

Electrification of Transport

UK – Oxfordshire – Oxford Brookes

Professor Allan Hutchinson
Head, Sustainable Vehicle Engineering Centre

POWER Meeting, Oxford, October 2010

Outline

- Oxford Brookes University and the Sustainable Vehicle Engineering Centre
- UK activities and government stimulation
- MINI E project
- E-Mobility project outputs
- Oxfordshire EV consortium and electrification of Oxford
- Forward look – Oxford Brookes University

Oxford Brookes University

- 8 Academic Schools (**Technology**, Arts & Humanities, Built Environment, Business School, Health & Social Care, Life Sciences, Social Science & Law, Westminster Institute)
- 18,000 students (42 % M, 58 % F)
- Three main campuses
- Best Modern University for well over a decade Times News Paper League Tables (1996 – 2010)



School of Technology

- **Subject areas in the School**
 - **Mechanical, Automotive and Motorsport Engineering**
 - **Mathematical and Statistical Sciences**
 - **Communications (Sound, Media, Telecoms...)**
 - **Computing**
- **1,600 FTE students and 100 members of staff**



Formula Student Competition



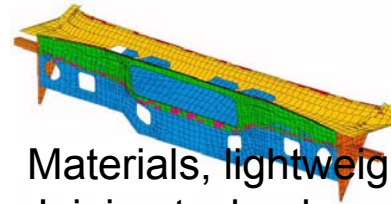
Principal Research Groups - Engineering

Sustainable Vehicle Engineering
Centre (SVEC)

Advanced Vehicle Engineering
(AVE)

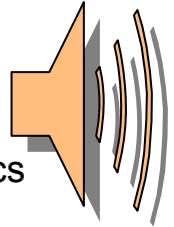
Stress Materials Analysis Research
and Testing (SMART)

Joining Technology Research
Centre (JTRC)



Materials, lightweighting and
Joining technology

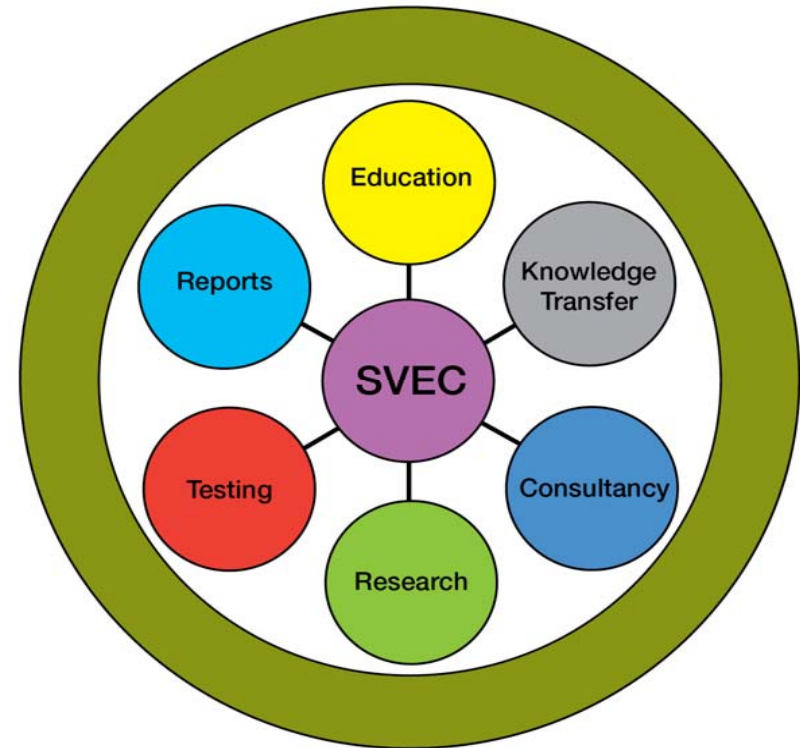
Dynamics &
Auto Acoustics



More efficient engines, powertrain
Engine emissions

The Sustainable Vehicle Engineering Centre

- Forecasting, strategy, business models and implications of legislation
- Life cycle analysis and end-of-life
- Sustainable technologies
- **EV introduction and e-mobility research**
- **Infrastructure, personal mobility and transport**



www.brookes.ac.uk/go/svec

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 - ▶ Advanced Vehicle Engineering Group
 - ▶ Faraday Advance and the Materials KTN
 - ▶ Thin-Walled Structures Group
 - ▶ SMART Group
 - ▶ Joining Technology Research Centre
 - ▶ Sustainable Vehicle Engineering Centre
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 - ▶ Reports
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Whole Life Vehicle Conference 2009



Sustainable Vehicle Engineering Centre (SVEC) ran a very successful Whole Life Vehicle Conference on 18 and 19 November, at Turweston Aerodrome, Silverstone, to examine the sustainability of the automotive industry.



