Decarbonising Personal Transport

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Energy and People event

Edinburgh, 13th December 2013

UKERC Energy Demand| transport

- Development of a bespoke sectoral model: *UK Transport Carbon Model* (UKTCM)
- Scenario analysis to address key sensitivities in transport energy use/ CO_2
- Investigate how changing patterns of travel will affect energy demand
- Examine range, scale, timing of actions to reduce surface transport emissions
- Strategic policy modelling to provide evidence to policy makers

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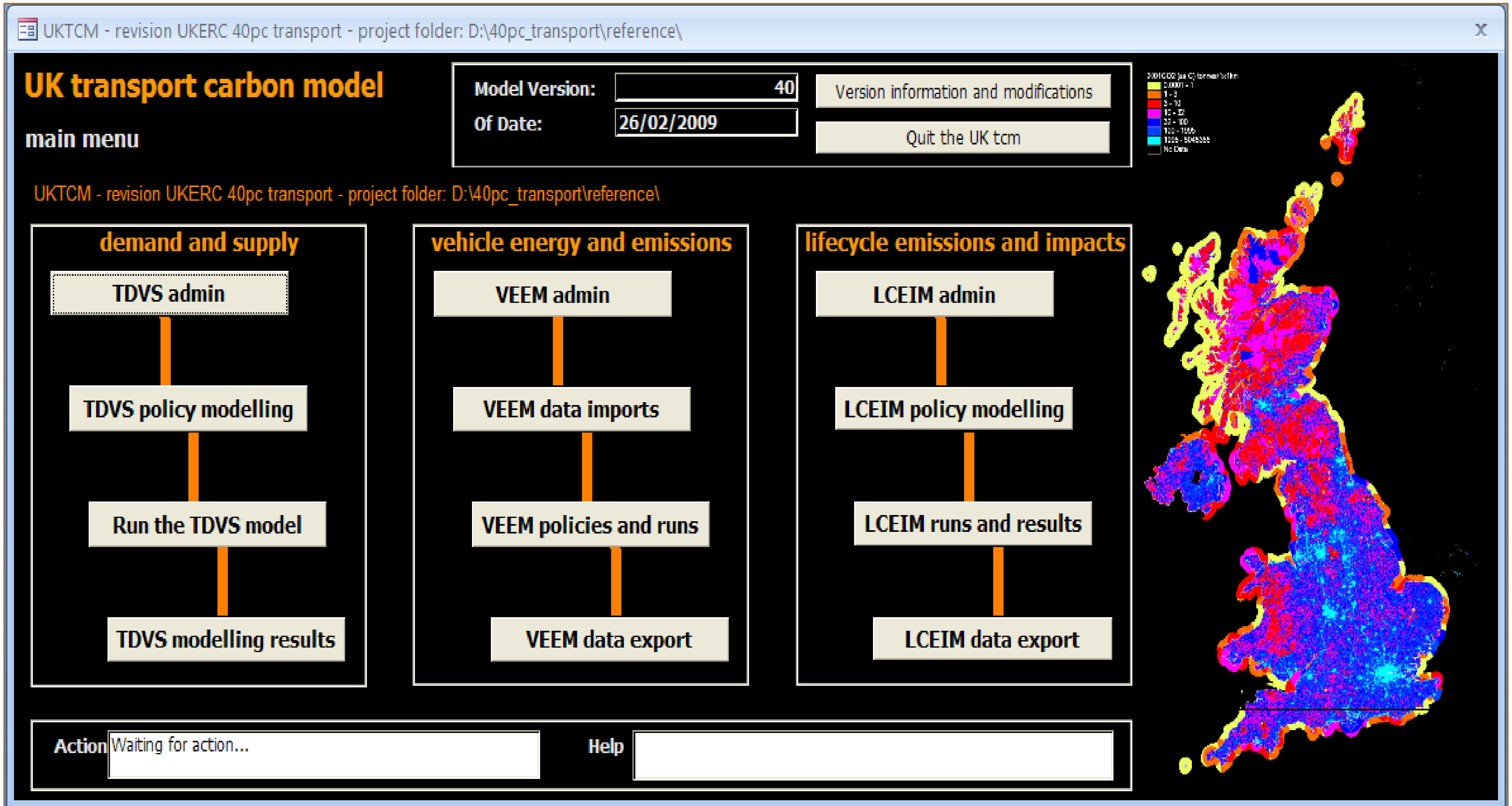
UK Transport and Carbon Model



Modelling focus

Modelling the (whole lifecycle) GHG impact of:

- ✓ Alternative projections of future travel demand
- ✓ Fiscal incentives for low carbon cars
- ✓ Lower/higher speed limits
- ➢ Electric vehicle uptake

NB: Focus on surface passenger modes

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Alternative travel demand scenarios

Transport sector – lifestyle and mobility changes in 2050

- Accessibility
- Localism
- Slower speeds
- Compact cities
- Car-free zones
- Car clubs
- ICT
- Teleworking
- Tele-shopping
- Less air travel
- Policy acceptance

Total distanc	Down 21%
Mode choice	Car from 81% - 38% distance Cycling from 1% -13% distance
Vehicle choice	HEV, + BEV + PHEV = 77% share of vkms in 2050
Driving Style	Ecodriving = 5% reduction in CO_2 per km by 2025
Occupa ncy	Car occupancy up 23% by 2050

