

UK support for early market for low emission vehicles

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The challenge

- **Mandatory 80% CO₂ cut by 2050**
 - Road transport responsible for nearly 25% of UK emissions
 - Vehicle use increasing
- **Vehicle CO₂ reduction trajectory is still off target**
- **A sector of *major* importance to the UK**

A quick tour of the UK automotive sector

- **£53bn turnover**
- **827,000 direct jobs**
- **1.5m vehicles produced**
- **3m engines produced**
- **£1.3bn annual R&D spend**



Significant manufacturing and research presence

- **11 of the volume VM's**
- **19 of the world's top 20 suppliers**
- **80% of the world's top motorsport teams**

<http://www.automotivecouncil.co.uk/automotive-industry-in-the-uk/interactive-uk-map>

Policies

UK Government is supporting (£400m to 2015) the creation of an early market for ultra low carbon vehicles encompassing:

- Support for infrastructure;
- Vehicle purchase incentives;
- Support for the supply chain;
- Focussed R&D and demonstration programme; and,
- Skills development

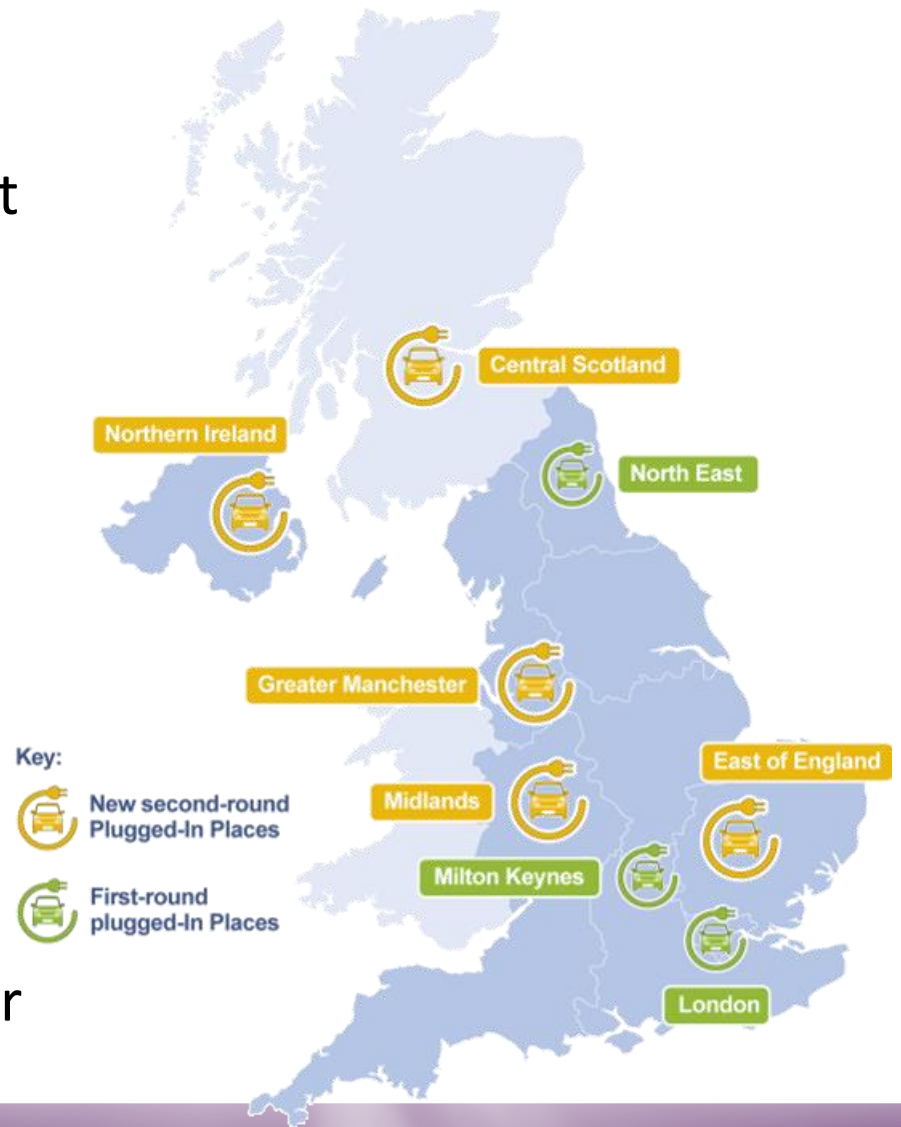
Office for Low Emission Vehicles (OLEV) established

Infrastructure:

‘Plugged in Places’

- £30m from central government
- 8 regional projects;
- Test business models, technology, usage
- Ensuring interoperability

>2500 charge points now installed in UK through PiP & private sector investment, with commitments to deliver a further 4000 by end 2012.