The conference attracted around 100 participants who were treated to 28 high quality presentations from the government, world-leading designers, engineers and automotive experts. Quentin Willson attended the first day of the conference

Latest News

Your opinion matters - The National Student Survey 2010 (Feb 25, 2010)

[More News ...](#)

Coming Events

Mar 06, 2010: 6 March 2010 - School Open Day

Apr 13, 2010: 13 April 2010 - Eco Lunch

Apr 13, 2010: 13 April 2010 - Sustainable Vehicle Engineering Centre - Workshop Event

Jun 15, 2010: One Day Research Conference

[More Events ...](#)

Follow-up Workshop at Oxford Brookes University on 13 April 2010

EV Introduction and e-Mobility Research

- Electric vehicle project – MINI E
- NEW EV Group
- Intelligent Transport Systems Doctoral Training programme and HMI
- LCA batteries, power electronics and motors (PhD)
- EV user expectation and experience studies in UK covering **all** TSB Phase 1 vehicle trials
- EU POWER E-mobility project – regional business models
- Fleet manager and DRIVEGreen courses
- Education – U/G and P/G
 - energy, sustainability, personal mobility, green campus curriculum
 - cross-university
 - potential e-bikes and e-scooters
 - schools – low carbon future

The Goals -

UK Climate Change Bill	EU Climate and Energy Package	
• A redu emis • At redu emis emissions by 2050	to: duction in use Gas by 2008- 12	

Through the Climate Change Act 2008, the UK has signed up to achieving legally binding reductions in GHG emissions by 80% by 2050!

The Challenge –

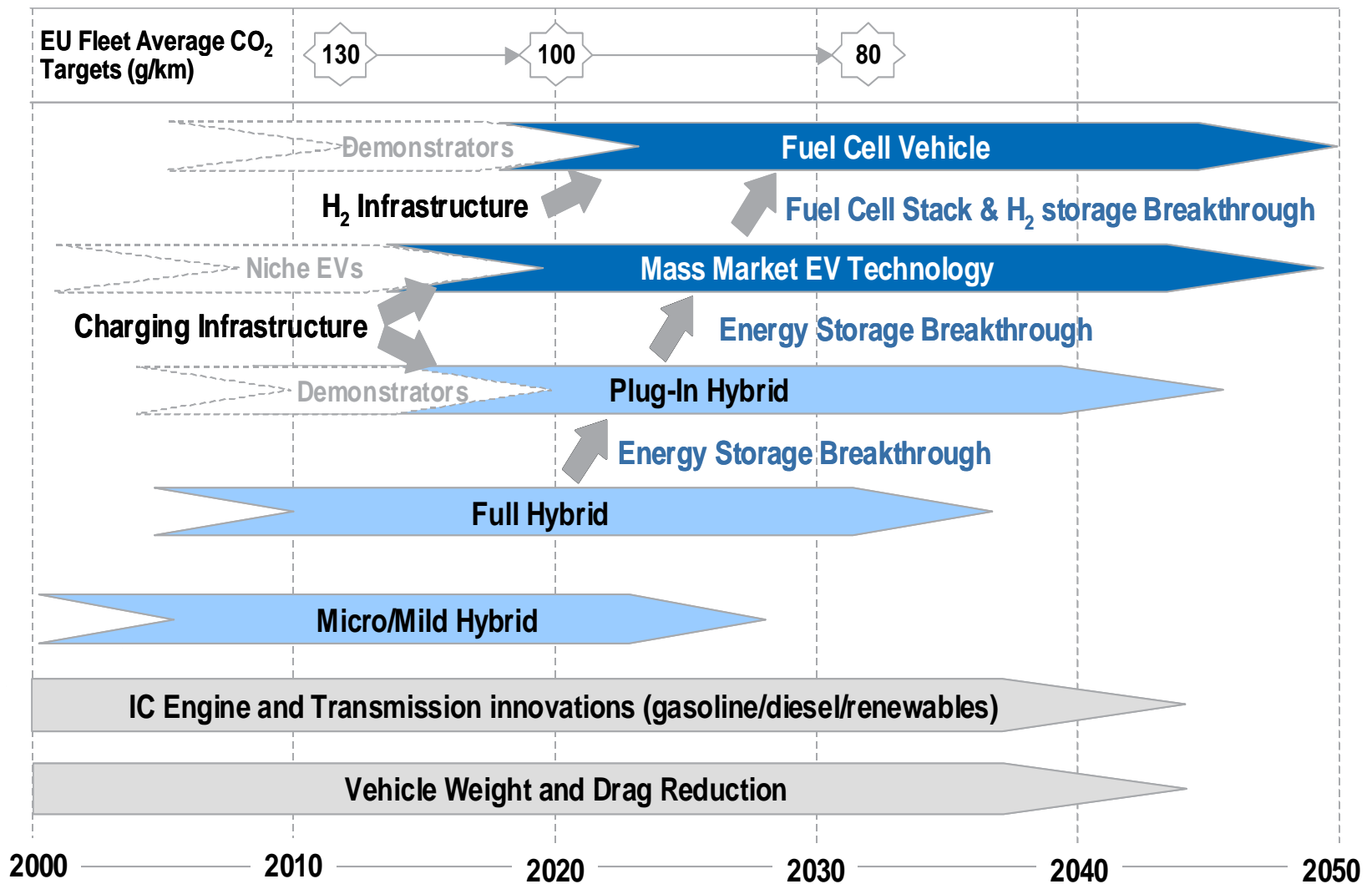
- Road transport accounts for 22% of UK domestic carbon dioxide emissions
- The transportation sector is almost totally dominated by liquid fossil fuel

UK Government initiatives

Test Bed UK

- Establishment of Automotive Council
- Vehicle trials in demonstrator projects, eg MINI E, and publication of results
- High level conferences organised by Cenex
- Electrification of selected 'J' cities – infrastructure, cars, scooters, bicycles, buses, car clubs, inter-modality of transport
- Developing the 'hearts and minds'
- Electric car grants to stimulate the markets