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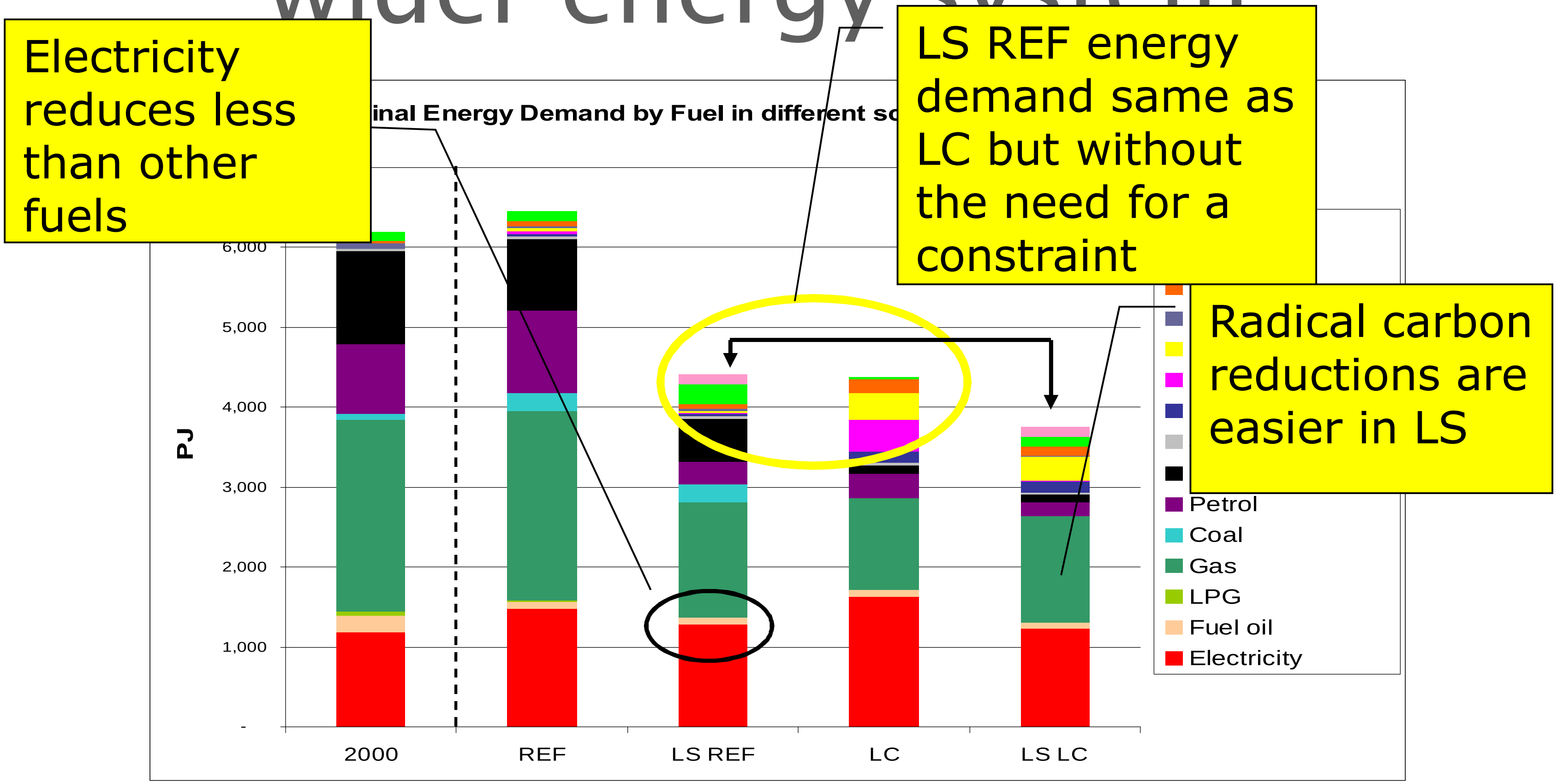
Impacts of lifestyle on the wider energy system



- Social and lifestyle change reduces total energy demand by ~15% below baseline levels by 2025 and ~30% by 2050

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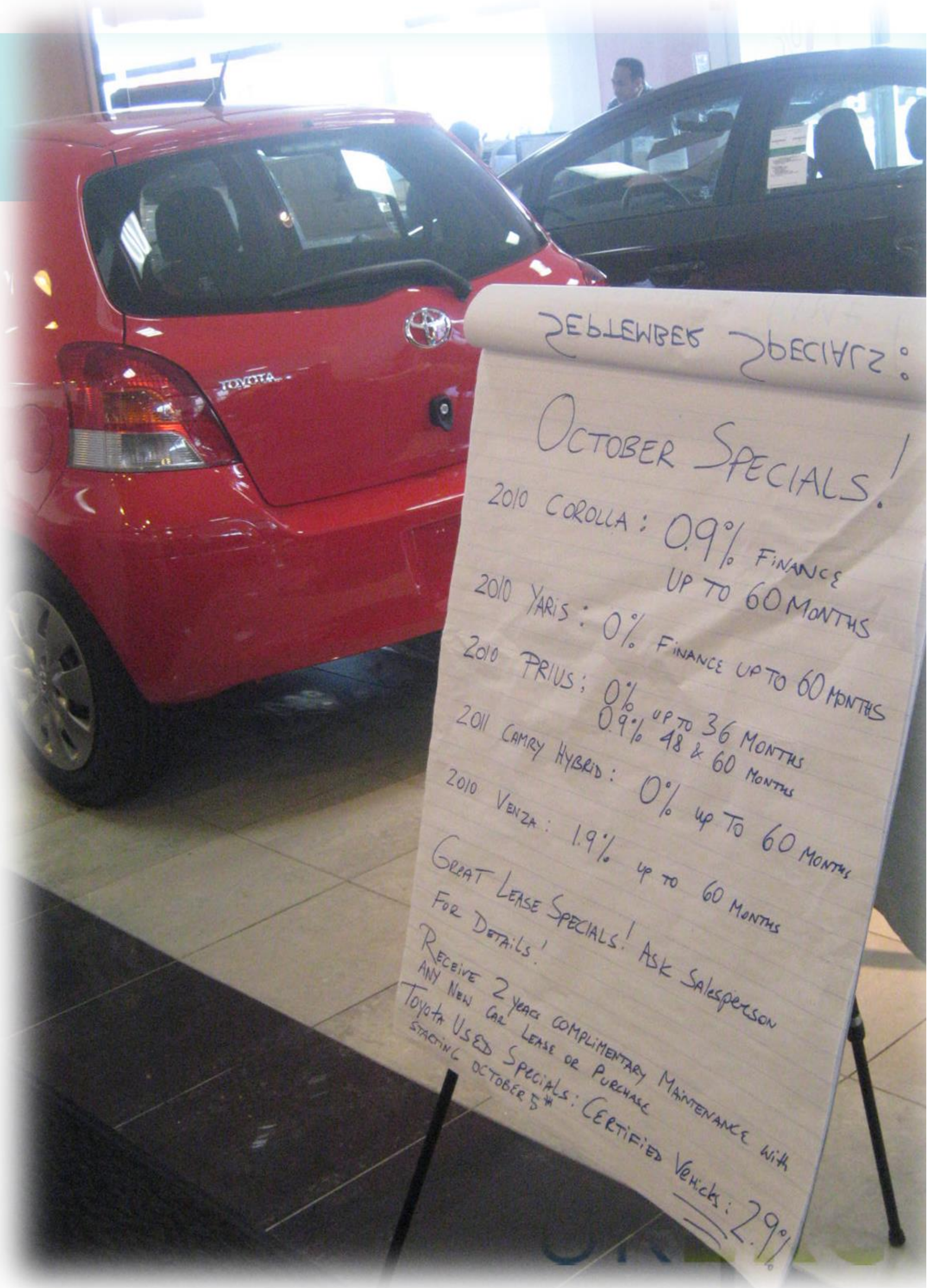
Fiscal incentives on vehicle purchasing and ownership



