Consumers, Vehicles and Energy Integration (CVEI) project

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Project aims

- To address the challenges involved in transitioning to a secure and sustainable low carbon vehicle fleet

- To examine how tighter *integration* of vehicles with
  the energy supply system can benefit:
  - vehicle users
  - vehicle manufacturers
  - organisations throughout the energy supply chain

The outputs will:

- help inform UK and European government policy
- help shape energy and automotive industry products

Project structure

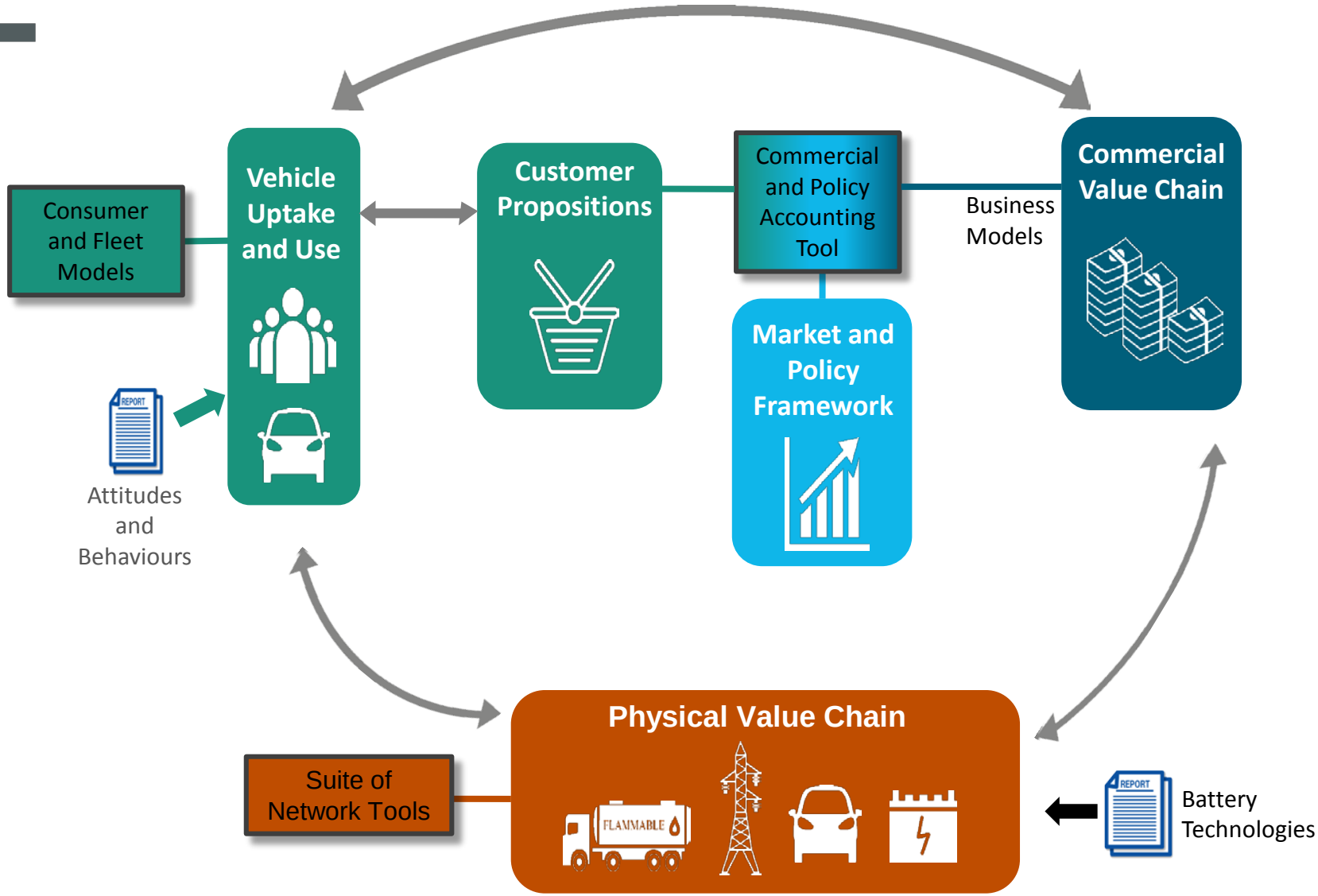
Stage 1 - detailed design & analysis to characterise:

- market, policy and regulatory frameworks
- business models and customer offerings
- integrated vehicle and infrastructure systems and technologies for electricity and liquid fuel / hydrogen
- consumer and fleet attitudes to adoption and usage behaviours