The Consensus Product Roadmap



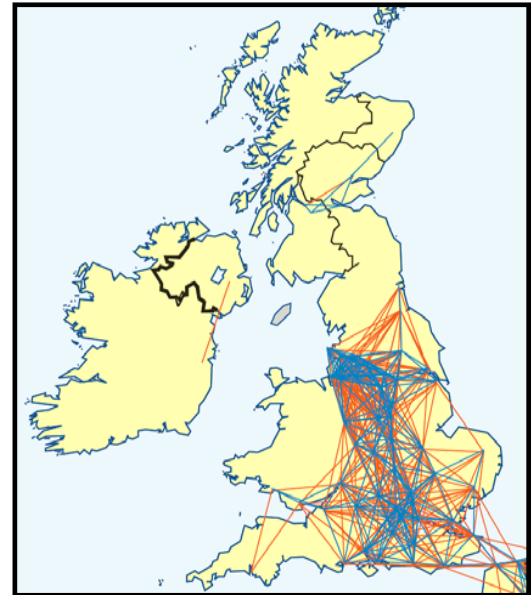


'Test Bed UK' (The auto view)

A Link and Node approach, rolling out new technology into vehicle and infrastructure sales

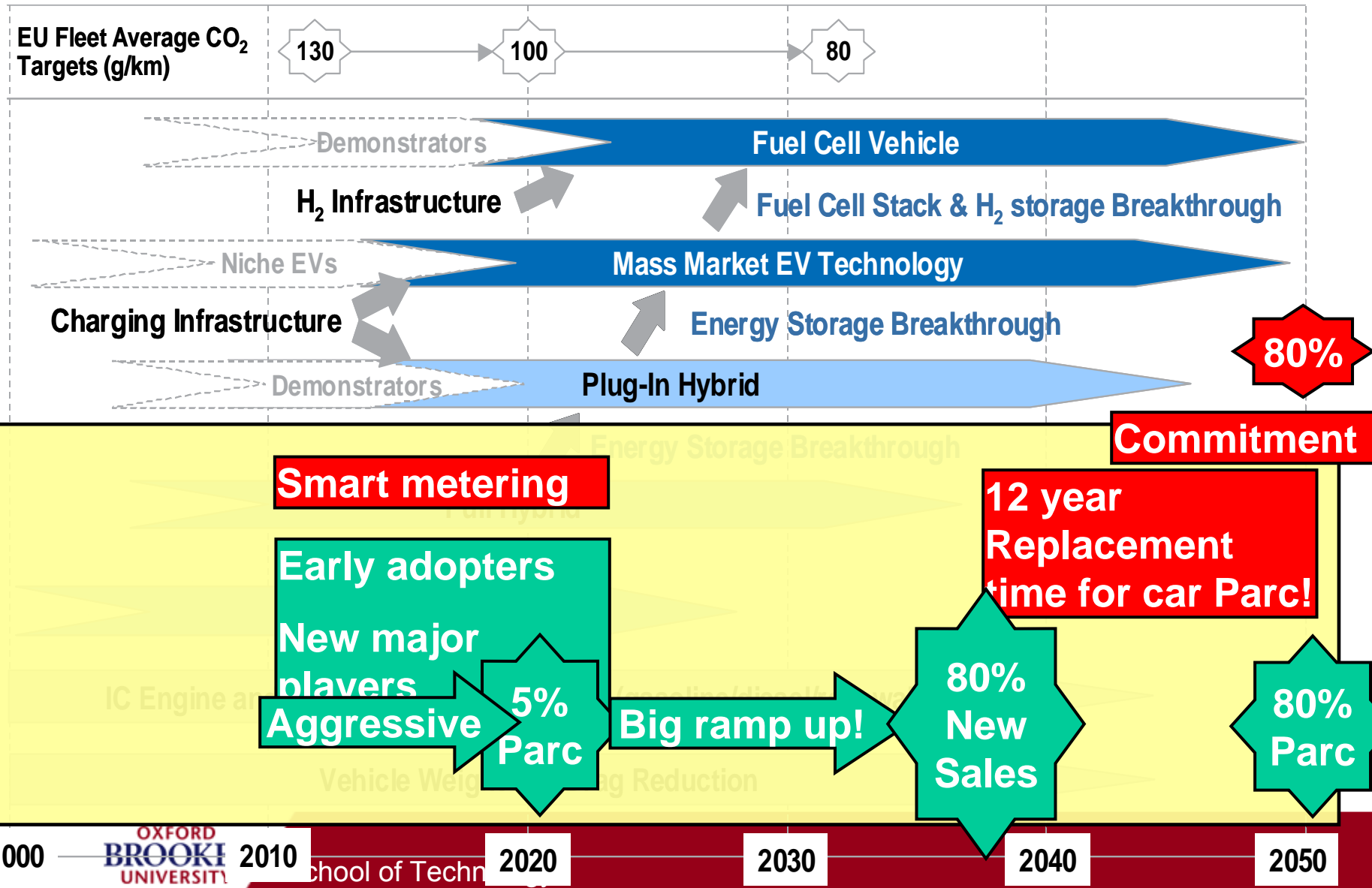
- To create a formal partnership mechanism between regulators, industry and consumers
- Assist OEM's, technology-driven SME's and research establishments demonstrate their expertise in LCV to UK
- Promoted UK plc to a wider worldwide audience
- Understand and develop the infrastructure and societal issues
- Provide a compelling reason for 1st and 2nd tier suppliers to be in the UK

