

**Introducing a new research report**

# Automotive technologies: The UK's current capability



## Foreword

As we publish the first authoritative study of the UK's current capability in automotive technology research and development, I would like to offer a few words of introduction and context.

In May 2009 the New Automotive Innovation and Growth Team (NAIGT) produced its final report, which included an industry-consensus high level Technology Roadmap for meeting the ambitious carbon reduction targets in road transport. This comprised a Product Development Roadmap and a Research Development road map. Future technologies needed to deliver the Roadmap to the envisaged timescales were also presented, in the Research Development Roadmap.

However, before a research strategy for the UK automotive sector could be developed from this it was clear that additional elements were needed, including an understanding of current UK strengths in each of the key research areas.

The study which we have now published represents an important step towards that understanding. Requested by the NAIGT, funded by the Technology Strategy Board and delivered by Ricardo, it analysed work being done in industry and academia and identifies UK capability levels in those areas that are important for delivering the Technology Roadmap. It also identifies our likely long-term capabilities, assuming that current levels of R&D investment are at least maintained.

However, by their very nature these reports cannot predict disruptive technologies that may emerge, and which any future strategy must also provide for. This report is also a snapshot of current status, and will need to be refreshed in future along with the Technology Roadmap on which it is based.

I must also point out that the areas highlighted in the study do not themselves represent strategic judgements. Our findings will have different implications for different organisations. For example, areas where the country does not have great strengths at the moment may in fact represent opportunity for some.

What I do believe is that the solid evidence in this groundbreaking study will enable both government and industry, in particular through the newly-formed Automotive Council, to develop effective strategies for future R&D – as we work together to make the UK a leading player in the low carbon automotive industry of the future.

We would like to thank all those who contributed to the work underlying the report, especially NAIGT members, members of the Technology Expert Group, and staff at the Department for Business, Innovation and Skills (BIS), the Department for Transport (DfT) and the Office for Low Emission Vehicles (OLEV).

**Iain Gray, Chief Executive**  
Technology Strategy Board

## Introduction

The research report, *Automotive technologies: The UK's current R&D capability*, forms part of a three-phase plan to produce an automotive technology strategy for the UK.

Phase 1, delivered by NAIGT, set out to describe a common view of the product directions of the major automotive original equipment manufacturers (OEMs) and to identify the technology requirements of those products as they evolve over time. This phase culminated in a Product Development Roadmap and a Research Development Roadmap which were published in the NAIGT report of 2009.

Phase 2 is the research study itself. Funded by the Technology Strategy Board and delivered by Ricardo, based on inputs from NAIGT members and UK stakeholders, the study seeks to broaden consensus, identify specific areas of UK capability and opportunity, and develop a structured evidence base for the strategic prioritisation of UK support. This resulted in an in-depth industry consultation to establish the wider R&D capability in the UK.

The third phase, the identification of strategic priorities based on the evidence in the study, will be taken forward by the Automotive Council.



