



HM Government

Department for Transport
Department for Business, Enterprise and Regulatory Reform
Department for Innovation, Universities and Skills

A man in a white shirt and green lanyard is operating a charging station for a red and yellow car. The background is a brick wall. The man is looking down at the charging station, which has a yellow coiled cable. The car is partially visible in the foreground, showing its red and yellow body panels. The overall scene is brightly lit, suggesting an outdoor or well-lit indoor environment.

Ultra-Low Carbon Vehicles in the UK



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The challenge

Our transport system connects people to places and businesses to markets. As such it is fundamental to our economic strength and quality of life. However, the only sustainable future for transport lies in a transformative shift to low carbon. Our ambition must be twofold, to reduce the environmental impact of transport and for UK business to benefit from this transformation.

The internal combustion engine has dominated road transport over the past century. The automotive sector now faces huge changes: an oil crisis last year, a financial crisis this year and a climate change crisis for many years ahead. It is clear that there is an environmental and an economic imperative to do things differently.



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This includes around 74,000 people in vehicle and engine manufacturing, and 106,000 people in the automotive supply chain.

In addition, it is estimated that a further 200,000 people are employed in the supply chain in metal forming, plastics manufacture and other manufacturing industries. We need to ensure that this strength is translated into global leadership in the development and manufacture of ultra-low carbon automotive technology such as hydrogen powered, plug-in hybrid and fully electric vehicles.

This is a big challenge for government. It must send the right signals and provide the right frameworks for business. And it must supply the necessary support to industry and workers to ensure that the market in the UK

¹ ONS ABI 2007 data, Published November 2008



19%

of the UK's domestic CO₂ emissions come from road vehicles

shifts rapidly and decisively to low carbon. The UK is committed to such a transition and will continue to press for a clear long-term regulatory framework at the European level, building on the recently agreed New Car CO₂ regulation, to maintain the momentum for a transformation of the industry (see Box 1).

Box 1: EU Regulation on New Car CO₂

Regulation can play a critical role in the transition to low carbon vehicles by establishing a clear, long term framework for action by industry.

The Government has supported the EU's New Cars CO₂ Regulation, helping to negotiate a solution which will stimulate innovation across all segments of car production, large and small, and which respects the diversity and competitiveness of the industry and markets across Europe.

A stretching target of 130g/km CO₂ by 2015 and 95g/km by 2020 has been set which provides a clear and accelerating trajectory for the deployment of low carbon vehicles and adaptation of new ultra-low carbon technologies. This enables industry to make strategic planning decisions and investments for the future.

The winners will be those companies which respond most effectively with a rapid evolution of new and attractive low and ultra-low carbon products.

Maximising the benefits of the transition to ultra-low carbon vehicles is a prime example of what a more active public policy for equipping UK businesses and workers for a changing global economy means in practice. It involves the public sector acting together to create and further economic opportunities for the private sector, while meeting the needs of society as a whole.

An industry renewed

The transition to a low carbon world will transform our whole economy. Lord Stern's landmark Review in 2006 set out the economic case for action on climate change and for investment in a low carbon economy.

Recognising this imperative, through the Climate Change Act the UK has become the first country in the world to adopt a legally binding target to reduce carbon emissions – by at least 26% by 2020 and 80% by 2050. The UK is taking a global lead by setting Carbon Budgets which will sit along side the financial Budget. Transport will be part of this, with emissions from road vehicles accounting for 19% of the UK's domestic CO₂.

This level of change brings with it opportunity.

In recent years, both the Committee on Climate Change and the King Review of Low Carbon Cars have suggested that a significant decarbonisation of road transport is possible. A wide range of solutions are required (for example through introduction of sustainable biofuels and changes in patterns of mobility), and improvements to existing vehicle technology have a critical role to play.



To achieve this, the way we build and power cars needs to change. In the short term we need improvements to existing technologies – continued advances in the efficiency of internal combustion engines, for example through improved fuel injection systems, light weighting or drag reduction. To achieve the longer-term cuts in carbon emissions, we need the new, cleaner technology that is only now emerging or almost within reach.

We are also acting to decarbonise our electricity generation to maximise the potential for CO₂ reduction from electric and plug-in hybrid vehicles. While electrically powered vehicles will increase demand for power, through smart management of our networks we can minimise the need for new power stations and maximise the benefits these vehicles can bring in the creation of a greener grid. Our early demonstrations of electric vehicles will involve some of the UK's leading power companies so that we can learn how best to manage this transition.