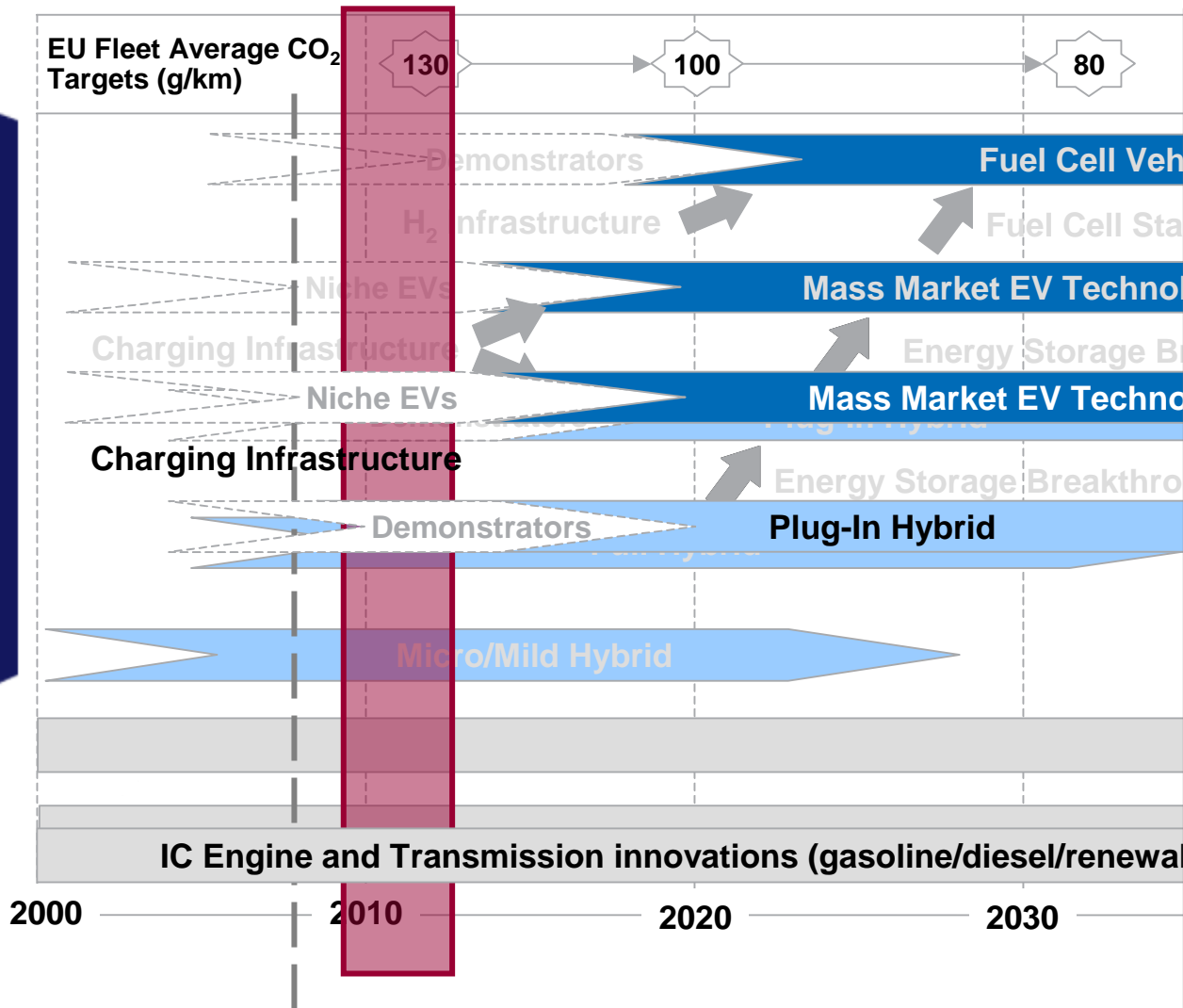
Distance between centres of urban areas



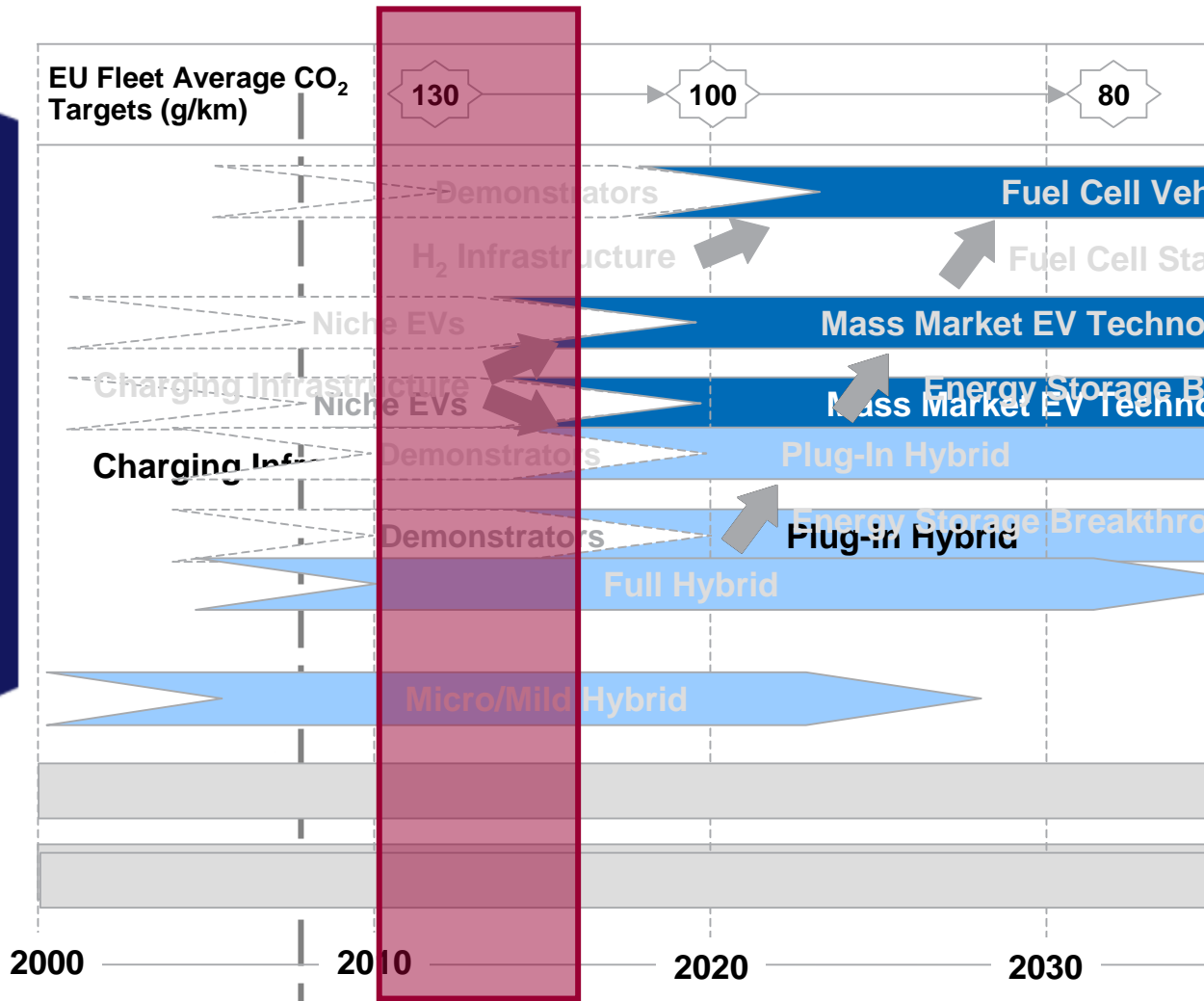
UK Demographics and OEM diversity provide a compelling reason for Test Bed UK