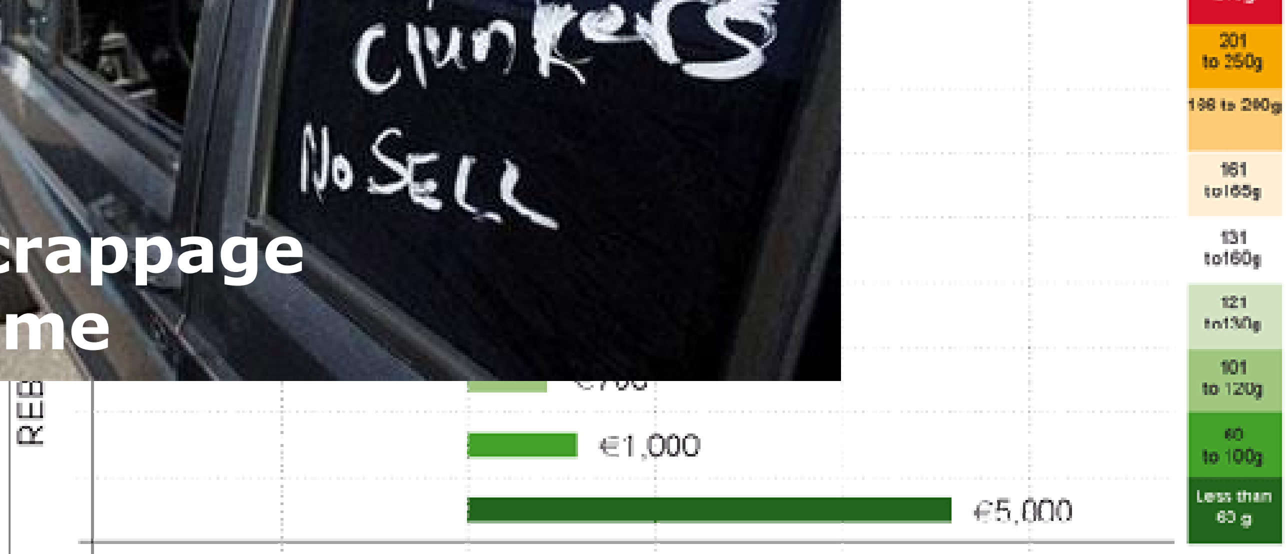
3 types of tax on car ownership:

VED band	CO_2 g/km	Standard rate* 2009-10	2010-11	First year rate 2010-11
A	Up to 100	£0	£0	£0
B	1			£0
C	1			£0
D	1			£0
E	1			110
F	1			125
G	1			
H	1			
I	1			
J	1			
K**	2			
L	2			
M	C			

1. VED scheme in the UK

3. Scrappage scheme

2. Feebates



Research questions

Which of these new car purchasing incentives:

1. accelerate car technology transitions the fastest
2. save most life cycle GHG emissions
3. have few adverse revenue effects and
4. other benefits such as traffic reduction

