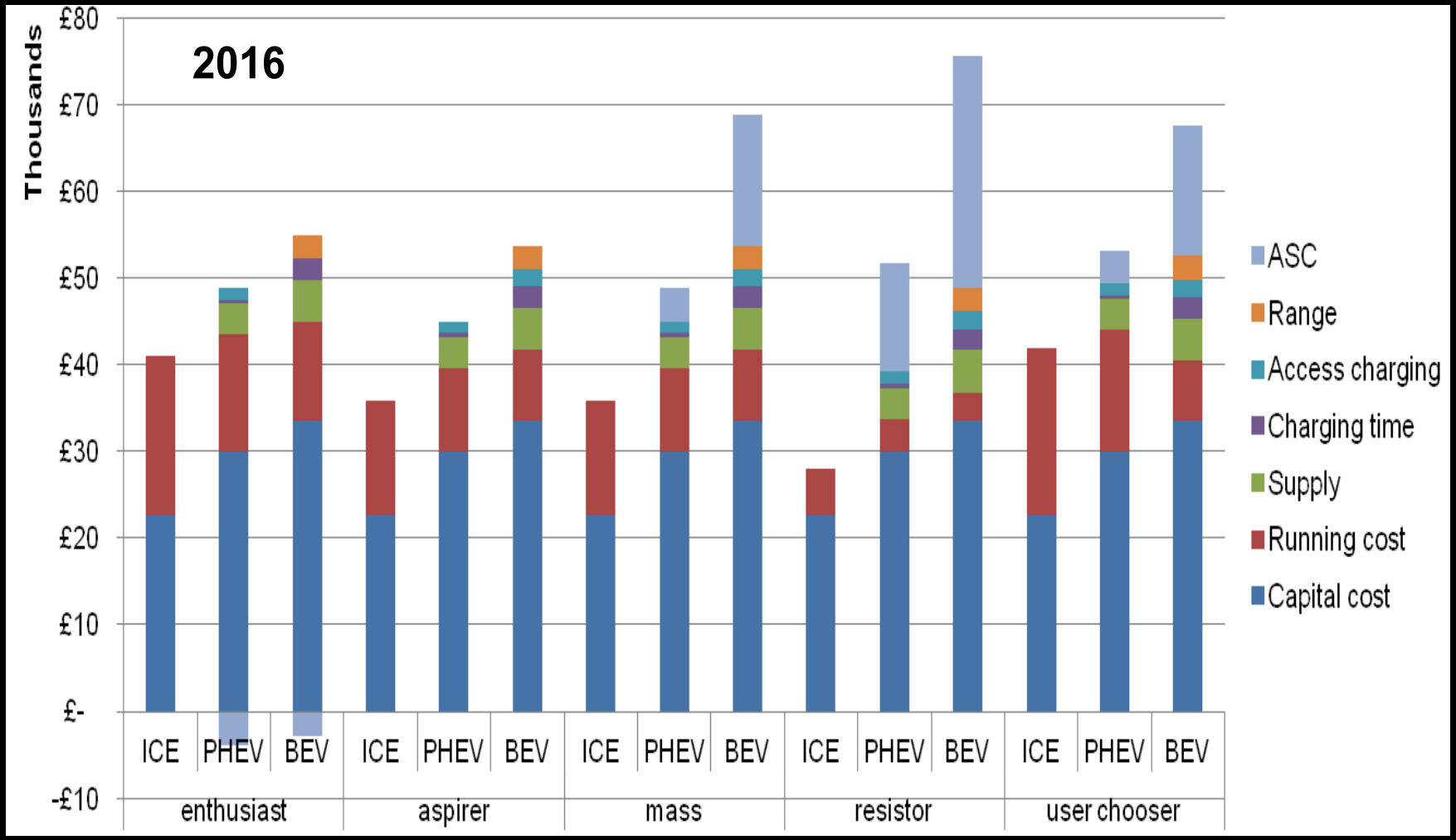
All show preference for PHEVs

Most segments have a strong bias against BEVs

Enthusiasts are willing to pay a premium

Mass market buyers strongly reject BEVs but not PHEVs (as much)

Example: Perceived cost (disutility) for consumers with overnight charging but no access to day charging, medium (C/D) car, 2016



Element Energy (2013)