Why is urgent action required now?

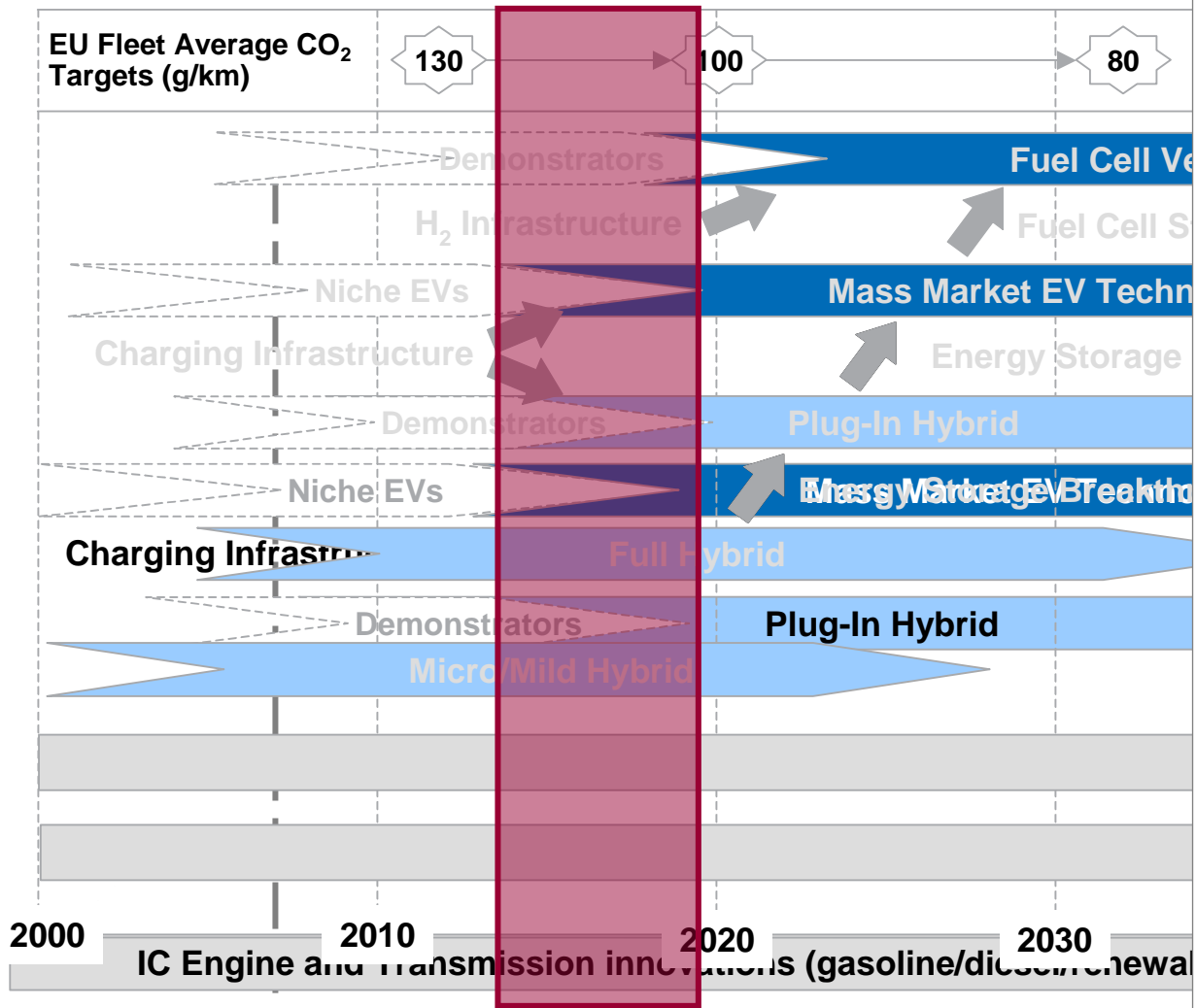




- TSB trial of ~340 EV's and PHEV's to develop an understanding of vehicles in field trials
- Multiple cars within the trial option