Vehicle purchase incentive

- Key element of UK early market support
- Enabling new, green technologies to compete
- Reducing the main barrier for consumers
- Provides 25% towards the cost up to max £5,000 for passenger cars or 20% up to a max £8,000 for vans
- ‘Technology neutral’ approach means that vehicles with tailpipe emissions of 75g CO₂/km or less, including electric, plug-in hybrid and hydrogen-fuelled cars, are potentially eligible
- At March 2012 - 1276 claims from 1,412 eligible cars
- Scheme extended to Low Emission Vans in 2012



Procurement Programme

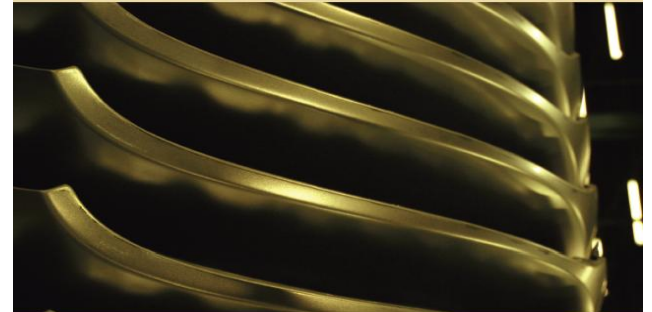
- **Low Carbon Vehicle Public Procurement Programme (LCVPP)** was launched in December 2011 providing a grant to public sector organisations towards purchase of hybrid vans (restricted to 500).
- Aims to demonstrate carbon reduction potential of new hybrid technologies and accelerate introduction to market.
- Provide benefits to manufacturers and supply chain.
- Assess economies of scale, potential for full commercialisation and provide further low carbon options for fleet buyers in the public sector.

UK Research & Development priorities

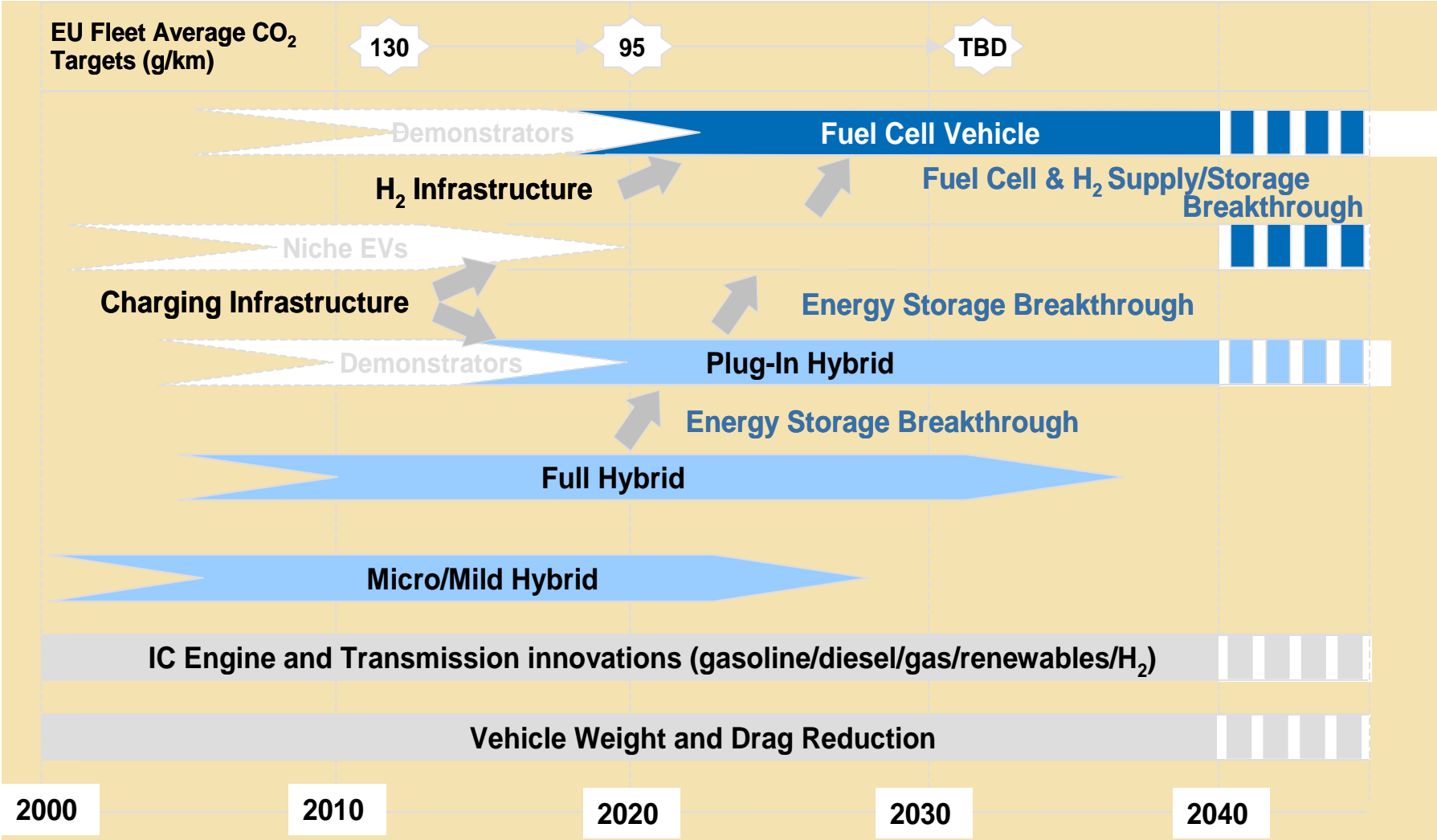
- ‘An Independent Report on the Future of the Automotive Industry’ was published in 2009 setting a 20 year vision for automotive industry and recommendations to achieve it.