By acting now there is real potential for the UK to take a lead in this sector.



By acting now there is real potential for the UK to take a lead in this sector. While there is a great deal of investment globally in low carbon technologies such as hybrid cars, the market for the next generation of ultra-low carbon cars remains wide open. If UK firms and workers can adapt to the shift in production to

CASE STUDY: Ford EConetic engine – designed and built in the UK



Developed by Ford at the UK's Dunton Research and Engineering Centre and now in production at the wind-powered Dagenham Diesel

Engine Centre in Essex, the range of Duratorq TDCi turbo diesel engines are providing affordable technology solutions for everyday driving. These high technology diesel engines power the most fuel efficient versions of the Ford Fiesta, the Ford Focus and the Ford Mondeo and are the result of a £130m investment programme. EConetic brings leading-edge green technology to mass market applications. The powertrain combines with other developments such as optimised rolling resistance tyres, low friction oil, enhanced aerodynamics and a "green shift" indicator light to deliver best in class CO₂ performance – the Fiesta 1.6l variant achieves 98g CO₂/km whilst the Focus 1.6l achieves 115g CO₂/km. Ford intends to extend the EConetic brand across its full range of vehicles.

ultra-low carbon vehicles, the potential market in the UK and abroad is huge.

The UK automotive industry has reached a consensus as to how this opportunity can be seized and the challenges answered. This co-operation has been fostered through the New Automotive Innovation and Growth Team (NAIGT), which will publish its report in the



coming weeks. In planning for a low carbon future they have agreed a technological roadmap from now to 2050 (see Box 3). The NAIGT will also recommend that government takes ownership and works with the industry to provide strategic direction for the development, production and use of vehicles in the UK.

As a Government we accept there is a role to be played and have made this a core priority. We have already committed around £400 million of support to encourage development and uptake of ultra-low carbon vehicles. Further, the £2.3bn package of support for the automotive sector in the downturn has been tailored to support its long-term future as a world leading low carbon industry.



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This document sets out how we will coordinate public sector activity and work with industry and academia to:

- Build on the R&D activities of the automotive industry to make the UK a leading place in the world to develop, demonstrate and manufacture ultra-low carbon vehicles.
- Accelerate market penetration of ultra-low carbon cars which will contribute materially

to the overall national target on emissions for greenhouse gases and air pollutants.

- Maximise the benefit to UK operating firms and supply chains of this accelerated market penetration and continue to attract inward investment for the development and production of ultra-low carbon vehicles.

Industry, Government and the regions working together can enable the UK to become a world leader in low carbon transport, at the forefront of the development, demonstration, manufacture and use of ultra-low carbon automotive technology.

While there is a clear recognition that technology will continue to evolve, it is also clear that we must ensure that prohibitive costs or a lack of supporting infrastructure do not hold back companies and individuals from making ultra-low carbon cars a part of everyday life.

Box 2: The shift to low carbon vehicles

Short term (next 5 years)

- Incremental improvements to efficiency of new cars.
- Increased take-up of new model hybrids.
- Interested cities and regions developing electric vehicle charging infrastructure solutions to provide a 'core' of electric car cities.
- Gradual emergence of early market ultra-low carbon vehicles.



It may take some years before we see ultra-low carbon cars being used on a large scale but automotive firms are deciding now where to locate their production and are looking for clear government leadership and a potentially strong domestic market. Now is the right time for us to take bold action.

Medium term (5–10 Years)

- Continued improvements to efficiency of new cars.
- Continued take-up of new model hybrids.
- Increased coverage of electric vehicle charging infrastructure enabling wider use of ultra-low carbon vehicles.
- Ultra-low carbon vehicles enter large scale production.

Longer term (10 Years +)

- Combinations of hybrid vehicles, downsized powertrains, and lightweight vehicles become dominant.
- Continued rollout of charging infrastructure.
- Mass market development of ultra-low carbon vehicles leading to significant market penetration.