# Overall assessment summary – all categories

Technology category	UK capability			Research area focus (selected items of interest)			Indicative ROI
	S	M	L	Short	Medium	Long	
FIE	Dark Blue	Dark Blue	Dark Blue	High pressures, more flexibility, hybrid app's	Design for biofuels		4
Air handling	Dark Blue	Dark Blue	Dark Blue	Boost systems for downsizing	Improved response, eg energy storage		3
Friction reduction	Dark Blue	Dark Blue	Dark Blue	Components, lubricants	Materials, coatings, nano technology		3
Alternative actuation	Dark Blue	Light Blue	Light Blue	Electric actuation	Combined function actuators		2
Heat energy recovery systems	Light Blue	Dark Blue	Dark Blue	-	E-turbines, secondary cycles	Thermoelectric devices	3
Novel thermo cycles	Light Blue	Dark Blue	Dark Blue	-	Alt. combustion modes (CAI, HCCI)	Novel concepts for very high efficiency	3
Flexible valvetrains	Light Blue	Dark Blue	Dark Blue	Fully variable mechanical systems	Adv. combinations w other tech's		2
Engines for HEV/PHEV	Light Blue	Dark Blue	Dark Blue	Simple, light engines for niche app's	Optimised engines		4
Integrated engine design & dev't	Dark Blue	Dark Blue	Dark Blue	Flexfuel engines	2/4 stroke switching	Mild hybrid, boosted engines	5
Electric motors	Dark Blue	Dark Blue	Dark Blue	Low cost, compact	Lower cost	Super high eff., new materials	4
Hydrogen fuel cells	Light Blue	Dark Blue	Dark Blue	Support to demonstrators	Efficiency, cost improvements	New MEA materials	4
Power electronics	Dark Blue	Dark Blue	Dark Blue	Low cost	Flexible	High temp, new materials	4
Conventional MT / AT	Light Blue	Light Blue	Light Blue				1
Advanced DCT / CVT	Dark Blue	Dark Blue	Dark Blue	Lower cost	Improved efficiency		2
Driveline components	Dark Blue	Dark Blue	Dark Blue	Lightweight gearsets	Composites		2
Actuation improvement	Light Blue	Dark Blue	Dark Blue	Electromagnetic actuators	Combined function actuators		2
Adv trans fluids	Dark Blue	Dark Blue	Dark Blue	Fluids for low friction	Nano technology		4
Trans concepts for HEV / PHEV / EV	Dark Blue	Dark Blue	Dark Blue	Optimised calibration for HEVs	Multi-speed for EVs, Low cost for HEV		3
Battery cell dev	Light Blue	Dark Blue	Dark Blue	Imp. quality, durability & cost, end-of-life/recycling	Reduce cost & imp energy/power density	Novel cell chemistries (alt. to lithium ion)	2
Battery pack int.	Dark Blue	Dark Blue	Dark Blue	Thermal control, safety/crash protection			5
Capacitor tech.	Light Blue	Light Blue	Light Blue				1
H <sub>2</sub> storage tech.	Light Blue	Dark Blue	Dark Blue	-	Cost reduction	Alt. H <sub>2</sub> storage (solid state etc.)	3
Mechanical energy storage tech.	Dark Blue	Dark Blue	Dark Blue	Tech demo for benefits			5
Lightweight structures	Dark Blue	Dark Blue	Dark Blue	Lightweight steel, aluminium	Carbon fibre composites	Smart components & materials	5
Components for low rolling losses	Light Blue	Light Blue	Light Blue	High eff y bearings, low drag brakes			1
Improved aerodynamics	Dark Blue	Dark Blue	Dark Blue				2
New vehicle classes	Light Blue	Dark Blue	Dark Blue	-	Design for EVs, personal mobility	Modular vehicles	3
Adv. p'train control – software	Dark Blue	Dark Blue	Dark Blue	Model-based multivariable control	Cylinder p based ctrl, integrated powertrain ctrl	Adaptive in-cycle model-based control	3
Adv. p'train control - hardware	Dark Blue	Dark Blue	Dark Blue				
Vehicle energy mgmt	Dark Blue	Dark Blue	Dark Blue	Thermal mgt, e-ancillaries	Energy mgt strategy PHEV, EV	Energy mgt strategy fuel cells	4
Driver info systems	Dark Blue	Dark Blue	Dark Blue	Economy aids	Innovative driver interaction methods		4
ITS	Light Blue	Dark Blue	Dark Blue	Info enabled control: topology, V2I	Electronic horizon: incl. traffic, V2V		5
Autonomous vehicle control	Light Blue	Dark Blue	Dark Blue	-	X-by-wire	Autonomous control w. active safety integration	3
Sensors & sensor integration	Dark Blue	Dark Blue	Dark Blue	Sensor networking	Sensor fusion		2
1 <sup>st</sup> gen biofuels	Dark Blue	Dark Blue	Light Blue	Improved processes	-	-	1
2 <sup>nd</sup> gen biofuels	Light Blue	Dark Blue	Dark Blue	New 2 <sup>nd</sup> gen process	Demo 2 <sup>nd</sup> gen process		3
3 <sup>rd</sup> gen biofuels	Light Blue	Dark Blue	Dark Blue	-	-	New 3 <sup>rd</sup> gen processes	3
Electrical infra.	Light Blue	Dark Blue	Dark Blue	Smart metering / charge points	Future charging options (e.g fast charge)	Smart grid / energy mix	4
H <sub>2</sub> infrastructure	Light Blue	Light Blue	Dark Blue	-	-	H <sub>2</sub> fuelling options & infra. strategy	3
Advanced process tools	Dark Blue	Dark Blue	Dark Blue	Virtual prototyping			4
Integrated tool-chains	Dark Blue	Dark Blue	Dark Blue	Multi-domain modelling	Standards for tool integration		4
Auto-optimisation methods	Dark Blue	Dark Blue	Dark Blue	Multi-attribute optimisation			4
Advanced testing methods & equip	Dark Blue	Dark Blue	Dark Blue	Design of Experiments methods			3

