Designing effective policies to promote low emissions vehicles in the UK
IAEE conference 2014
George Day, Head of Economic Strategy
Energy Technologies Institute (ETI)

Innovating to deliver affordable, secure, sustainable low carbon energy

**Unique features**

**Deep partnership** of public and private sectors - money, skills and market interests

‘Industrial style’ targeted procurement and delivery of projects using technically and commercially skilled staff

**Stand alone organisation but able to call on the skills, resources and capabilities of all its members** to enable effective and successful delivery

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<th>ETI Technology Programme areas</th>
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<tr>
<td>Offshore Wind</td>
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<td>Marine</td>
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<td>Distributed Energy</td>
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<td>Buildings</td>
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<td>Energy Storage and Distribution</td>
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<td>Smart Systems and Heat</td>
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<td>Carbon Capture and Storage</td>
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<td>Transport</td>
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<td>Bioenergy</td>
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Overview

‘Macro’ level analysis

- Understanding the energy system transition

‘Micro’ level analysis

- Understanding consumers

Policy application?

- Current UK policy space
Energy System Modelling Environment

A national energy system design tool, integrating power, heat, transport and infrastructure

Modelling approach
- Least cost optimisation (policy neutral)
- Back-casting from 2050
- Probabilistic treatment of uncertainty
- Spatial & temporal factors

Informed by ETI members/advisors

Internationally peer reviewed
ETI’s energy system analysis
How much to decarbonise transport?
Costs and emissions reductions

- Upgrade from 'do nothing' to efficient ICEs and limited bio-fuel
- Add electric infrastructure (network reinforcement, recharge points)
- Add short range PHEVs
- Upgrade to medium range
- Upgrade to long range

Costs for extra carbon reduction with high bio-fuel or H2 are highly uncertain

Carbon reduction (from 2010):
- 0%
- 20%
- 40%
- 60%
- 80%
- 100%
- 120%

Reference: residual emissions

Extra carbon reduction would require high bio-fuels or H2

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Cutting carbon intensity for liquid fuels

An example for a 'Category C' (e.g. Ford Focus, VW Golf, etc) type vehicle

Note: emissions from electricity or liquid fuel production are excluded from this chart

An example for a 'Category C' (e.g. Ford Focus, VW Golf, etc) type vehicle

Model Year

Conventional Power-trains (including stop-start)

Range of hybrid type power-trains

Tank-to-wheel CO₂ emissions (g/km)

Based on standard European test cycle (NEDC)
Transitioning the market

Investment in hydrogen infrastructure R&D now should focus on its value as an insurance option.

Majority hydrogen fuel

Insurance option: Hydrogen / electric mix (phase out liquid fuel)

Majority electric fuel

Majority electric fuel

Least cost and risk path: Liquid / electric mix

Majority liquid fuel (fossil and bio)

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Key insights from system level analysis

- Extent of light transport decarbonisation depends on broader energy system
- Efficiency is the lowest cost and quickest technology to deploy
- A combination of efficient conventional vehicles and PHEVs could deliver sufficient carbon reduction (if bio CCS is deployed)
- PHEVs are a crucial and low risk (i.e. low regrets) technology
- Hydrogen is a key ‘insurance policy’
- UK will need to make infrastructure choices – probably by the mid 2020s to hit 2050 carbon targets
- Transition costs are significant – so policy intervention is crucial
‘Micro’ view – consumer choices

In depth research of mainstream consumer attitudes to low carbon vehicles

- Literature review
- Insights from Technology Strategy Board demonstrator programme
- Research with mainstream UK consumers to give them experience of using pure electric or plug in hybrid electric vehicle
- In-depth surveys and quantitative choice experiment with circa 3000 UK consumers with recent experience of buying a new or nearly new car