Benefits of consumer segmentation

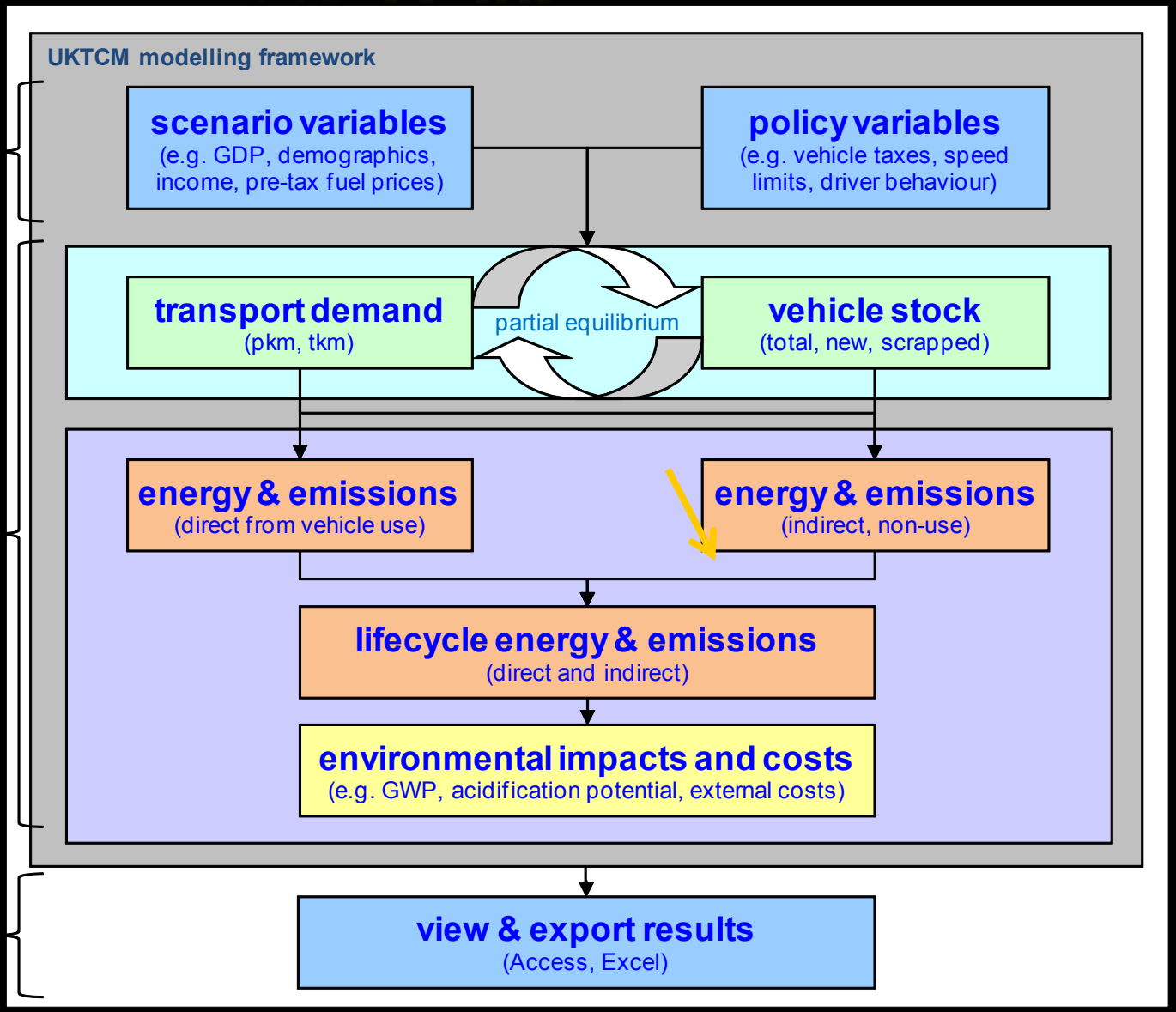
Using multiple segments significantly increased the explanatory power of the model

- Highlights attitudinal/demographic factors influencing PIV purchase decisions
- Allows reactions to different attributes (e.g. willingness to pay for EV range) to be captured explicitly (rather than within the error term of the model)