An Independent Report on the Future of the Automotive Industry in the UK

New Automotive Innovation
and Growth Team (NAIGT)



UK 'consensus' Roadmap



UK Capability Study

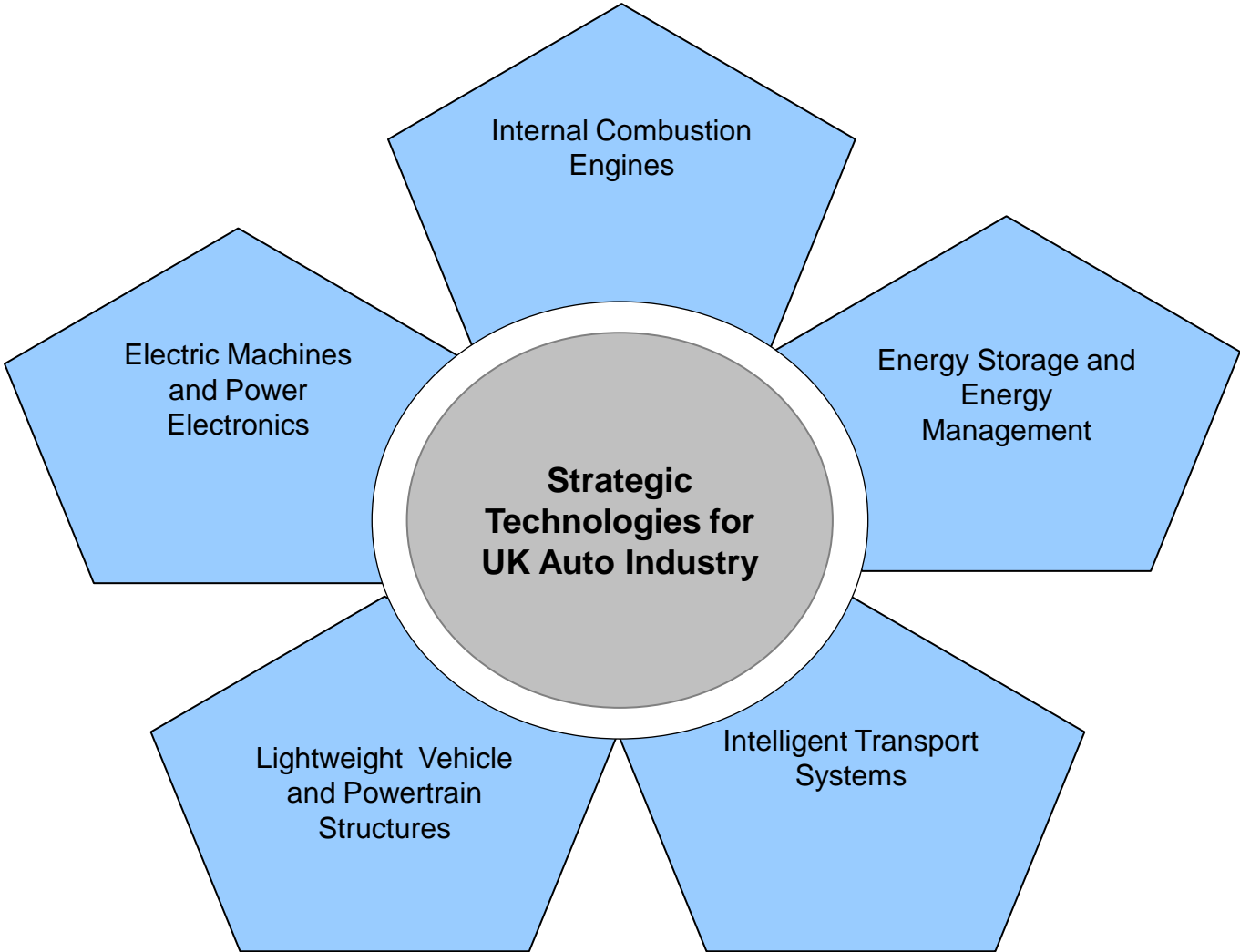
- Capability Review shows how the UK capability aligns with requirements of roadmap
- Allows decisions on funding priorities