S = Short term, M = Medium term, L = Long term, Dark Blue = High potential to deliver product requirements, Med Blue = Medium potential, Light Blue = Lower potential, Grey = No significant market requirement at that time  
 Indicative ROI – scale 1-5 with 5 being the best.





## Mapping the UK industry's capability

In carrying out the research for the study, Ricardo – acting as contractor for the Technology Strategy Board – identified and contacted 110 organisations across a balanced range of technology areas corresponding to those identified in the NAIGT study as relevant to CO<sub>2</sub> reduction. Information was gathered from industry stakeholders through questionnaires, interviews and workshops. Data was gathered from Technology Strategy Board projects, Engineering and Physical Sciences Research Council projects and projects supported by other Government bodies over the last five years.

This is the first time such in-depth information has been gathered from

industry. Ricardo collated the key insights from these information sources and formed conclusions on the relative abilities of the UK to play a part in the delivery of the NAIGT Consensus Product Roadmap. These conclusions were peer reviewed through presentation to Government and industry players.

A simple analysis was then carried out to give an initial indication of likely UK return on investment levels across the range of identified technologies. Again, these conclusions were peer reviewed through presentation to Government and industry.

Together, these results form an evidence base upon which the Automotive Council will be able to make informed, strategic decisions regarding priorities for future support. The full research report gives further details of the process and findings.

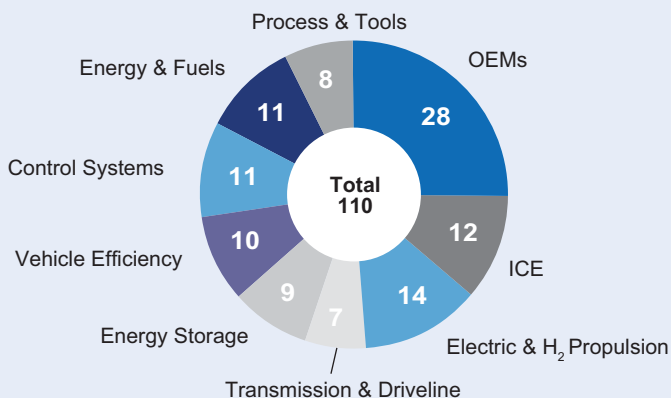
## Further information

An Independent Report on the Future of the Automotive Industry in the UK, NAIGT, 2009 published by BIS

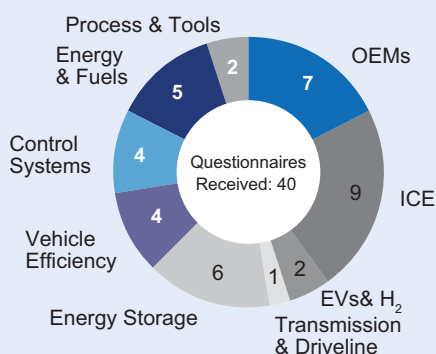
The full research report from Ricardo is available at [www.innovateuk.org](http://www.innovateuk.org) under Publications/reports

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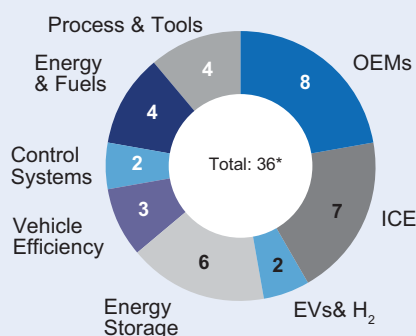
Organisations contacted (by main activity area)



Questionnaire participants



Workshop participants



*The Technology Strategy Board is a business-led executive non-departmental public body, established by the Government. Its role is to promote and support research into, and development and exploitation of, technology and innovation for the benefit of UK business, in order to increase economic growth and improve quality of life.*

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