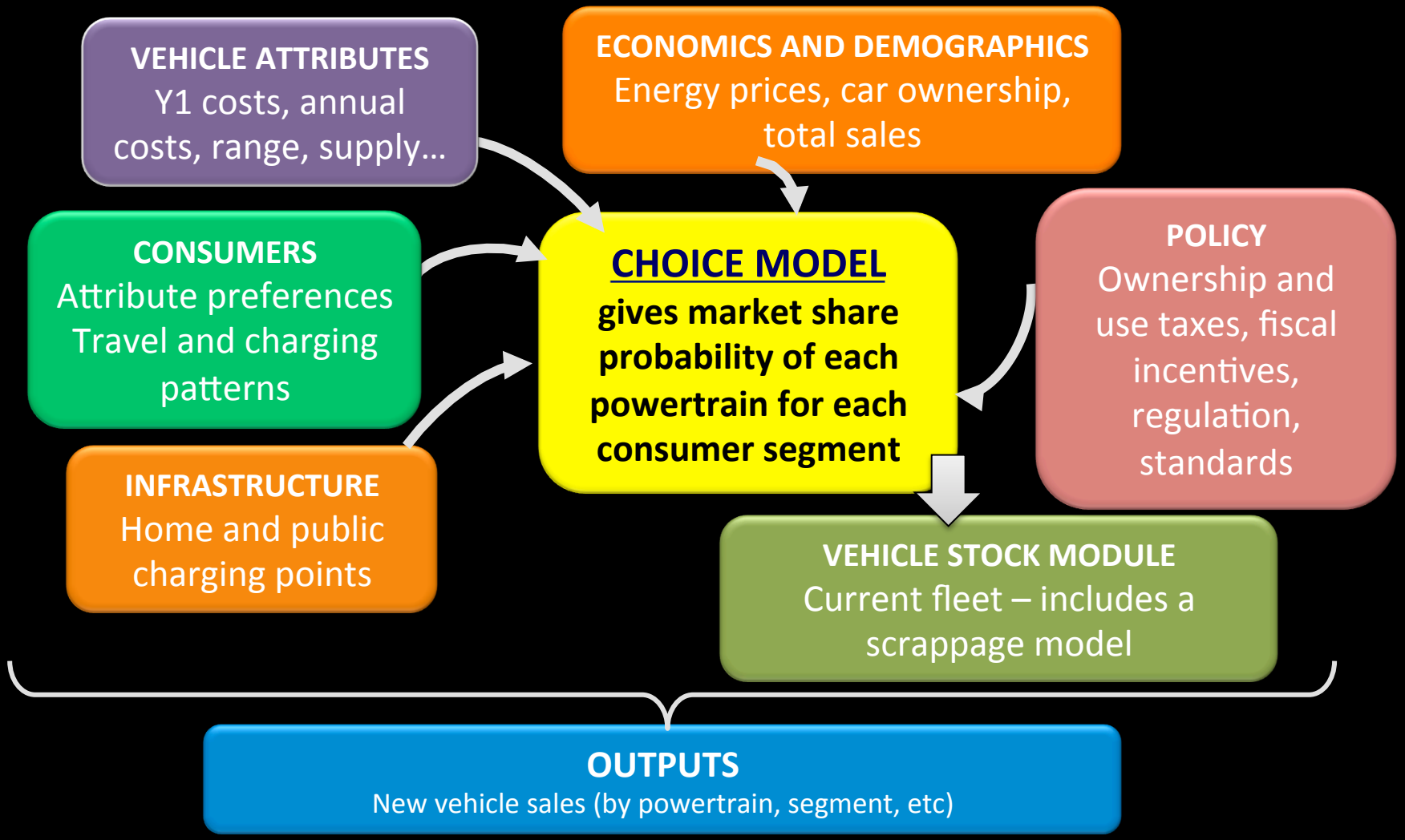
Integrating segmentation and vehicle choice into systems models