Ultra-low carbon vehicles in the UK

Our strategy for making the shift to ultra-low carbon vehicles in the UK is based on five goals. These recognise the vital way in which supply and demand for ultra-low carbon vehicles will have to interact in the next few critical years. Government will actively encourage consumer uptake of ultra-low carbon solutions, their development and manufacture here in the UK by:

- Supporting the automotive industry through the downturn for a successful transition to a low carbon future.
- Securing the future competitiveness of the UK industry by enhancing its reputation as a leading location for research, development and demonstration of ultra-low carbon vehicle technology.
- Creating a viable environment to support the adoption of ultra-low carbon vehicles in lead cities and regions, including investment in the skills base.
- Making ultra-low carbon vehicle solutions competitive for consumers by helping to reduce the upfront costs of these vehicles.
- Clear and strategic leadership by Government and a smarter coordination of public sector activity.

Supporting the automotive industry through the downturn

The automotive industry has been hit quickest and hardest of all UK manufacturing



The **£2.3bn**

Automotive Assistance Programme
opened for business on
27 February 2009

sectors by plummeting domestic and global demand. The economic crisis is forcing car manufacturers around the world to restructure and consolidate. Even before the financial crisis, the UK's ability to compete on a 'cost per unit' basis in the automotive sector has been eroded by rising skills bases and improving infrastructure in many of the emerging economies. UK companies must shift from competing on a purely cost basis, to competing on a cost and innovation basis and playing to the strengths of our innovative and dynamic automotive sector.

This combination of factors accelerates the need for a transformation of the automotive industries in the UK and elsewhere. Only by redirecting toward a low carbon foundation and creating a stable investment framework to encourage long-term investment in the UK can there be a viable future for the sector.

The UK Government will assist the industry to access support for this transformation from all available sources. We helped secure the €4bn annual budget for the European Investment Bank's (EIB) new clean transport facility which is particularly targeting the automotive sector, and are supporting UK automotive companies in accessing EIB loans. Nissan and Jaguar Land Rover have already received EIB approval in principle for loans worth more than £500m.

The £2.3bn Automotive Assistance Programme (AAP) opened for business on 27 February after receiving State-Aid clearance and Government continues to promote this programme to core automotive businesses. Over 50 companies have since asked for further information on the programme with a number providing full expressions of interest.

The aim of the AAP is to support automotive companies in the continued delivery of investment that will create or sustain jobs, develop cutting edge technology, bring special economic value, maintain R&D in the UK automotive industry and support the development of green technologies to develop solutions for carbon reduction, all of which have to offer value for money to the taxpayer.

Alongside the launch of the AAP the Government announced that a further £35m of Train to Gain support would be available through the Semta sector compact to meet the automotive industry's specific skills needs. This is an opportunity to reposition the UK workforce at the leading edge of rapidly developing technology.

The Government is investing in science, technology, engineering and maths (STEM) subjects within our universities to provide the higher level skills that the industry needs in the future. The Higher Education Funding Council for England (HEFCE) have undertaken a £250m programme to support subjects that are strategically important and vulnerable, and this includes STEM subjects. Furthermore, recognising the cost of science subjects, from 2007/8, £100m will be invested over four years to maintain provision in science subjects including physics and engineering.

The next generation of researchers and engineers will have the skills to continue the transition to low carbon through the Research Councils' support for doctoral training. Since December the Engineering and Physical Sciences Research Council (EPSRC) has announced over £290m in awards for Doctoral Training Centres and other training, a proportion of which will support sustainable transport objectives.



When we publish our Low Carbon Industrial Strategy this summer we will set out the wider actions we will take across the skills system to support innovation in lead cities and regions and deliver a successful transition to a low carbon economy.

Making the UK a world leader in research, development and demonstration of ultra-low carbon vehicles

There are still huge technological challenges to meet in the transition to low and ultra-low carbon vehicles. The UK's automotive sector has a global reputation for research and development, design engineering and manufacturing².

We can also draw on a world-class science and research base and a superb reputation for innovation. We've already established two independent centres of excellence in the areas of low carbon technologies/fuel cells (CENEX) and Intelligent Transport Systems (innovITS).

Furthermore, the Technology Strategy Board's Low Carbon Vehicles Innovation Platform, worth over £120m, brings together funding from the Technology Strategy Board, Department for Transport, Advantage West Midlands, One North East and the EPSRC, with a view to:

- Accelerating industry investment in low carbon vehicle commercialisation.
- Building new partnerships to address technical challenges including between

CASE STUDY: ZyteK – globally leading, innovative SME



ZyteK is now one of the few companies worldwide producing electric vehicle powertrains, and the only one manufacturing vehicles (the Smart

Fortwo ED) for a major car manufacturer, Mercedes Benz. The ZyteK electric engine is a complex assembly of many high technology products tightly packaged into a single unit. This technology is also being applied into Motorsport – ZyteK is developing a hybrid electric drive for a leading Formula One team that has already run competitively in the 2009 season.

academia, innovative SMEs, mid size companies and large original equipment manufacturers, to address technical challenges.

