Energy Options for Transport
Meeting note of launch event, 21st April 2016

The Energy Research Partnership (ERP) held a launch event on 21st April 2016 for its report Energy Options for Transport. The event was chaired by Professor Phil Blythe, Chief Scientific Advisor (CSA) at the Department for Transport (DfT), and attended by representatives from the energy and transport sectors.

Key points from the ERP's report were presented by Simon Cran-McGreehin of the ERP's Analysis Team:

- A range of options could be used to cut road GHG emissions.
- Decisions about which options to pursue should weigh up strategic considerations, including interactions with wider energy sector; they must also weigh up the effort of deployment and the confidence of delivering the necessary performance.
- Steps can be taken to aid deployment and ensure performance, and to manage implications.

The panel of guest speakers presented on the following topics (slides are available on the event's page, here):

- Andy Eastlake (Low Carbon Vehicle Partnership, LowCVP): development of vehicles;
- Liam Lidstone (Energy Technologies Institute, ETI): user interactions and energy systems integration;
- Bob Moran (Office for Low Emission Vehicles, OLEV): policy perspective.

Discussions between the panel and attendees included the following points. These points have not been attributed to individuals, and do not necessarily reflect the overall view of the panel, attendees or the ERP.

Mobility services

- Mobility can be viewed as a service (distinct from traditional vehicle ownership) e.g. as per ride-sharing apps for road transport and engine leasing in aviation.
- Automation of road transport is happening to various degrees and for various reasons. Automation can offer some savings in fuel use and CO_2 emissions: examples include platooning for HGVs, optimised acceleration and braking, and traffic-responsive road signals. Full automation could potentially increase access to transport (e.g. for people without driving licences), acting to increase energy use.
- Automation could offer the prospect of "uncrashable" vehicles, allowing for reductions in weight (due to removal of primary and secondary protection measures) and hence in fuel use and CO_2 emissions. This would have to take account of public perceptions of lighter vehicles (there can be a preference for heavier vehicles), the risks of software being hacked, and the remaining "crashable" legacy vehicles.

Policies and regulations

- Transport and energy sectors need to work together more closely, which can be supported by links at the ERP and a new transport energy initiative by the LowCVP.
- Air quality is a major issue for government, local authorities and customers; a rapid transition to ultra-low emission vehicles (ULEVs) would help to address this issue.
- Local authorities' policies can be significant factors (e.g. for air quality) and can be largely independent of national government. Local authorities can have a direct impact via their own fleets (e.g. buses), and an indirect impact on other vehicle users by a) introducing regulations to incentivise ULEVs and b) giving confidence by building a critical mass of ULEV infrastructure (e.g. for buses' high-power rapid chargers).

Life-cycle impacts

- Life-cycle impacts (of energy vectors, vehicles and infrastructure) must be considered when incentivising purchases of ULEVs. Vehicles' embedded impacts are determined by industrial manufacturing in the UK and abroad, for which decarbonisation will require measures including CCS.
- Larger battery capacity in battery electric vehicles (BEVs) can overcome "range anxiety", but adds embedded impacts. If the issue is the duration of recharging, it could be addressed through faster recharging (avoiding larger battery embedded impacts, but potentially adding embedded impacts from materials for rapid chargers).

Energy efficiency

- Energy efficiency for heavy goods vehicles (HGVs) has historically been higher than for light road vehicles, due largely to commercial cost pressures. For cars, recent increases in the energy efficiency of new internal combustion engine vehicles (ICEVs) have been the main means of reducing their GHG emissions to date. In future, low-carbon liquid fuels will make an increasing contribution to GHG emissions cuts, so further efficiency improvements will make a "diluted" (but still important) contribution to GHG emissions cuts; but energy efficiency also reduces fuel bills, demand in energy supply chains and pressure on infrastructure.
- Fuel consumption can be strongly affected by driving style (with some differences between petrol and diesel) which is affected in turn by fuel costs. Cost differentials between fuels can affect driving style, e.g. costs per km are significantly lower for electric vehicles (EVs) than for ICEVs (owing to energy efficiency and fuel costs) so some EV drivers can feel less inclined to make further fuel savings through improved driving style (although this tends to be counteracted by awareness of range limitations).