UK Transport Carbon Model

UKTCM | outline

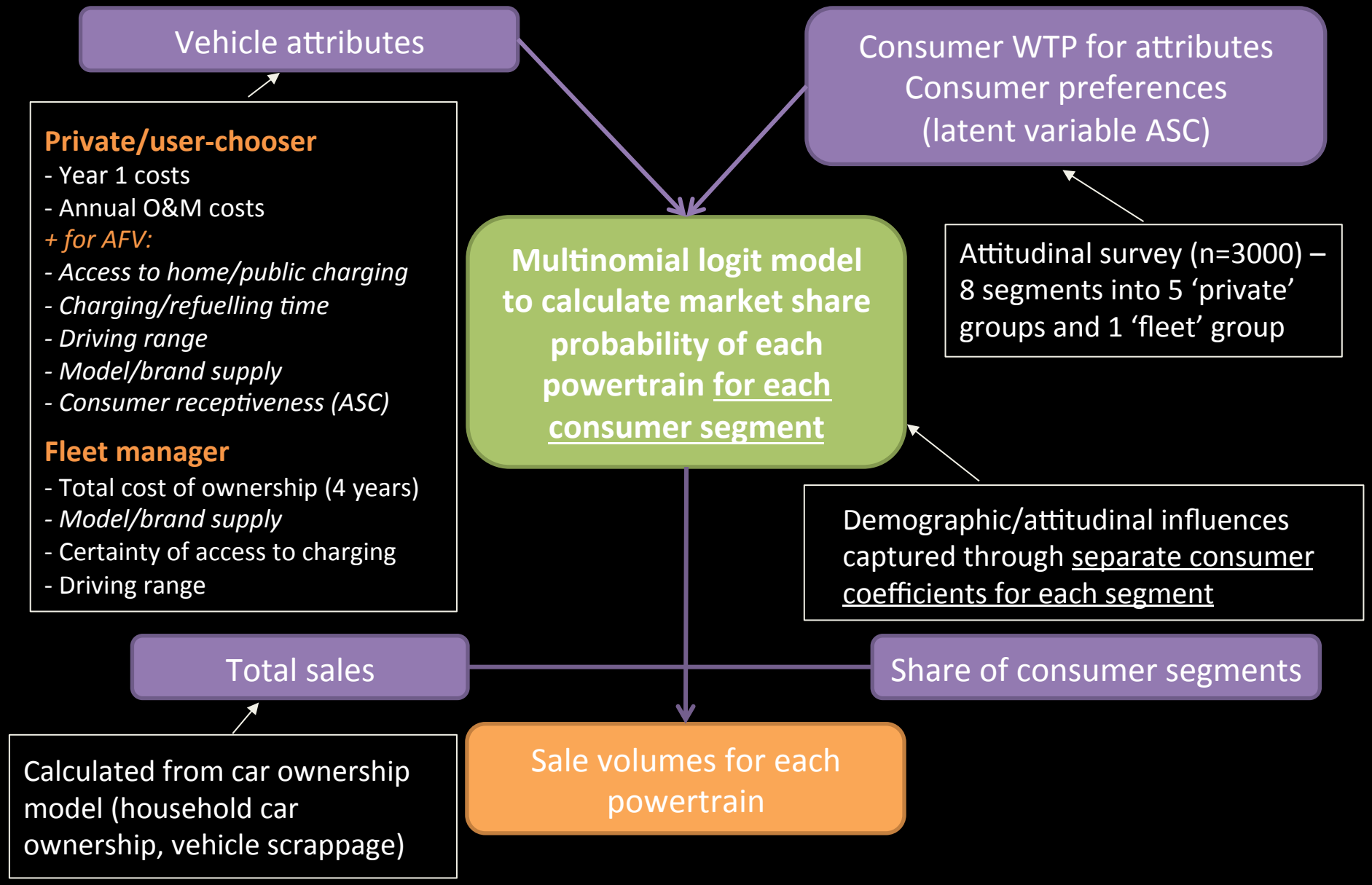


UKTCM | new car choice model

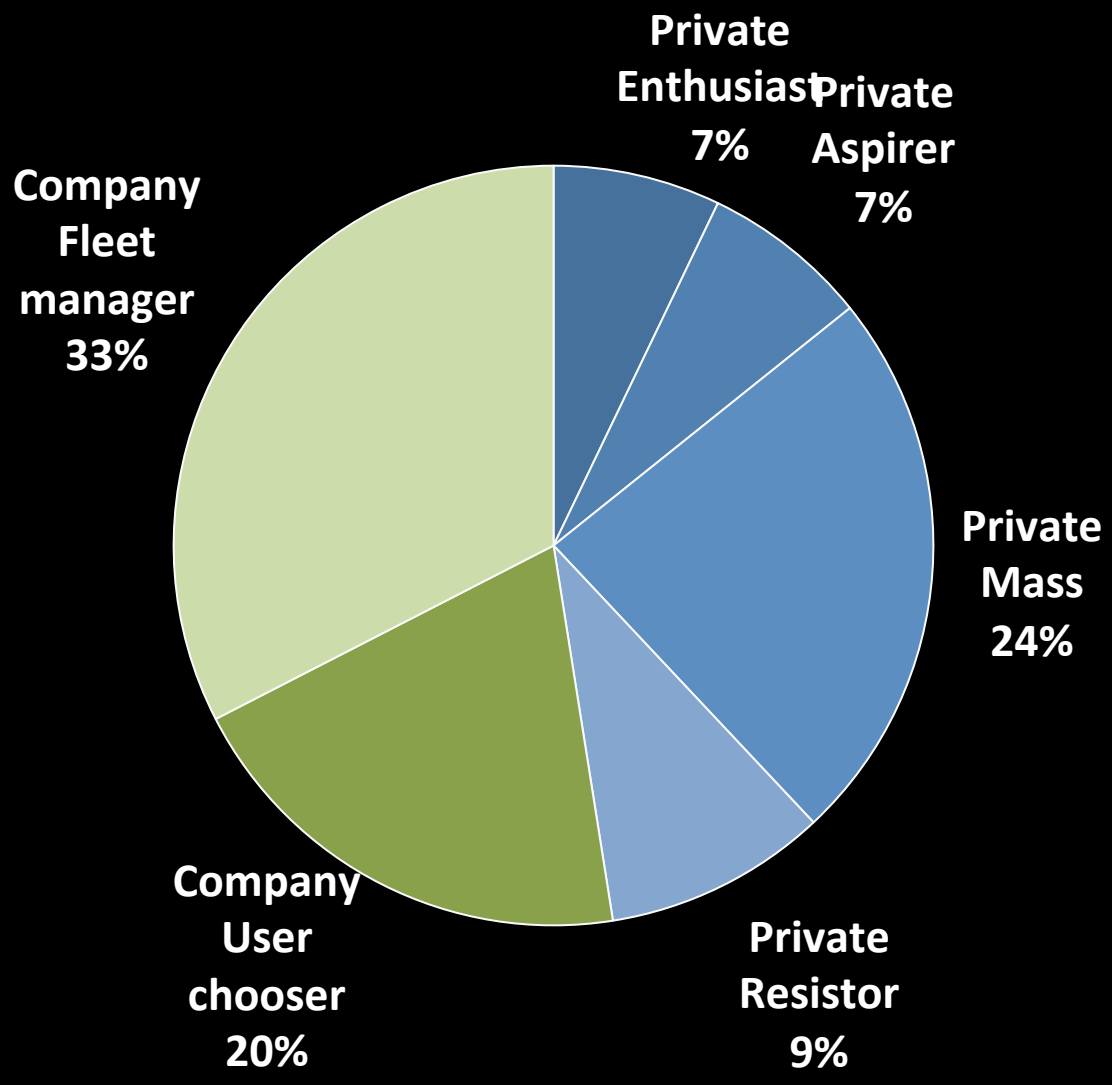


Powertrains included: ICE (petrol, diesel, HEV, gas, bio, H_2); Plug-in (PHEV, BEV); Fuel cell (H_2)

A car choice model for each consumer segment, now including a‘fleet manager’ segment



Run model for each vehicle size and consumer segment



NB Same private consumer split applies across vehicle segment, but private / fleet sales split and mileage vary across vehicle segments

Example: scenario analysis exploring UK Committee on Climate Change EV pathway for 4th and 5th carbon budget

UK CCC's *high EV uptake pathway*:

- 9% market share for PIVs by 2020
- 60% market share for PIVs by 2030
- Indicative 100% market share for PIVs by 2040, so that, taking the stock turnover into account, the vehicle stock is 'virtually decarbonised' by 2050

- NB: in 2013 only 0.1% of new car sales were PiV; in 2015 so far they are higher at 1.2%

Committee on Climate Change (2013) Fourth Carbon Budget Review – technical report | Sectoral analysis of the cost-effective path to the 2050 target