- Increasing the UK-sourced products offered to the market as a result of that research, development and demonstration (R, D & D) investment and the introduction of new UK participants in the supply chain, and
- Delivering benefit to UK Gross Value Added (GVA) and to the UK's contribution to the achievement of national and international CO₂ emissions reduction targets.

² Investigation into the Scope for the Transport Sector to Switch to Electric Vehicles and Plug-in Hybrid Vehicles, CENEX, Arup, October 2008



Up to **£20M**

to support the development of lead cities and regions, bringing together consortia of cities and companies to start the processes of building infrastructure



Internationally leading numbers of ultra-low carbon vehicles on UK roads, driven by real consumers.



Projects to be funded within the Technology Strategy Board's recent £10m competition, under this platform, for the development of enabling system and sub-system technologies will seek to deliver more efficient, cost effective ultra-low carbon vehicles for mass market applications. Some of the technologies developed for electric and plug-in hybrid cars could also filter through to conventional cars.

A further R&D competition under the Innovation Platform will open in June, to reinforce the development of the supply chain for these new vehicles. This will build on the enabling system and sub-system technologies competition, which demonstrated the breadth and capability of UK companies, but have a wider remit and will build up the capabilities of companies of all size in this area.

We are signalling the strength of our intent by ensuring that there are ground-breaking numbers of ultra-low carbon demonstrator cars on the road in the UK. To do this Government will capitalise on the immediate opportunities for supporting research, development and demonstration through the:

- Immediate scaling up of the Technology Strategy Board's ultra-low carbon vehicle demonstration competition, more than doubling the planned 100 vehicles, most of which will be on the road within the next 18 months. This will put the UK at the global forefront, with internationally leading numbers of ultra-low carbon

vehicles on UK roads, driven by real consumers. This competition has proved highly successful and the scaling up of the number of demonstrator vehicles is a direct result of the number and quality of the bids received. The competition has demonstrated the depth and level of expertise in the UK and has attracted significant international interest.

- Showing public sector leadership in our procurement decisions to help demonstrate the potential of electric and low carbon vehicles, for example through the DfT's £20 million Low Carbon Vehicle Procurement Programme, which currently focuses on vans. We plan to announce the winning companies in May.

Creating a viable environment to support the adoption of alternatively fuelled ultra-low carbon vehicles in lead cities and regions

Beyond demonstration, there are considerable challenges that will have to be met before the scale of deployment of ultra-low carbon vehicles on the UK's roads can increase dramatically. Key to these is the need to ensure that the initial infrastructure that is required to make ultra-low carbon vehicles viable is in place. This will allow economies of scale to reduce the costs of new technologies.

Reduce the price of electric and plug-in hybrid cars by around

£2000-£5000

for consumers



CASE STUDY: Elektromotive – electric vehicle charging stations

Elektromotive is a UK based company founded five years ago that specialises in the research, design and manufacture of electric vehicle charging stations. Its “Elektrobay” recharging station has been successfully trialled in London by Westminster City Council since December 2006. By the end of May 2009 Elektromotive will have 100 charging stations operating in London and a further 68 around the UK. Elektromotive also have Elektrobays operating in Sweden, Holland and Germany and are working on projects in Ireland, Spain and the Middle East. Their new 3 Phase Dual Elektrobay is due to be launched in May 2009.

As part of doing this Government is committed to supporting the development of lead cities and regions, bringing together consortia of cities and companies to start the processes of building infrastructure and increasing consumer confidence, thus growing the market for ultra-low carbon cars. This will take the number of ultra-low carbon vehicles on the roads from the hundreds to the thousands.

- To support those who are ready to meet this challenge we will provide access to seed money worth up to a total of £20m to those consortia committed to establishing themselves at the heart of this market in the UK.

