

Decarbonising transport network plus call 2018:

Annex 1: Report from EPSRC Decarbonising transport workshop

To scope the challenge of decarbonising transportation and the role research and innovation will play, EPSRC held a workshop in June 2018, attended by academics, business representatives and members of the Department for Transport.

The aims of the workshops was to help define what the current research landscape looked like in the UK relevant to decarbonising transport and what the research needs might be for meeting the transport aspects of the governments clean growth strategy. Specifically delegates were asked to think about the technological needs of the presented challenges and how engineering and physical science approaches would benefit the overall decarbonisation solutions.

UK landscape

The delegates were asked to identify large investments relevant to the challenge of decarbonising transport in the UK, in terms of Air, Sea, Land and Multimodal approaches to transport.

The delegates identified a range of HEI based projects and groups, UKRI and public sector investments, business stakeholders and other research or innovation activities.

Key technologies for reaching low carbon transport

Delegates were asked to identify those technologies and science areas which would have relevance in terms of the same groups as above, delimiting these into short, medium and long term realisations.

Delegates were specifically asked to focus on those area which do not currently have significant investment and research capacity. The results of the short brainstorming session of areas for research and development are listed below.

Land	
Short term	<ul style="list-style-type: none"> Biofuels Structural efficiency (light weighting/design) Improvements to Freight through existing technologies and optimisation Low carbon fuels Improving efficiency of HGVs/Coaches Off highway low carbon efficiency Good walking and cycling infrastructure New combustion systems compatible with hybridisation and electrification High capacity lorries Range extenders for sustainable fuels Road pricing Sustainable renewable fuels
Medium Term	<ul style="list-style-type: none"> Gas powered HGVs L-category (2-3 wheelers) Urban transport and E-bikes Utilise rail electrification structure for charging e-vehicles (when and where there is capacity) Improved logistics systems New combustion systems compatible with new sustainable fuels and low toxic emissions. Step change in battery technology and weight Affordable rail electrification Step change in engine efficiency Hydrogen as an energy vector/Hydrogen combustion systems. Fuel-engine optimisation Ride sharing technologies Fuels from waste Drones for freight Improved smoother roads
Long term	<ul style="list-style-type: none"> Ultra-light weighting of trains Autonomous vehicles (+ve or -ve) Managing transport system logistics Wireless charging by the roadside New biofuels Electrification of urban freight Electrification of long haul freight and other vehicles. E-Highways

Sea	
Short term	Operational efficiencies Liquefied natural gas Port logistics and route planning Speed reductions for better fuel consumption Fuel legislation and new formulations Improved hydrodynamics Wind technology Wind assistance- Kites/sails, flatness ratios Transformative logistics Energy efficiency technologies
Medium Term	On-board renewables Alternative fuels- hydrogen, biofuels, ammonia, methanol Autonomous shipping and logistics Digitalisation for improved efficiency Bimodal shipping- electric mode in port PV panel charging combined with hybrid ships Charging infrastructure Localised production for reduced demand Demand reduction through carbon pricing
Long term	Small 'last mile' transport boats Small scale nuclear power for boats Batteries for boats CCS on shore for full mitigation of fuel use

Air	
Short term	Electric personal air mobility vehicles Operational practices New technologies for ground movement More efficient engines, bodies etc. Connectivity for onward or inbound low carbon transport
Medium Term	Reducing demand and pricing regimes Elimination of unnecessary air freight Hybrid-electric large aircraft Mode shift to high speed rail Air to space management
Long term	Superconducting machines for engines Alternative fuels- biofuels, hydrogen, low carbon synthetic, LNG, liquefied methane Batteries for planes

Across multiple systems	
Short term	Demand reduction Energy from Waste Trade-off between infrastructure and vehicle based technologies/solutions Extending range/update of low tech transport Life cycle methodologies
Medium Term	Alternative to Gas in generation CCS in production for transport fuels Multimodal transport integration Co-ordinated use of scarce resources Combined utility technologies (zero waste) 'Cold' energy storage
Long term	Automation and connectivity Ownership models of transport Vehicle sharing Novel charging infrastructure across all modes

These outputs were clustered and discussed by the delegate to create a list of condensed areas for each medium that could deliver high impact research that would help in decarbonising the transport system.