Assumptions for BASE vs CCC for 2030

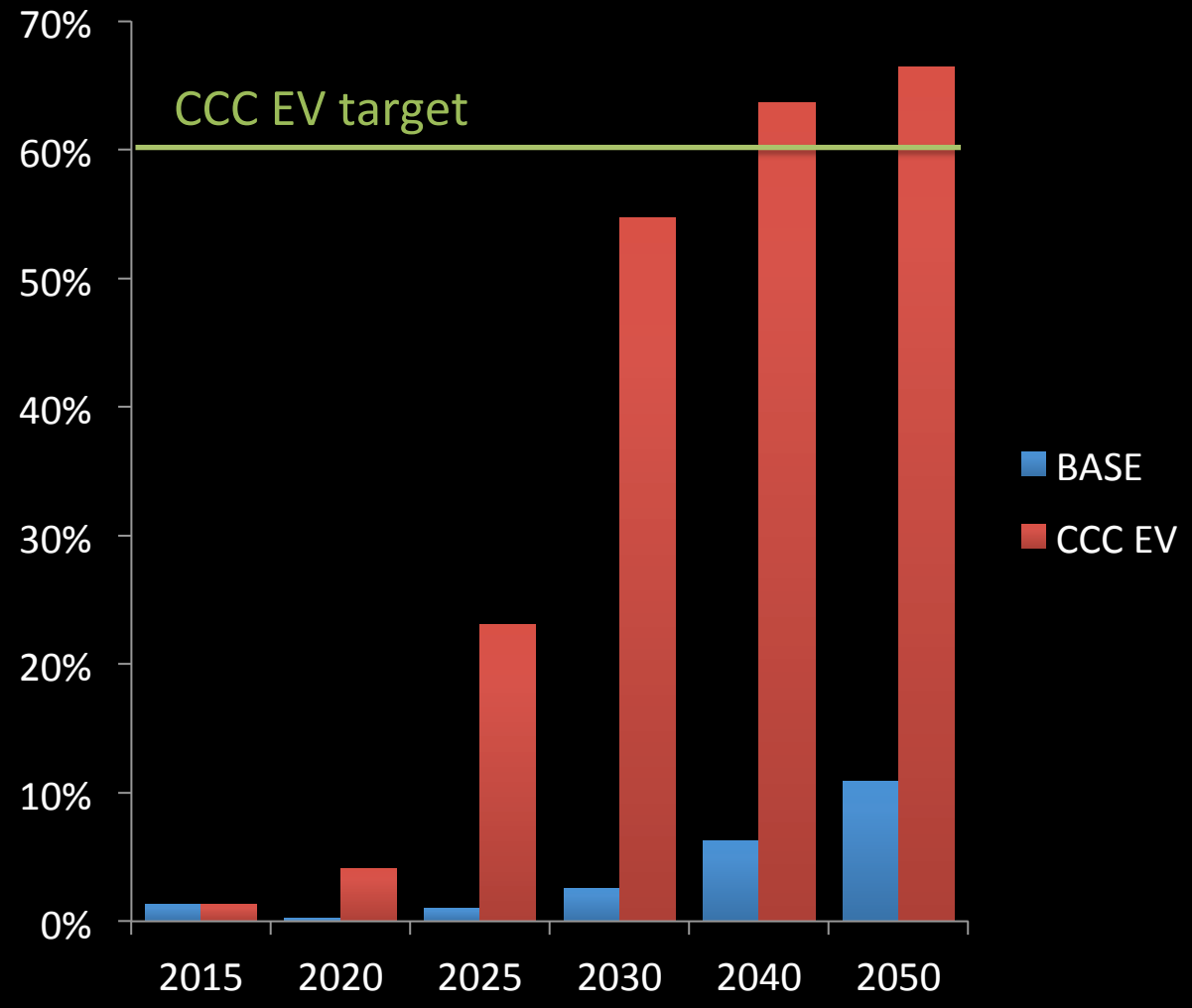
3.2m new cars predicted in 2030 (UK tcm)
So PiV target is 60% of this = 1.92m

- Baseline / REF scenario
  - Company car tax regime unchanged beyond 2020
  - No plug-in car grant (£5k) beyond 2017
  - no infrastructure intervention
  - certainty of access to charging for fleet only 40%
  - UKERC assumptions on vehicle costs, car CO2 / fuel efficiency improvements, etc.
- *Adapted* CCC EV scenario
  - All potential consumers 'aware' by 2026
  - preferences 'equalise' once 25% of new market share (except Resistors)
  - Increase in overnight access and rapid network
  - reduced charging times
  - Increase in certainty of access to charging for fleet to 65%

Achieving these ambitious targets may require transformative change in supply, demand, infrastructure and policy

- Vehicle supply: PIVs to be available in all vehicle segments and by all major brands by 2030 – *driven by car CO_2 regulation?*
- Awareness and acceptance: all potential buyers aware of PIVs by 2020s – *promotional campaigns, field trials, car clubs, neighbour effect to achieve critical mass for acceptance*
- Charging infrastructure: investment in high levels of overnight (mainly off-street) charging complemented by a national network of ~2000 rapid charging points for day charging to increase market base for PIVs – *public & private investment*
- Equivalent value support: for private and company/fleet buyers – to mitigate purchase price premium – *capital incentives, graded purchase tax/VED, innovative business models*

Plug-in vehicle sales
(share of total)