The aim is to ensure the development of a network of electric vehicle infrastructure

across the UK that will lead to the linking of cities and regions. Central government will take an overall lead in the development of this programme, drawing on the work of the Energy Technologies Institute and pioneering local authorities, like the City of Westminster, in this area. Although government has a role in helping support the minimum infrastructure to make the transition to ultra-low carbon vehicles viable, we expect that the private sector, either in the form of electricity suppliers and distributors or other third parties, will ultimately take the lead in infrastructure provision.

Making ultra-low carbon vehicle solutions competitive for consumers

Consumers have not yet had the opportunity to see many ultra-low carbon cars on the roads. Mass market electric and plug-in hybrid cars are not yet available in significant numbers and the first of these to market will be more expensive than their conventional counterparts.

- The majority of the £250m recently announced by the DfT will be used to create a scheme to reduce the price of electric and plug-in hybrid cars by around £2000-£5000. We will begin discussions with the automotive and finance industries on how this reduction can best be delivered and coupled with the existing benefits for low emissions cars, such as exemptions from Vehicle Excise Duty. We aim to make these cars an attractive choice for consumers.
- Eligible cars will need to meet strict safety standards, not exceed a maximum CO₂



ceiling and be designed for the mass market. We will work closely with our key stakeholders in the coming months to agree the parameters of the scheme and the appropriate delivery mechanism. The scheme is likely to be operational in 2011 and more details will be announced later in the year.

Clear and strategic leadership and coordination across Government and beyond Whitehall

The development of a strong ultra-low carbon vehicle market in the UK will require a coordinated and strategic focus to Government activity. This fast paced agenda cuts across departmental responsibilities and activities and through all levels of government.

This revolution in road transport envisioned by Government and others will require new ways of working together. The NAIGT have agreed a research and development roadmap to 2050 which if met would provide the technologies for this vision, recognising the need for flexibility as innovations come to market (see Box 3).

Over this period government, cities, utilities, the automotive industry, consumers and infrastructure providers will need to work together to increase the number of ultra-low carbon vehicles on our roads.

CASE STUDY: International Conference of Electric Vehicle Experts



Last October the UK hosted an international meeting of experts on low carbon cars to explore the challenge of bringing electric cars to market.

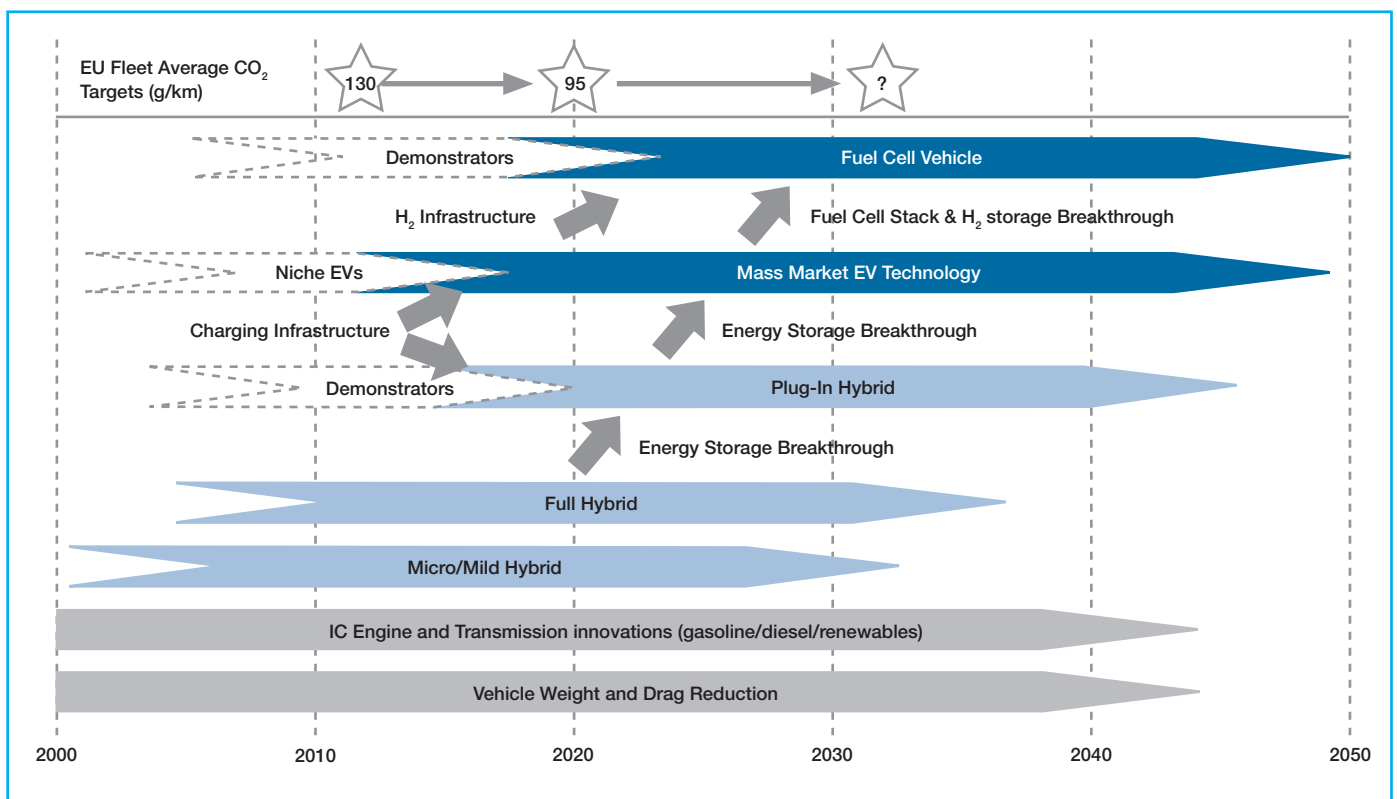
Some 140 delegates from more than 15 countries representing government, industry, the automotive research community and academia attended. This event has firmly established the UK as a leading player in the work on low carbon cars.