- Major scale trial of ~4000 vehicles in 'J-Cities working with auto council, energy providers, central and regional government
- Potentially controlled by ETI but as part of their demonstration project
- Identify solutions for Infrastructure, Payment methods, Ownership models

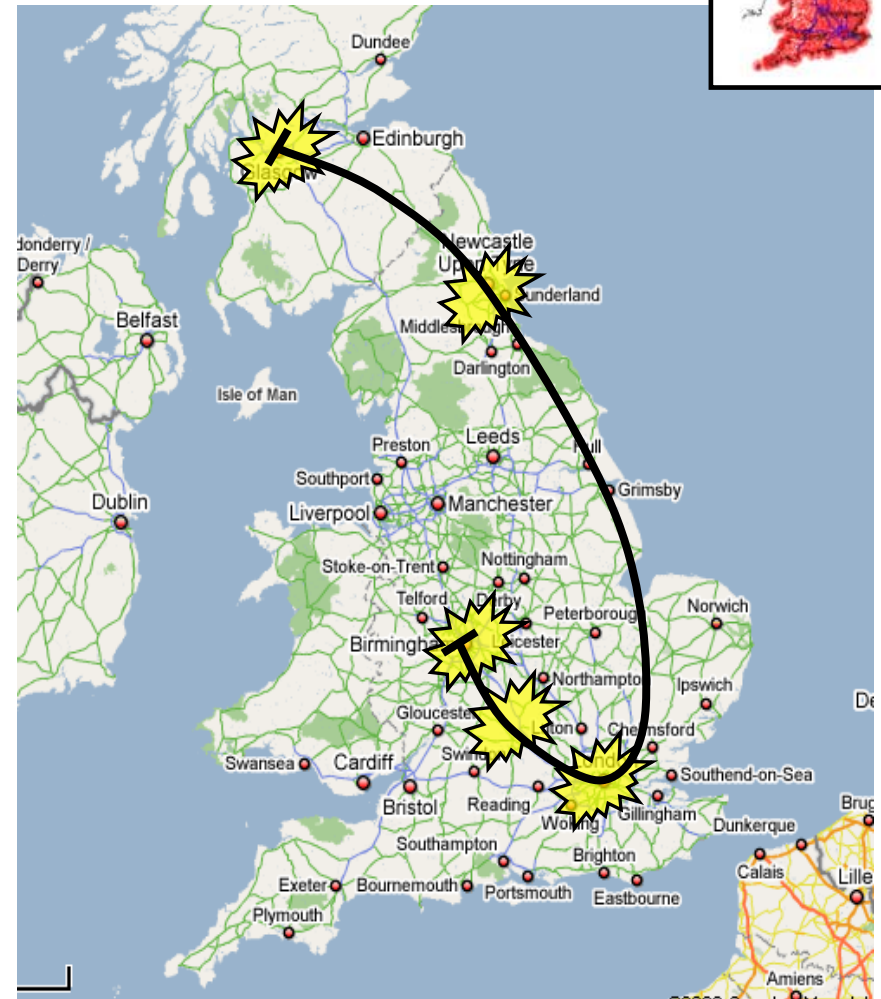


- General understanding from formal trials and chaos approach to rollout of EoT
- Financial model created based around agreed technologies, infrastructure scaling, and projected volumes based on public acceptance
- Potential Public Private Partnership drives whole project forward?



The Leading 'J' Cities group

- Links two of the main primary arteries – the Orange rollout model
- Passes through many of the key VM's and centers of excellence for EoT



Plugged-in places

The first UK cities to receive government grants to develop an electric infrastructure and to promote e-mobility early in 2010 are:

- London
- Milton Keynes
- Newcastle

The second round of applications is due at the end of October. Some 12 to 18 applications are expected, including one from Oxford.



MINI E Project UK

Technology Strategy Board
Low Carbon Vehicle Innovation
Platform

BMW Group



**OXFORD
BROOKES
UNIVERSITY**



Demonstration and learning projects.

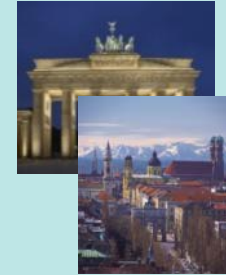
MINI E: Large-scale field trials in the United States, Germany and United Kingdom.