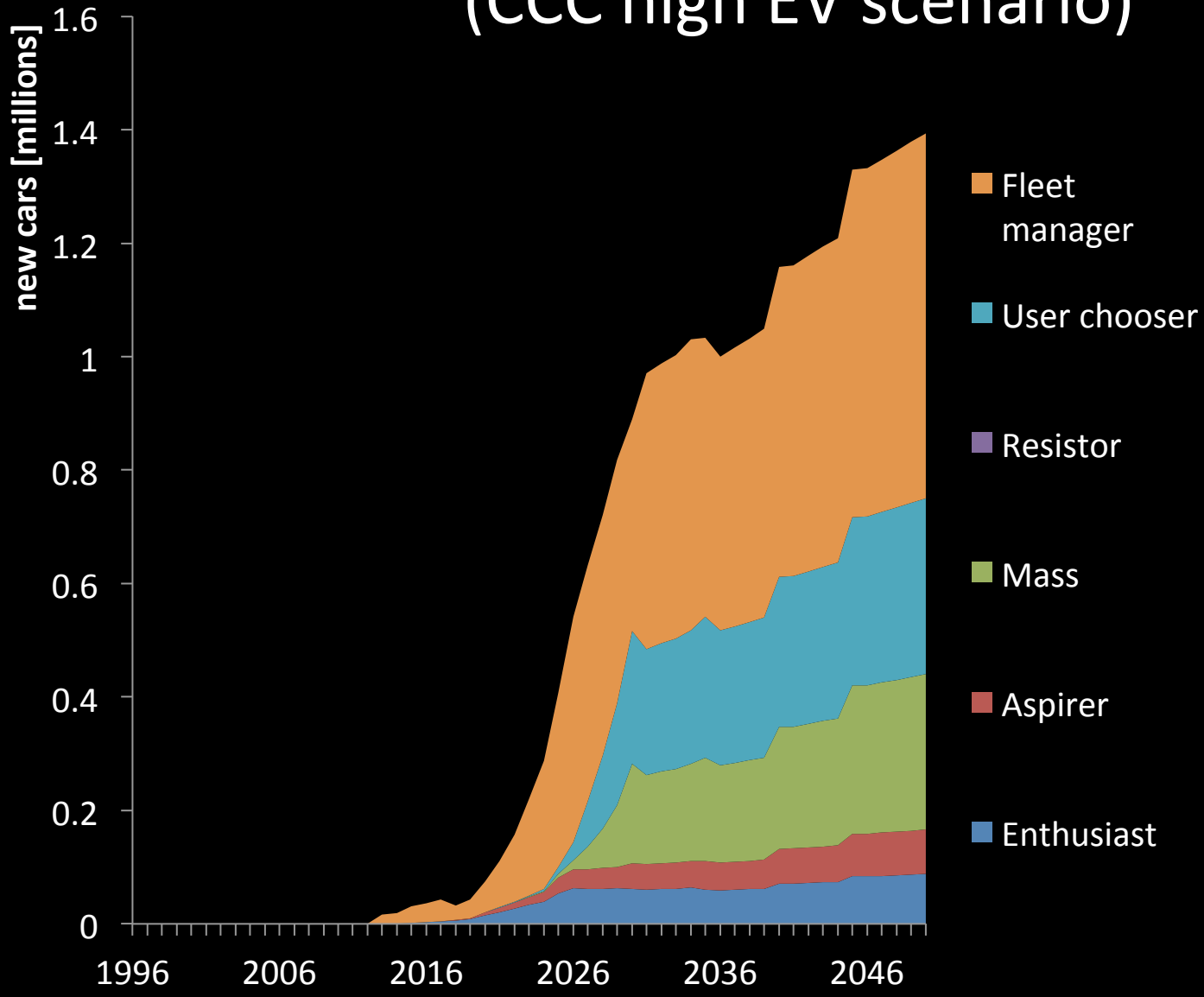
In baseline scenario market collapses then picks up again

In CCC EV much higher uptake and pace in 2020s – plateau from 2030s?

100% will be difficult to achieve even in long term

Continued value support (PIV grant, ECA) needed

Battery EV take up by consumer segment (CCC high EV scenario)