As this collaborative activity intensifies, global suppliers and manufacturers will be drawn to the UK as the leading location to trial and develop vehicles and technologies. This point of critical mass will establish 'Test bed UK', the NAIGT's concept of how the UK can nurture a dynamic and growing ultra-low carbon automotive industry in a competitive global market.

Delivery is key. Business has said clearly that we need to be better at providing a co-ordinated and strategic focus to Government activity and this is one of the recommendations of the NAIGT report. We have heard this message and taken it seriously. The Low Carbon Industrial Strategy will respond with an answer in the summer.



Box 3: High-level technology roadmap for the UK's decarbonisation of road transport



The future

The Government's aim is for the UK to be a world-leader in ultra-low carbon vehicles. We will do this by backing industry to develop the best technological solutions, and cities and regions to partner industry in creating the initial infrastructure that will make them viable. It will also help consumers make the choice to make the transition to green transport.

Our demonstration projects will put hundreds of ultra-low carbon vehicles on the UK's

roads over the next year. We expect vehicle numbers to rise to the thousands in the early part of the next decade, with ultra-low carbon cars being a common sight on our roads by the end of the decade. Over the longer term these vehicles have the potential to provide the dominant form of road passenger transport as we move to a radically lower carbon transport system.



The next five years for consumers

2009 and 2010 will see:

- The Government put cutting-edge demonstration cars on the road in a combination of high-profile fleets and general usage. These will prove the concept, and demonstrate the potential of these cars in real-world settings.

2010 to 2012 will see:

- A small number of urban centres emerging as the UK's electric car cities.
- Help from government that will make ultra-low carbon cars cheaper by in the region of £2000 - £5000 per vehicle.

2012 onwards will see:

- Electric and plug-in hybrid cars will become increasingly common in the UK's electric car cities and will begin appearing elsewhere. These cars will be easy and fun to drive. Refuelling them and paying to refuel them will become an increasingly straightforward part of life for their drivers.

The next five years for industry

2009 and 2010 will see:

- Publication of the complete NAIGT analysis on how the UK will position itself to attract investment in for research and manufacturing of ultra-low carbon vehicles.

- Government showing leadership by committing to incentives for low carbon transport.
- Government creating an extensive demonstration network in the UK and expanding it to make the UK the most visible place on the map for trials of ultra-low carbon prototypes.

2010 to 2012 will see

- The UK established as an attractive location for investment through a structured approach to demonstration and R&D.
- The emergence of locations in the UK for new markets.
- Consumer incentives in place to stimulate demand.
- Industry bringing models to market, moving to mass production, and lowering the costs of core technologies such as batteries.

2012 onwards will see:

- Critical mass in selected locations developed from coordinated action of the automotive industry, infrastructure and energy providers and cities.
- Better understanding of the business models that work here in the UK.



www.hmg.gov.uk/lowcarbon

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