Energy vectors

- All commentators foresee an ongoing role for liquid fuels, albeit with a range of views on volumes and timeframes; some foresee ICEVs becoming less popular than alternatives. Light vehicles will probably use more petrol than diesel, to provide air quality benefits and to balance the refining output of diesel needed for heavy road vehicles. Petrol and diesel will have rising proportions of biofuels and synthetic fuels. Low-carbon liquid fuels are particularly important for heavy transport, but it is unclear where they will be developed: Aviation's limited decarbonisation options suggest that it should be a first-mover, but it currently faces limited policy pressure to decarbonise. However, for safety reasons, it could be better to develop fuels for heavy road transport before applying them to aviation.
- Electrification of road transport is inevitable: all commenters foresee a much-increased role especially in urban areas, but views range from a rapid uptake of BEVs to incremental change with plug-in hybrids (PHEVs) and range-extenders (REs). The distance travelled using electric power is more important than the number of EVs. Also, electrification can have a role in vehicles with non-electric powertrains.
- Hydrogen is likely to have a role for HGVs; some view it as the only option in the short/medium term. Hydrogen could gain in popularity and have a large role in light road transport as well.

Vehicle uptake

- Costs are a major determining factor in many vehicle purchases. Total cost of ownership (TCO) of the different energy options is anticipated to converge by 2030. Fleet operators consider TCO (including upgrades to power networks), and they have large buying power, which could be particularly significant for large fleets affected by local policies (e.g. for urban air quality).
- Factors other than TCO can affect purchasing decisions when a least-cost outcome is either not achievable or is not the main objective. For example, small companies concerned about cash-flow can be more affected by vans' upfront costs than by TCO; and emotive factors such as style can affect car choices. The number of vehicle models has affected uptake of EVs (especially for vans); more models are coming to market for each vehicle class (driven by tailpipe CO_2 targets) and could facilitate higher uptake (as happened in Norway where incentives had limited impact until wider choice was available).
- Policy drivers other than cost are important. For example, natural gas or hydrogen for HGVs and buses could help to meet targets for urban air pollution; action could be taken (including adding infrastructure in cities) to encourage local authorities and commercial operators to adopt these vehicles.
- Unforeseen factors could affect uptake of non-ICEV vehicles (similar to the way that smart heating controls for buildings have increased in popularity due to new entrants' products), potentially outpacing infrastructure changes being planned by utilities.
- Overall, an energy option would need to deliver the desired benefits in a way that is workable for customers and is affordable (although impacts vary between users); this might or might not be least-cost. For example, hydrogen road transport would deliver the benefits of lower CO_2 emissions and lower air pollution; it would be workable (i.e. a familiar customer experience for refuelling and range, using some existing infrastructure), and affordable (i.e. comparable with other major national projects). Hydrogen road transport would not be least cost (accounting for vehicles, energy and infrastructure). All of the factors would need to be weighed up.

Infrastructure

- Upstream energy production facilities would be needed, including new liquid fuel refineries, low-carbon electricity generation, and low-carbon production of hydrogen.
- Coverage of fuelling points is key: universal coverage of liquid fuel stations should be maintained for legacy vehicles, even if demand falls; and emerging energy options need sufficient coverage to provide confidence to customers.
    - Natural gas and hydrogen stations would be hubs like liquid fuel stations, offering some efficiencies. Natural gas fuelling points would require network extensions and compressors at fuelling sites. Hydrogen would need a network of fuelling stations, and fuel distribution could possibly use repurposed gas grids (with network extensions).
    - Electrical charging points tend to be distributed (not in hubs). Electric vehicles would require new charging points and the supporting network upgrades, primarily for homes (most charging would likely happen overnight) and businesses (for daytime charging); but to give confidence to users there would need to be an extensive public charging network and information provision to allow users to plan journeys accounting for chargers' locations, availabilities and rates of charge.
- Transport would interact operationally with energy networks.
    - EVs could help to manage some electricity system issues: charging could be timed to limit peak demand or to utilise cheap power; and EV's energy storage could offer energy storage for vehicle-to-grid power flows. These options would depend upon battery warranties (including second-life uses) and business models to engage users (e.g. via smart meters or other data provision). Storage business models would require price volatility: this is politically undesirable, and it would be reduced by the storage that sought to profit from it.
- Co-ordination is important for the planning of infrastructure upgrades.
    - Infrastructure investment can be a "chicken-and-egg" problem: infrastructure is needed to give users' confidence, but user commitment is needed to justify infrastructure expenditure.
    - Network upgrades (e.g. on low-voltage circuits for charging points) could be more efficient if done alongside other upgrades (e.g. for electrical heat pumps and solar PV panels); alternatively, there could be logistical benefits in postponing some upgrades to smooth out the workloads.
    - Much of the energy distribution infrastructure that would be needed for electricity, gas and hydrogen is owned by monopoly network companies. Their price control agreements with the energy regulator last for 8years, and need to incorporate sufficient foresight and flexibility for developments that could occur over that duration. Business planning begins 2-3years in advance of a price control, and so trials to gather evidence about new approaches might need to start perhaps 5-6 years in advance of a price control.
    - Co-ordination would be needed between network companies' price controls and other investments e.g. commercial energy production projects and government-funded transport projects.

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