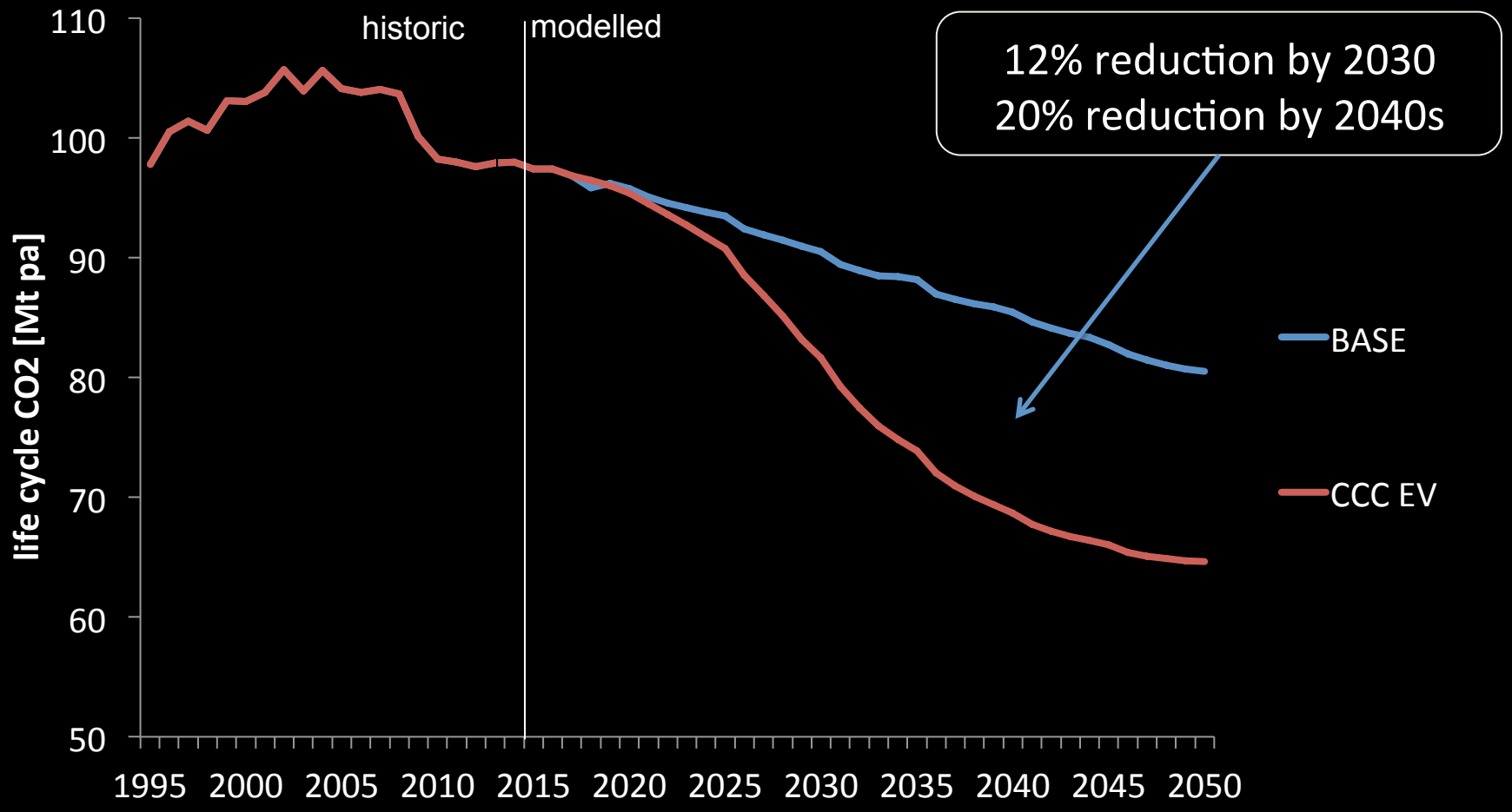


BEV market driven by fleet manager segment …

…and user choosers

Resistors keep resisting

Direct CO_2 emissions decrease for cars but offset by indirect emissions from electricity generation and other upstream/downstream emissions



Conclusions | Challenges (1)

Be realistic:

- There are too many behavioural features to include in transport models (particularly given multiple actors in the system)
- Data does not readily exist on these behavioural features in different choice / national contexts
- Evidence – concentrates on behavioural features of *private* end users (not fleets, other decision makers, investors etc)

Be Interdisciplinary and apply mixed methods

Conclusions | Challenges (2)

Think outside the box:

- Attitudinal factors may be as important as socio-demographic and economic attributes, especially for private travel
- Differentiation across segments can improve model fit
- System thinking - many influences on transport service demands do not come from the transport sector (built environment, ICT, retail patterns …)
- Policy diversity - using insights to develop new policy strategies beyond fiscal instruments

UKERC

Get in touch

Dr Christian Brand

Environmental Change Institute | Transport Studies Unit

University of Oxford | South Parks Road | Oxford | OX1 3QY | UK

+44 (0)1865 285527 | christian.brand@ouce.ox.ac.uk

www.eci.ox.ac.uk | www.tsu.ox.ac.uk