Multimodal approaches		
<ul style="list-style-type: none"> • Zero waste Transport (including manufacture) <ul style="list-style-type: none"> • Life cycle • Demand reduction • CCS for transport 		
Land	Air	Sea
<ul style="list-style-type: none"> • Renewable/ alternative fuels • Electrification of long haul freight • Engine efficiency • Wireless charging on the roadside • Autonomous vehicles • Road pricing 	<ul style="list-style-type: none"> • Alternative Fuel, • Electric aircraft • Novel engines 	<ul style="list-style-type: none"> • Fuel formulations (including Hydrogen, biofuels, methanol and ammonia) • Operational efficiency • On-board renewables in combination • Domestic fleet

This, and the conversations around these clustering have been synthesised to the following diagram (created after the workshop) (figure 1).

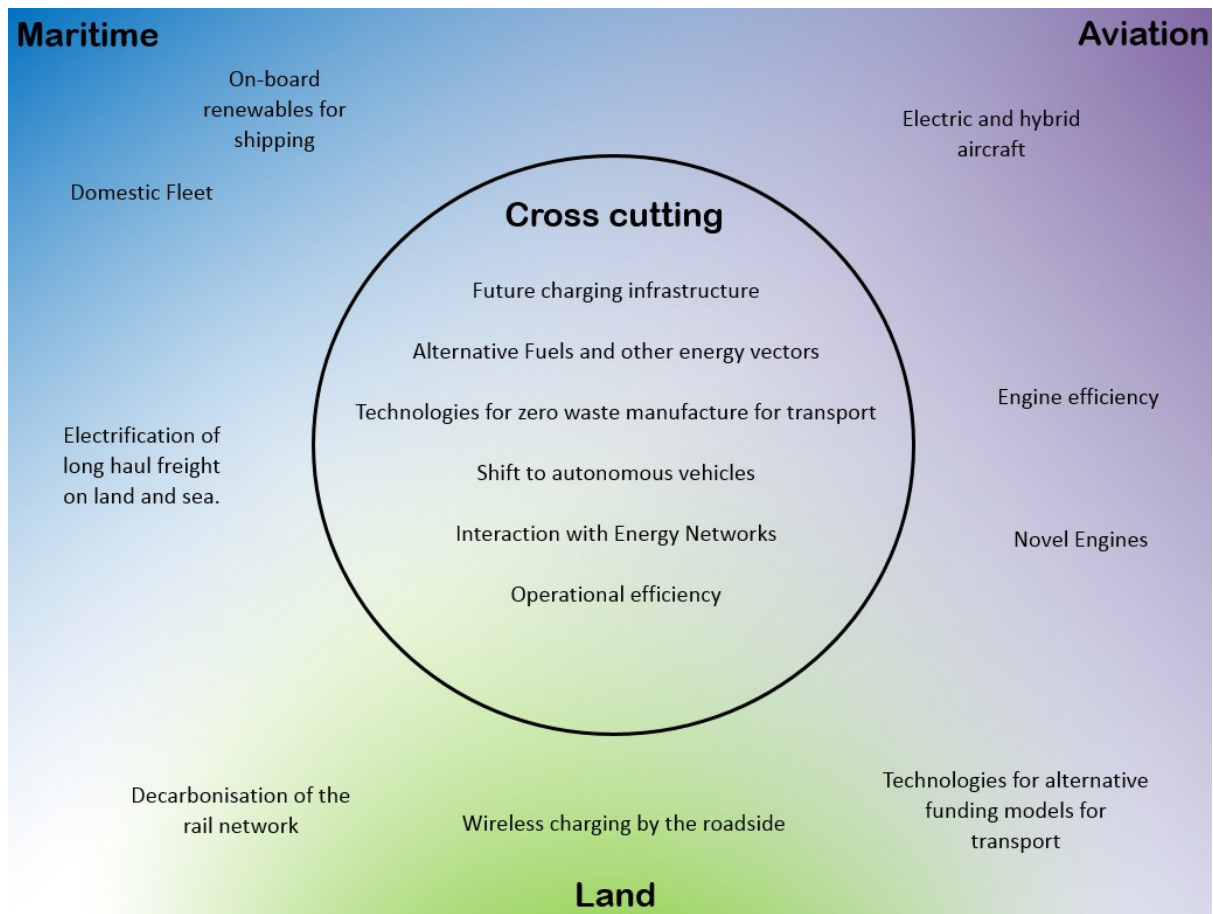


Figure 1: Diagrammatic representation of identified key technologies for decarbonising transport.

Additional conversations around the various technological routes to realisation of the challenges were held and a variety of options discussed. The delegates agreed that a multimodal approach would be required and that no one technology could be identified at this point which would be central to decarbonising any of the specific modes.