United Kingdom



- TSB grant
- Integration of private users
- Cooperation with Scottish & Southern Energy

Germany, Berlin / Munich



- Vattenfall Europe AG
- Funding through ministry for environment
- Open application process
- Smaller demonstration project with E.on in Munich

USA, Los Angeles / New York



- East and West Coast
- One-year lease program
- Open application process

MINI E Project UK Project Parameters

40 MINI E for a field trial (2 x 6 months): private, public sector and corporate fleet drivers

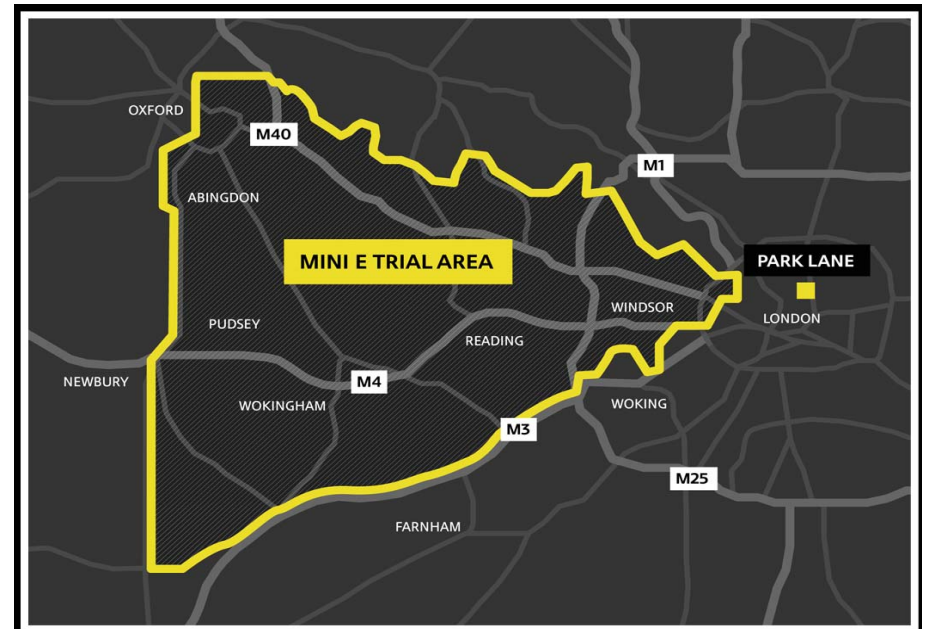
Selection of about half of the test users through an open public application process

Location of field trial in Oxford and the South East

Public and private charging points

Quantitative vehicle and energy data

Qualitative user data



Research role of Oxford Brookes University

FIELD TRIALS: Methodology, collection and analysis of data

- Development of methodology
- Selection of vehicle users (two separate 40-driver selections for two 6-month periods, for 'fleet' and 'private' users)
- Evaluation of questionnaires, diary, interviews (driver responses)
- Focus groups
- Analysis of electronic data collected from on-board vehicle data-loggers
- Compilation of user information studies

BUSINESS MODELS

- Development of future scenarios using inputs from field trials, forecasting models and knowledge
- Generation and evaluation of potential future business models for e-mobility (UK, mainland Europe)

Results summary from Phase 1

Results	Implications
<p>Expectations: Users don't expect an EV to have the same characteristics as a conventional car. However, the majority of users expect an EV to fulfill their daily mobility needs.</p>	<ul style="list-style-type: none">- The challenge is not to develop an EV to fulfill all the requirements of a conventional car, but to capitalize on the unique advantages of an EV. EVs are seen as a solution for a certain range of applications.
<p>User behavior: The features of the MINI E allow even today nearly the same daily behavior as with a conventional car. But a successful learning process needs to take place by every user.</p> <p>Users do not accept unpredictable temperature related variations in range, but range is still sufficient in almost all cases. A few situations need a different solution.</p>	<ul style="list-style-type: none">- Even today an EV is a suitable solution for a major range of mobility. The few exceptions can be solved.- The challenge is not to develop an EV to fulfill all the requirements of a conventional car, but to capitalize on the unique advantages of an EV.- Technical solutions must guarantee stable vehicle characteristics throughout all driving conditions.- EVs are seen as a solution for a certain range of applications; users need a learning process to discover those.
<p>Charging and infrastructure: Actual charging times are not an issue. For today a wide range of normal mobility needs could be solved without a public charging infrastructure, but users like the option.</p>	<ul style="list-style-type: none">- Home charging is sufficient to enable vehicle roll out. Strategic partnerships in public infrastructure can increase the value of an EV fleet.