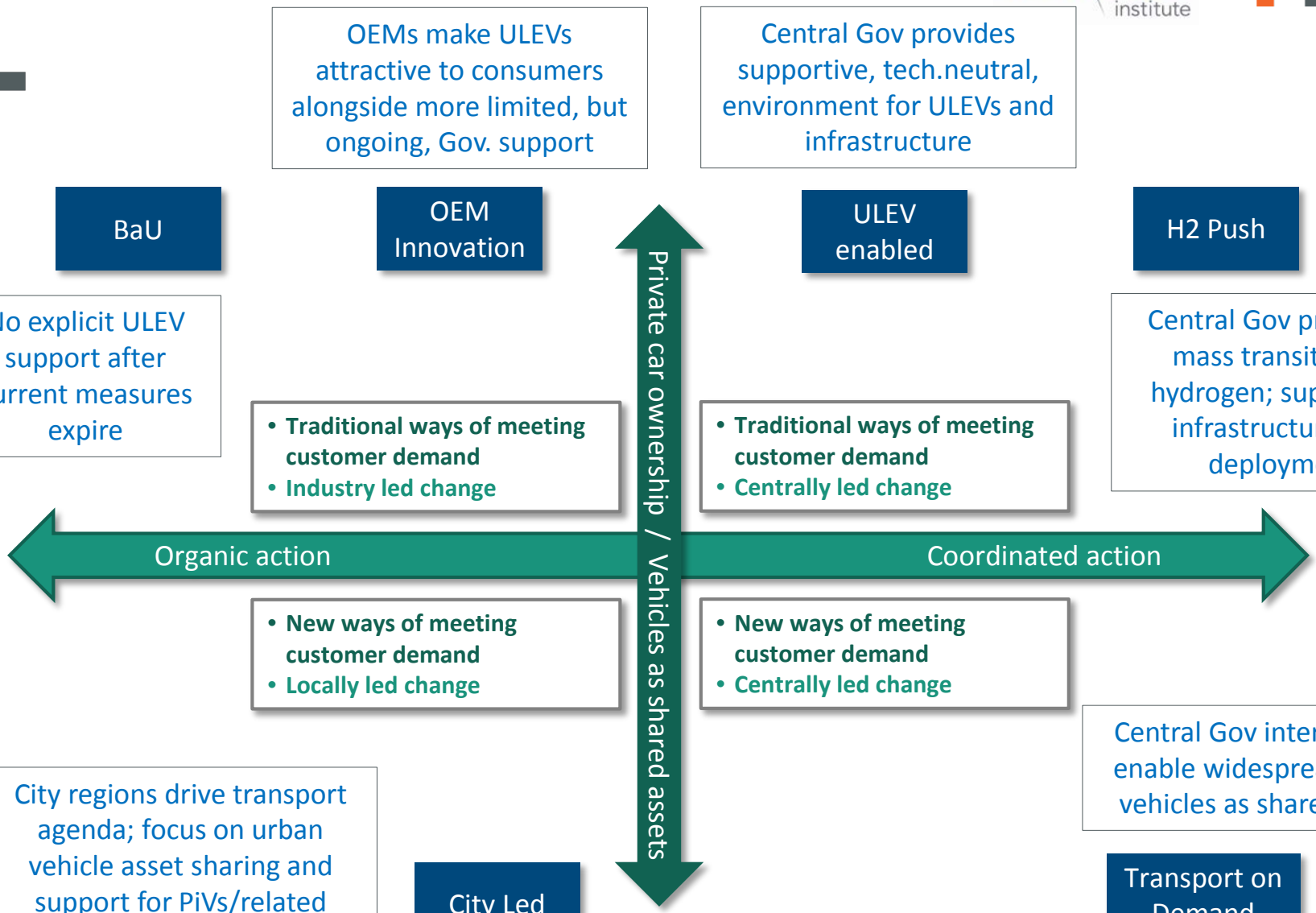
Stage 2 – test and validate solutions and assess responses:

- Experimental field trials with mainstream consumers
- In-depth case studies with fleets
- Updates to analytical tools

Modelling framework



Narratives (scenarios)



Stage 1 initial analysis suggests:

- Overcoming upfront cost of ULEV ownership in the medium term is essential
  - Encouraging faster uptake in short-term costly compared to carbon savings
- Some de-risking and direct support for new infrastructure to encourage investment is important
  - Significantly smaller in comparison to direct subsidies for vehicles. More important in the short-term for chargepoints; rapid charging development is a priority
- Fiscal mechanisms are important
  - ULEV uptake can lead to a sizeable drop in net transport-related Gov. revenues. Maintaining the share of net transport revenues within the wider economy would need tech. neutral mechanisms (e.g. road prices in the order of 1-2p/km)