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 apps	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	Dark 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 PHEV		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 ₂ storage tech.	Light Blue	Dark Blue	Dark Blue	-	Cost reduction	Alt. H ₂ 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	Dark Blue	Dark Blue	Dark Blue	High effy 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 st gen biofuels	Dark Blue	Dark Blue	Dark Blue	Improved processes	-	-	1
2 nd gen biofuels	Light Blue	Dark Blue	Dark Blue	New 2 nd gen process	Demo 2 nd gen process		3
3 rd gen biofuels	Light Blue	Dark Blue	Dark Blue	-	-	New 3 rd gen processes	3
Electrical infra.	Light Blue	Dark Blue	Dark Blue	Smart metering / charge points	Future charging options (eg fast charge)	Smart grid / energy mix	4
H ₂ infrastructure	Light Blue	Dark Blue	Dark Blue	-	-	H ₂ 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.

UK Research & Development priorities



Collaborative R&D

- UK Government funds specific programmes and research to meet its priorities, mainly delivered through the **Technology Strategy Board (TSB)**, a non Governmental organisation
- **Low Carbon Vehicle Innovation Platform (LCVIP)** launched by TSB in 2007 is designed to deliver our R&D funding on low carbon vehicles.
- LCVIP is running **>110 projects** engaged with **>400 UK companies** and **>£125m public sector investment**
- Collaborative R&D is set through competition, with criteria set jointly with input from industry and Government.
- Industry-led, innovative, collaborative projects must deliver significant carbon reductions compared to existing best-in-class technologies.

Latest activities ...

- **TSB Integrated Delivery Programme 7 (IDP7)**, released in November 2011, aims to strengthen UK capability by encouraging reduction of costs in the supply base and a faster adoption of new technologies on UK roads. **£25m** budget.
- **Low carbon truck demonstration trial** will deliver fleets of low-emission heavy goods vehicles onto UK roads as well as supporting infrastructure such as fuelling stations and electric recharging hubs.

Latest activities ...

- **A Skills Academy for Sustainable Manufacturing and Innovation** has been opened. This will be at the heart of skills and workforce development in the low carbon sector. This £9.8m facility will provide world-leading training to apprentices and people seeking to fill the emerging jobs.
- The TSB is establishing seven **Catapults** (world-leading Technology and Innovation Centres) one of which will develop and deliver world-class expertise in **High Value Manufacturing** necessary to support the automotive sector, whilst another will focus on **Transport Systems**