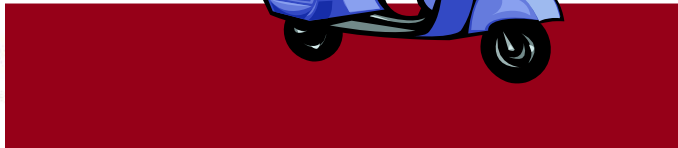
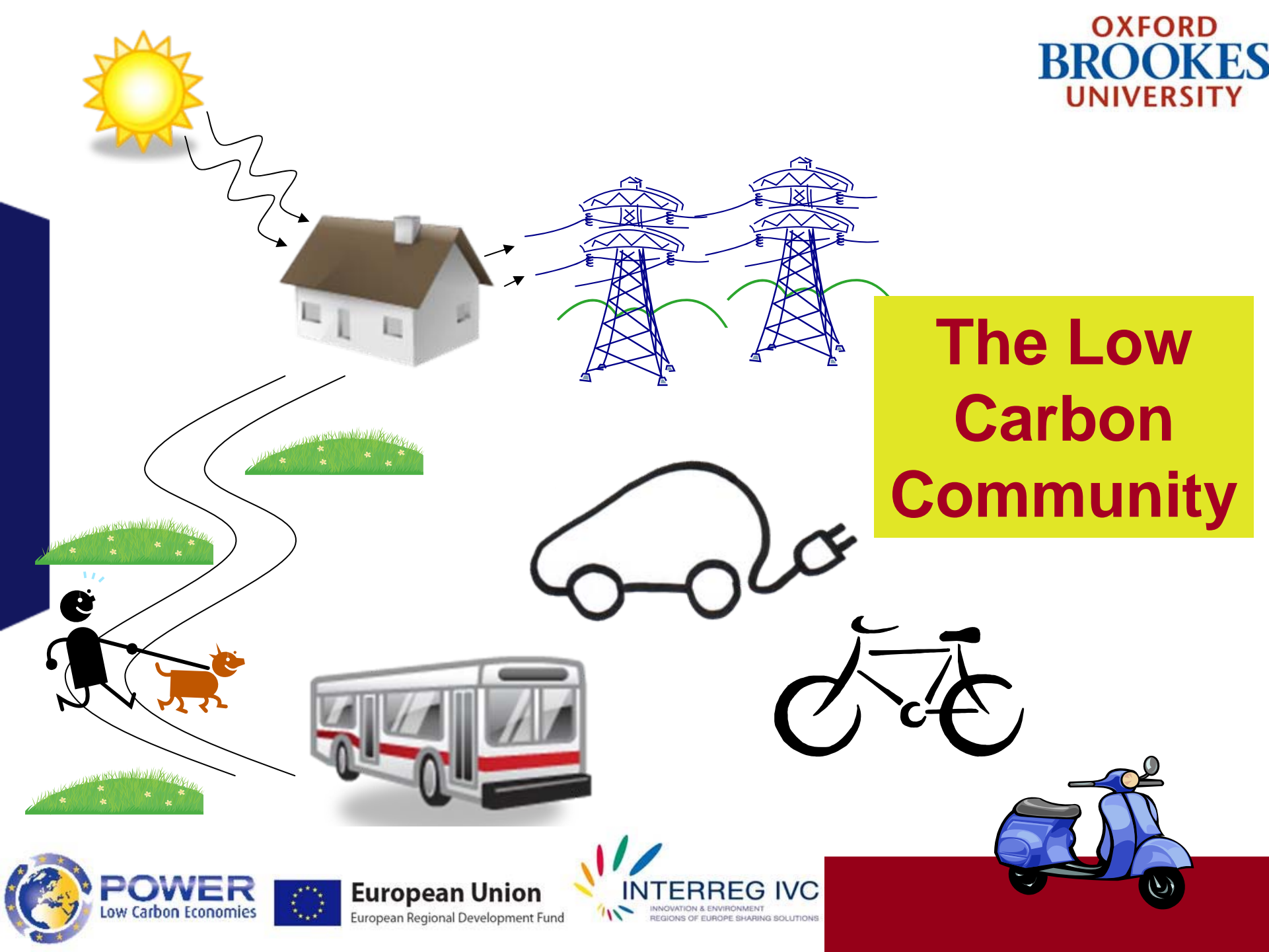
E-Mobility Regional Workshop in Oxford

Matthias Weller
Ed Gibbs
Tim Armitage
David Waller
Janet Borgers
Harry Cho
Rebecca Koenigsberg-Miles
Stephen Potter
Roger Pittman
Ed Bower
Helen Roby
David Farr
John Copley
Richard Bruges
Rosie Albinson
Liz Vasey
Andre Bozon
Andrew Bennett
Council
Allan Hutchinson
Pat Winfield
Shaun Savage
Jim Campbell
Roz Smith

AVL Powertrain
Frost & Sullivan
Arup
Oxfordshire County Council
SEEDA
AVL Powertrain
Delta Motorsport
Open University
Oxford City Council
Ricardo
Open University
Scottish & Southern Energy
Oxford City Council
Unipart
BP
Consultant
Consultant, ex-Honda
Science & Technology Facilities
Oxford Brookes University
Oxford Brookes University
Oxford Brookes University
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Oxford Brookes University



The Low Carbon Community



Oxfordshire EV Consortium meeting

Monday 4 October 2010, Oxford

- Oxford Conference Centre
- 125 attendees!
- Speeches by Deputy Leader of the County Council and Leader of the City Council
- Presentations by Government's Office of Low Emission Vehicles (OLEV) and Oxford Brookes University
- Focus on the business community to seek investment
- Very positive reactions from attendees

Aims

- Move from government push to business pull
- Stimulate inward investment in local businesses



Key elements of Oxford PIP bid

“Clean Air Future Environment” (CAFÉ)

Measures to reduce pollution:

- Promote use of EVs with OLEV car grant through parking and free electric
- Trials of zero emission buses, taxis and scooters
- Parking incentives for EVs at Park and Ride sites
- Link electric bicycle hire scheme with Park and Ride sites, station, etc

Measures to reduce congestion:

- Extended hybrid bus route from population centres to Park and Ride sites
- Charging infrastructure in new eco town
- Active travel system for electric transport
- Encourage modal shift to e-bikes and e-scooters through use of bus lanes and dedicated parking and rental schemes

Forward look

Infrastructure, Personal Mobility and Transport

Public attitudes

- Motivations for early adopters and buyers of new products

Planning of e-cities such as Oxford

- Infrastructure integration, PIP bid
- Charging points – Park&Ride, supermarkets, stations, car parks, roadside meters
- Car clubs
- Business opportunities/inward investment
- Incentives and local measures

Cross-disciplinary working within the University and with external stakeholders and Councils

Thank you for listening

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