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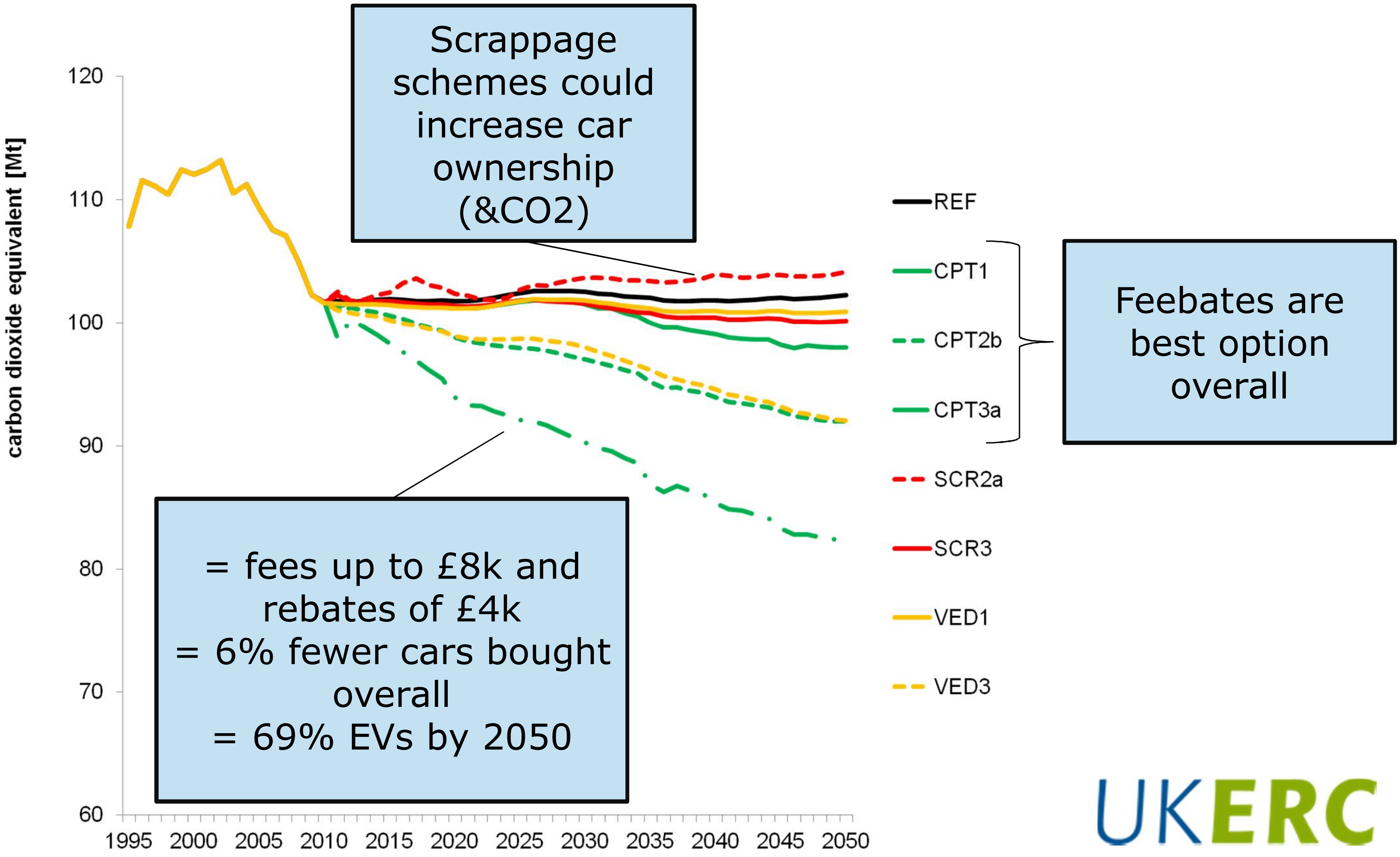
policy scenarios

Policies	Policy ambition		
	'Moderate'	**'High'**	**'Extreme'**
Purchase taxes / 'feebates'	***CPT1/1a:*** Tax of £2k for >225g (>175g), tightening every 5 years	***CPT2/2a/2b:*** Feebate: £4k fee for >200g to £2-4k rebate for <100g, tightening ***CPT2b***: 5p/kWh duty	***CPT3:*** Feebate: £8k tax for >200g to £4k rebate for <100g, tightening ***CPT3a***: 5p/kWh duty
Vehicle circulation taxes (VED)	***VED1:*** Graded tax by year of purchase, fuel type and CO_2; higher 1st year duty	***VED2:*** as VED1 but tightening every 5 years	***VED3:*** as VED2 but with double duty rates
Scrappage rebate	***SCR1:*** Simple rebate, 2009-2010 only (i.e. the recent UK Scrappage Incentive Scheme)	***SCR2:*** Rebate £2k for <150g, tightening every 5 years ***SCR2a***: variant assuming lower expected car life	***SCR3:*** Rebate up to £2k, graded by CO_2, tightening every 5 years

Scenario comparison – results



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Conclusions (car purchase taxes)

The scenario modelling suggests that:

Å Feebates are best option overall

    Å Accelerate low carbon uptake while being technology neutral

    Å Can be designed to be revenue neutral and can be applied equally to all vehicle sizes or classes

    Å But have to be stringent and adjust levels often

Å Vehicle circulation taxes are less successful but could be applied in tandem with feebates to fill revenue loss

Å Scrappage rebates are ineffective and potentially damaging in life cycle carbon terms

Å Need strong up-front price signals

Å Reward low carbon & penalise high carbon

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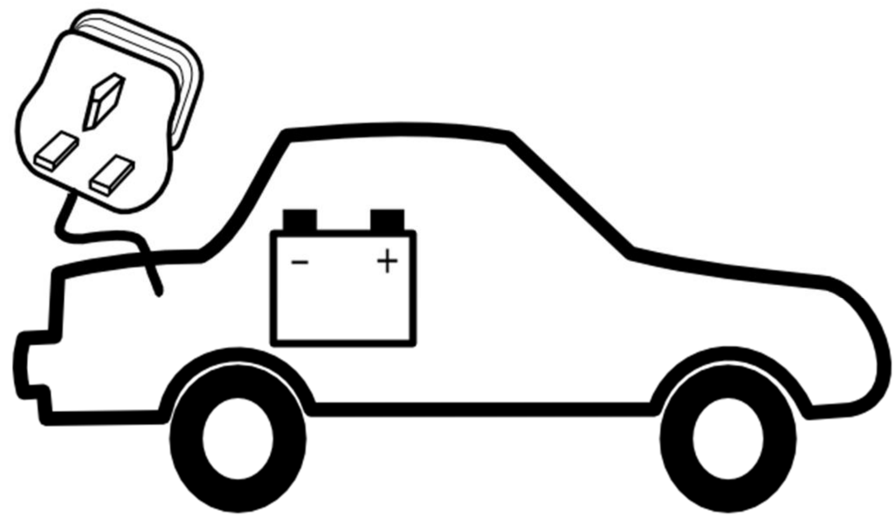
Plug-in Vehicles



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Modelling heterogenity

- How can we better model the socio-technical challenges (e.g. socioeconomic drivers of car purchase behaviour and 'taste heterogeneity') of electrification of the UK private car market?
- What are the lessons we can learn from using a more detailed consumer segmentation approach within a transport-energy-environment systems model?
- What does modelling the dynamic nature of the car market tell us about timing and uptake of plug-in cars?
- How effective (in terms of energy demand and life cycle GHG emissions) are different policy instruments (including regulation, pricing, availability of charging infrastructure) on different consumer segments?