Detailed analysis of national travel survey data

- Journey patterns
- Usage of different kinds of vehicles
Market segmentation

- **Earliest Purchasers**
  - Plug-in PIONEERS (2%)
  - Zealous OPTIMISTS (13%)
- **Interested Consumers**
  - Willing PRAGMATISTS (11%)
  - Anxious ASPIRERS (16%)
  - Uninspired FOLLOWERS (19%)
  - Conventional SCEPTICS (13%)
  - Image-conscious REJECTERS (18%)
- **Reluctant Consumers**
  - COMPANY Car Drivers (8%)

Bias for/against plug-in vehicles (£ equivalent):
- BEV
- PHEV/RE-EV
Analysis of car travel patterns

PHEV range extender kicks-in (indicates there are journeys that can’t be completed in a BEV)

- Able to Recharge Everywhere
- A Recharge Point at Both Home and Work*
- Home Recharge Point Only
- Work Recharge Point Only*

* Only for Cars Regularly Travelling to a Workplace (<50%)
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<th>Micro analysis: key insights</th>
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<th>Early adopters (pioneers) are not typical</th>
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<tr>
<td>• Mainstream consumers affected by a range of factors including range anxiety, embarrassment!</td>
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<td>• Most consumers not willing to pay more for carbon reduction or to pay higher upfront capital costs</td>
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<th>PHEVS are capable of meeting consumer needs and delivering substantial emissions benefits</th>
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<td>• Some attributes of PHEVs are valued</td>
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<tr>
<td>• Independence from oil and price volatility</td>
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<td>• Convenience of home charging</td>
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<th>A mid size vehicle with a 40-50 mile range (a little more than the current GM Volt) with just a single 3kW home recharging point could do around 75% of mileage in electric mode</th>
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<td>• But only a small segment of the market which only ever travels short distances</td>
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| PHEVs are an evolutionary technology with limited dependence on major upfront capital investment |
Current UK policy

• Govt has announced ultra low emission vehicles (ULEV) strategy for 2015-20

• £500m ($800m) package of support

• Biggest component is grant support for purchase of low emissions vehicles
  – $8000 per vehicle for at least 50000 cars (10000 grants have been made)
  – Purchase grant support also for other vehicles including light duty vans

• Smaller elements: Support for 2 to 4 City schemes (bus lanes, supporting ULEV car clubs, infrastructure, parking policy, fleets), ULEV taxis and buses, rapid charging infrastructure, home charging infrastructure

• £100m for ULEV R&D

• £1bn for Advanced Propulsion Centre – to build UK manufacturing capability

• Plus a range of tax advantages for ULEVs
Are upfront grants good value?

- Grants for new low emission vehicles mean high value depreciation
  - High total ownership costs

- Can government be sure that subsidies are not captured by manufacturers?
  - EU level standards already impact on manufacturers

- Would early adopters have been willing to pay anyway?

- How durable is the signal to manufacturers?
  - Lack of ability to give certainty about future levels of support to drive investment by manufacturers
International experience

- ICCT carried out comparison of fiscal incentives for electric vehicles

- Fiscal incentives – widely used and do appear to play a key role in driving early adoption
  - Markets with highest EV penetration have high level of incentives (e.g. Norway, Netherlands)
  - But no clear best practice in how to use most efficiently and how to phase out subsidies

- Some interesting examples e.g. California has higher growth rate and market share than expected
  - Other benefits e.g. lane access may be important
  - Mandate placed on manufacturers
Policy alternatives?

- Support for alternative business models?
  - Innovative financing to remove upfront capital cost barrier for consumers (advance long term ownership benefits to consumers)?
  - Energy cost stability

- More emphasis on durable measures to develop market?
  - Roll out of charging infrastructure
  - Target support on home and office charging points
  - E.g. mandate in new build properties
  - Lane access and other measures to improve ownership experience
To conclude..

- Cutting transport carbon emissions is expensive compared to other sectors

- Energy system view is valuable in understanding extent of emissions cuts required

- System modelling suggests least cost strategy for the UK would comprise a mix of liquid fuels (fossil & bio) with low carbon electricity
  - Hydrogen as an ‘insurance’ option

- PHEVs are a key technology option for decarbonising light transport which can overcome key barriers

- Still more work needed to understand most efficient way to develop market
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