Stage 1 initial analysis suggests:

- Demand Management for EVs is important for reducing overall system costs, in particular balancing and network reinforcement costs
  - This appears to allow for a viable Aggregator business model
  - But, must be tested in Stage 2; 'modest' customer response to Static ToU tariffs leads to sizeable reduction in system costs; this is even larger for Supplier Managed Charging

- Significant uptake in car-sharing (where individuals no longer own private vehicles but access one when required) can materially reduce costs

Stage 1 research with consumers

Research Aims	• Update understanding of consumer (EV Innovator) attitudes towards ULEV adoption including exploration of barriers • Explore consumer attitudes to managed charging scenarios (with consumers who have experience of a BEV or PHEV)

Method	• In-depth qualitative interviews, recorded, transcribed and analysed thematically
	• 4 groups of 15 participants:
	  • Consumers who have owned /leased a BEV for 18 mths or longer
	  • Consumers who have owned /leased a BEV for 6 months or less
	  • Consumers who have owned or leased a PHEV
	  • Non-EV owners who have had previous experience of driving and charging an EV, e.g. as a participant in a previous EV trial

Stage 1 research with consumers: Key findings

- Clear ‘plain language’ explanations of managed charging propositions needed to engage consumers
- Simple user-friendly interface needed to ensure complexity does not adversely affect engagement
- Energy use could be affected by public charging infrastructure and use of solar panels in home
- Managed charging preferences may depend on personality and individual circumstances
- Without direct experience of Managed Charging, users suggested a potential preference for user-managed schemes (e.g. Time of Use tariffs)

Stage 1 research with fleets

Research Aims	• Develop initial understanding of fleet attitudes towards ULEV adoption including exploration of barriers to adoption • Explore attitudes of fleets to managed charging propositions

Method	• In-depth qualitative interviews, recorded, transcribed and analysed thematically
	• Analysis of potential benefits to replacing existing vehicles with EVs - used as a stimulus for discussion
	• Participants:
	  • Fleet managers from 16 fleets diverse (as far as possible) in terms of fleet size, whether public/private, vehicle type, and average daily mileage
	  • Most participating fleets already had some EVs

Stage 1 research with fleets: Key findings

Interviews

1. EVs adopted in small numbers, mostly as “toe in the water”
2. Adopted for a number of reasons: reputation, evaluation, cost, CSR
3. Barriers: limited range, planning requires more effort, availability of public charge points and compatibility with duty-cycle
4. EVs characteristically chosen as one-to-one replacements; no use of wider across-fleet optimisation
5. Electricity supply not normally the remit of Fleet managers; so all relevant parties in the organisation must be considered
6. Managed charging must:
    - not impact operational needs
    - offer material financial benefit

Stage 2

Consumer Uptake Trial

➢ Enhance understanding of EV adoption

- 200 Mainstream consumers, given direct experience with BEV & PHEV (plus ICE control)
- Telematics, questionnaires and choice experiment (capitalising on reduction in 'psychological distance')
- Findings to inform analysis on uptake by mainstream consumers under different market and policy frameworks

Consumer Charging Trials

➢ Assess response to market frameworks and policy incentives for demand management

- 240 Mainstream consumers (half BEV, half PHEV)
- User-Managed & Supplier-Managed Charging (plus control group)
- Telematics and charging data, questionnaires and choice experiment
- Findings to inform analysis of effectiveness of charging solutions and vehicle-energy integration, and of system level impacts

Fleet Study

➢ Assess informed response to modelled fleet-wide roll-out

- Case studies - in-depth qualitative engagement with 8 fleets, drawn from categories with high potential impact on energy system (if EVs adopted)
- Wider fleet roll-out modelled and assessed with operators

Update of Results, Reporting and Dissemination

➢ Complete analysis and communicate results

- Capture learning, update modelling frameworks, assumptions, uncertainties and analysis
- Derive conclusions regarding uptake and integration of vehicles into system
- Final reporting and dissemination of key outcomes and next steps

Summary

- Substantial challenges associated with widespread roll-out of low carbon vehicles; shift from a “problem for the network” to an “opportunity through integration of vehicles as part of a wider system” can yield benefits for all actors in the system, including:
  - increased uptake of low-emission vehicles, managing charging and refuelling, and optimising the system design

- Analysis and solutions must be holistic (considering all parts of the system together, including users)

- Robust trials in Stage 2 will generate data to test solutions and inform analysis, and will add unique value:
  - Trial with mass-market users (i.e. people from the majority of the vehicle user and fleet operator markets)
  - Addressing widely-applicable plug-in vehicles (BEVs and PHEVs) suitable for wide range of users
  - Holistic system design