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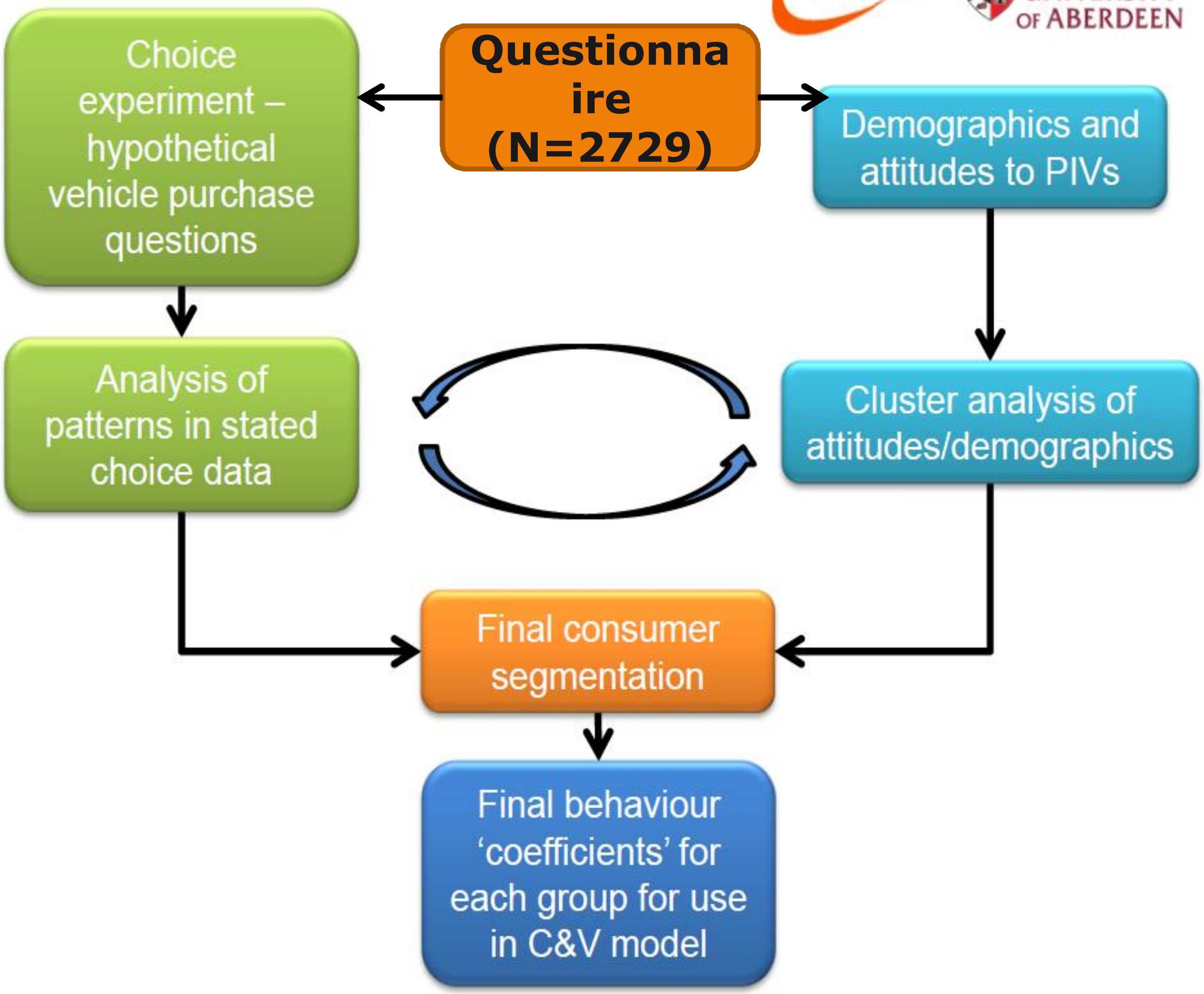
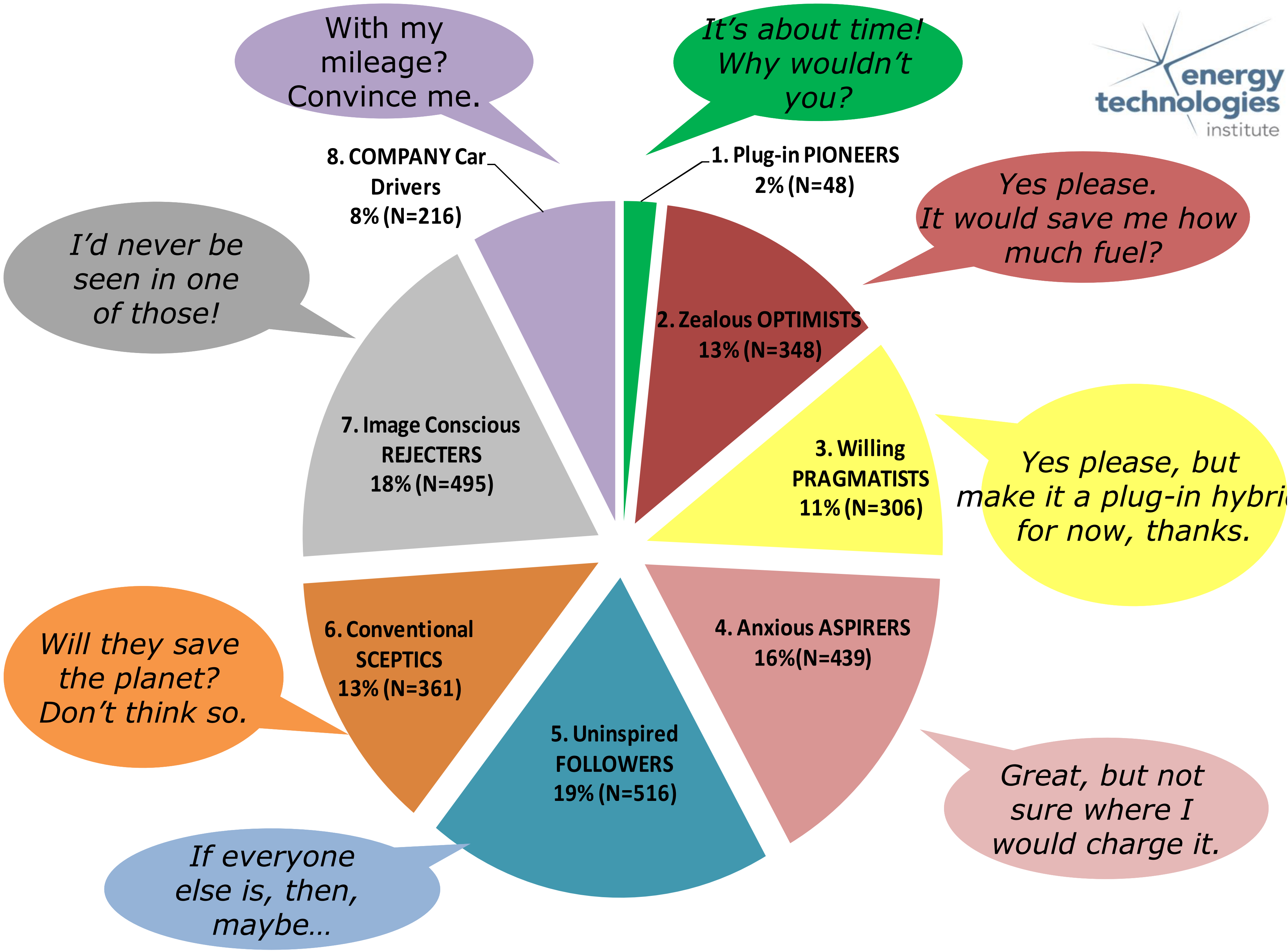
Consumer segmentation of plug-in vehicles



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


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

Mapping Uncertainty

Evidence Review
+
Semi-structured interviews with policy makers and other stakeholders

Location		Level: Statistical uncertainty	Level: Scenario uncertainty	Level: Recognised ignorance	Nature: Epistemic uncertainty	Nature: Variability uncertainty
Context	Natural, technological economic, social and political, representation					
Model	Model structure					
	Technical model					
Inputs	Driving forces					
	System data					

- How have key scientific, social and economic uncertainties been treated in the policy process?
- Who is taking responsibility for delivering targets (and therefore dealing with the uncertainty?)

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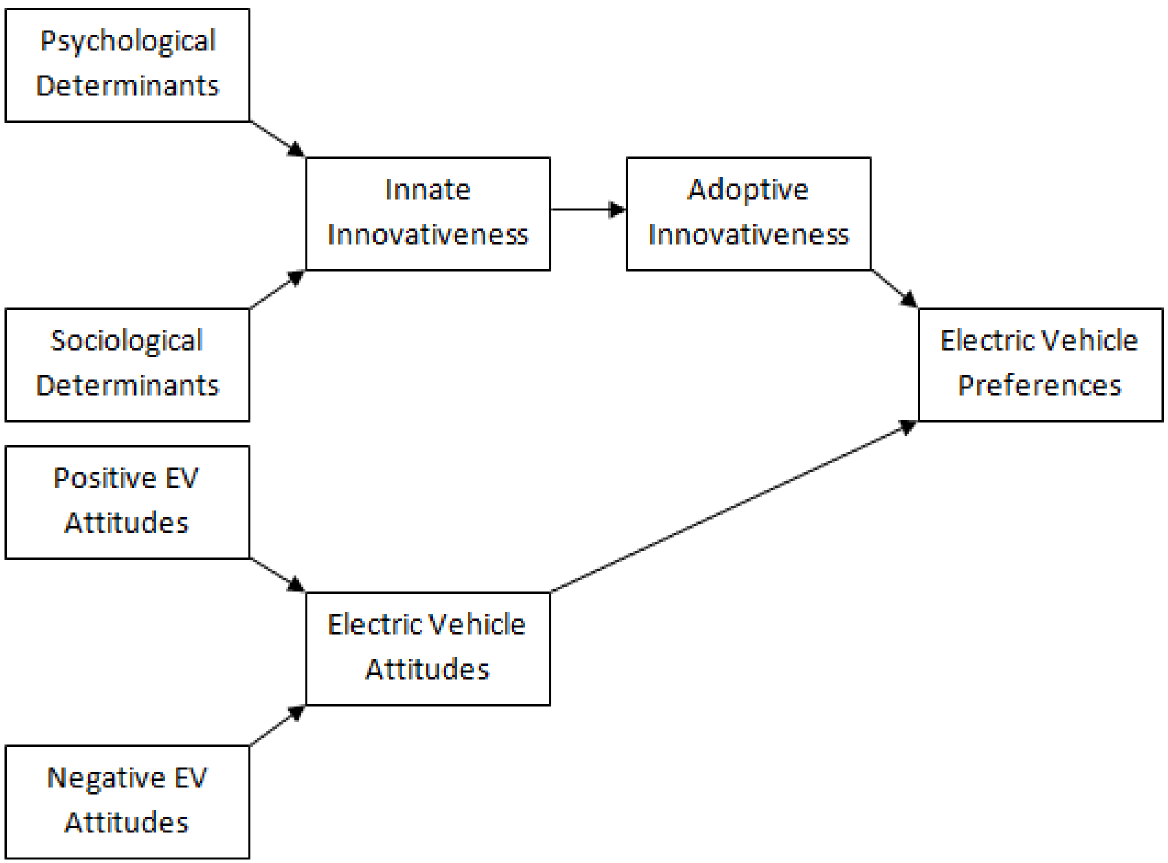
UKERC PhD Student:
Accelerating the Demand for Low Emission Vehicles: A Consumer Led Perspective
(Craig Morton)



Å Socio-psychological constructs account for more variance in likely EV uptake than socio-economic characteristics

Å *Innovativeness* is positively related to EV preference

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Associated projects

MOT
Motoring and Vehicle Ownership Trends in the UK

DEMAND
DYNAMICS OF ENERGY, MOBILITY AND DEMAND

Disruption
unlocking low carbon travel

Research Councils UK
Energy
For a Low Carbon Future

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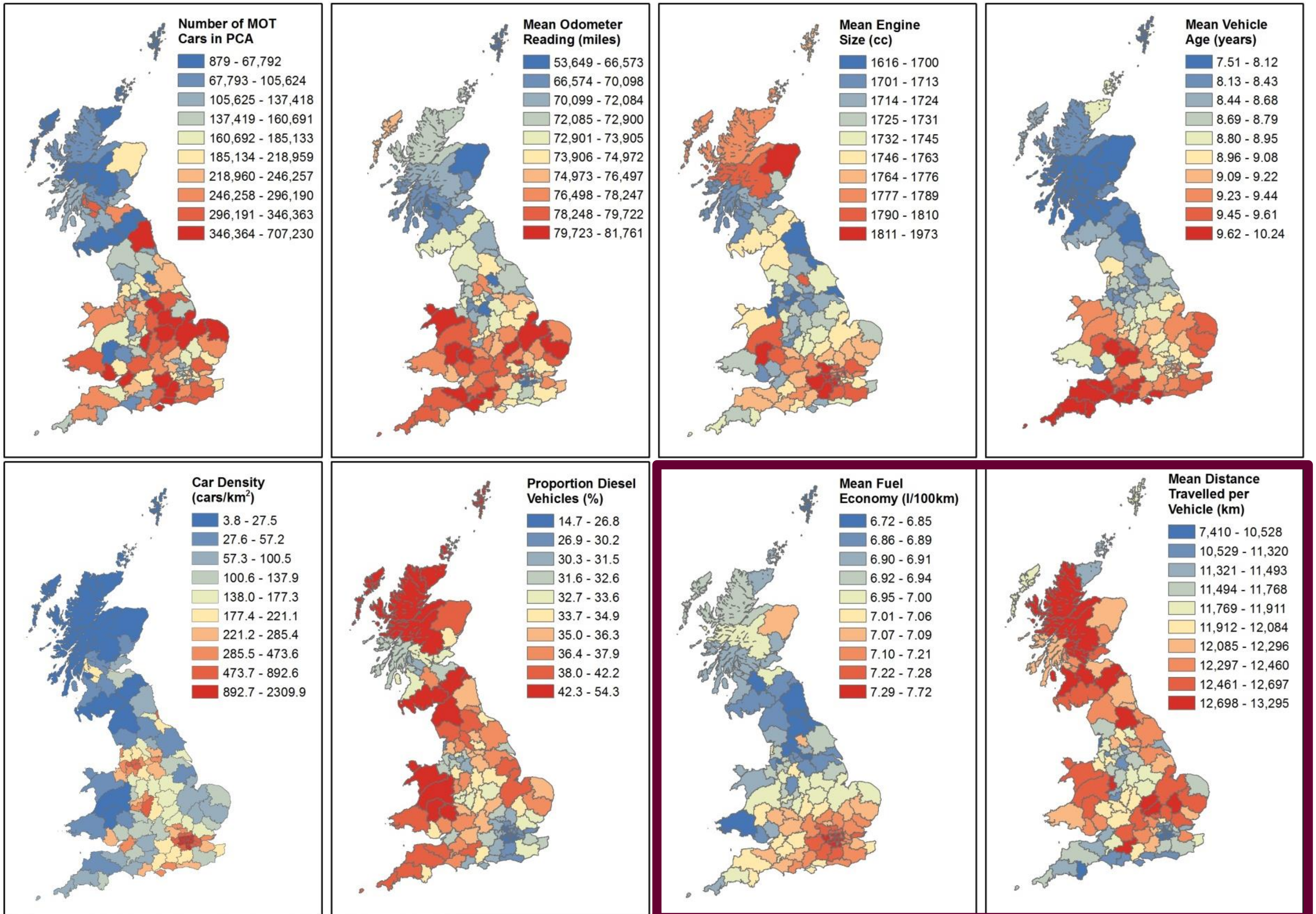
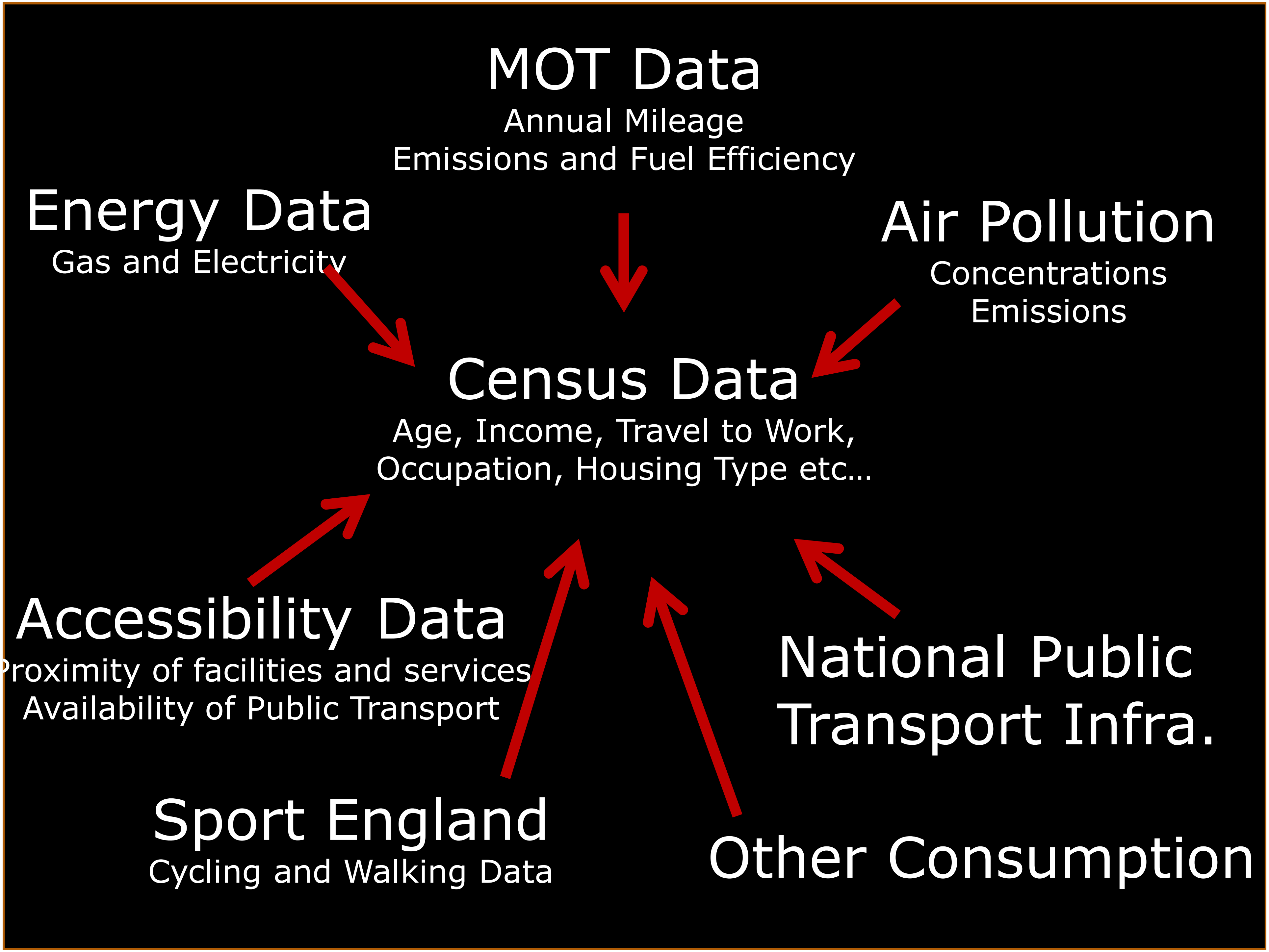
Key Parameters from MOT Dataset



Calculated for calendar year 2012


MOT Data
Annual Mileage
Emissions and Fuel Efficiency
Energy Data
Gas and Electricity
Air Pollution
Concentrations
Emissions
Census Data
Age, Income, Travel to Work,
Occupation, Housing Type etc...
Accessibility Data
Proximity of facilities and services
Availability of Public Transport
National Public
Transport Infra.
Sport England
Cycling and Walking Data
Other Consumption

Rhythms of DEMAND

1. Patterns, dynamics, structures:
   - Spatial, temporal, and social distribution of each practice: who does it where and when?
2. Time pressure and peak demand
   - Social synchronisation?
   - Peak demand and flexibility : how strong/hard is the structure? What can be changed by (what?) intervention?
3. Change over (macro) time
   - Birth, life and death of practices : how do practices evolve, change shape, expand, spread..?

Disruption: Key Arguments

- We are failing change travel behaviour at a large enough scale to meet carbon reduction commitments
- Disruptions occur regularly and will become more frequent
- These may provide opportunities to create step change in right direction rather than return to status quo
- May help develop policies that move away from simply ‘enablement’

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Disruption: data

- Longitudinal qualitative ethnography with families – everyday life (Brighton and Lancaster)
- Unplanned events – flooding, snow and ice, fuel shortage (national and local)
- Planned events – workplace consolidation (York CC), Olympics 2012
- Large scale survey – (Aberdeen, Reading, York, Liverpool, London, Yeovil & Chard): perceptions, experience, adaptiveness

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UKERC Transport Outputs

Journal papers

- Brand, C., Anable, J. and Tran, M. (2013) Accelerating the transformation to a low carbon transport system: the role of car purchase taxes, feebates, road taxes and scrappage incentives in the UK. Transportation Research A, pp.49, pp.132-148.
- Anable, J., Brand, C., Tran, M. and Eyre, N. (in press) Modelling transport energy demand: a socio-technical approach. *Energy Policy.*
- Brand, C., Tran, M. and Anable, J. (2012) The UK Transport Carbon Model: an integrated lifecycle approach to explore low carbon futures. *Energy Policy. 41, pp.125-138*

Book Chapters

- Eyre, N., Anable, J, Brand, C., Layberry, R. and Strachan, N. (2010) The way we live from now on: lifestyle and energy consumption. Chapter 9 in P.Ekins et al. (eds) *Energy 2050: the transition to a secure and low carbon energy system for the UK*. Earthscan.

Reports

- Gross, R., Heptonstall, P., Anable, J., Greenacre, P. & E4Tech (2009) *What policies are effective at reducing carbon emissions from surface passenger transport? A review of interventions to encourage behavioural and technological change*. UKERC Report ISBN 1 903144 0 7 8.

Working Papers

- Brand, C. (2010) UK Transport Carbon Model, Reference Guide v1.0, UKERC Working Paper. Environmental Change Institute, Oxford.
- Brand, C. (2010) UK Transport Carbon Model, User Guide v1.0, UKERC Working Paper. Environmental Change Institute, Oxford.

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