Demonstration Project Updates

- Strategies for market transformation

Introduction to Cenex

Presentation to the International Partnership for a Hydrogen Economy

Robert Evans, CEO, Cenex

29th March 2006

Scope of Presentation

- Introduction to Cenex
- Approach Cenex will employ as a support agency for hydrogen and fuel cell projects
  - Knowledge Transfer Network
  - Brokerage for Public Technology Procurement
- Conclusions

Background to Cenex

- Cenex is the UK's national Centre of Excellence for Low Carbon and Fuel Cell Technologies

- Cenex is a public-private partnership focused on the challenge of ensuring UK industry competitiveness in low carbon and fuel cell technologies
    - The future design of vehicles will be significantly influenced by need to lower carbon emissions to cut fuel usage and tackle climate change
    - UK companies need to leverage the opportunities offered by low carbon & fuel cell technologies to sustain a competitive position in the global motor industry

Ownership

- Ownership designed to reflect UK industry interests in low carbon and fuel cell technologies
  - Government sponsor
    - Department of Trade & Industry
  - Industry members
    - Air Products
    - Caterpillar
    - Intelligent Energy
    - Johnson Matthey
    - Millbrook
    - MIRA
    - Ricardo
    - TRW Conekt
  - Representative Organisations
    - Low Carbon Vehicle Partnership
    - Society of Motor Manufacturers and Traders
    - UK Petroleum Industries Association

Low Carbon & Fuel Cell Technologies

- Low carbon technologies
  - Light-weight materials for vehicle weight reduction
  - Advanced internal combustion engine technology
  - Electric and hybrid-electric powertrains and energy efficient drivelines
  - Alternative fuel combustion systems for bio-fuels and hydrogen

- Fuel cells and related systems

Cenex Aims

- To undertake technology mapping to communicate technology and market trends
- To mobilise an effective UK – located supply chain
- To influence the creation and deployment of fleet-scale demonstrators
- To facilitate affordable market entry by brokering public and private sector procurement
- To showcase UK competence and be a focal point for projects requiring international co-operation

Strategic Approach

- To ‘bring together’ UK expertise to promote innovation in low carbon and fuel cell technologies
  - though enhanced knowledge transfer and know-how
    - Establish and manage a Knowledge Transfer Network (KTN) for low carbon and fuel cell technologies
    - Enhance industry know-how through supporting technology demonstration (& replication) progressing to commercialisation
  - through public and private sector investment
    - via UK supply chain to generate technology supply push
    - via public procurement of low carbon & fuel cell vehicles to generate demand pull

Low Carbon and Fuel Cell Technology
Knowledge Transfer Network

Low Carbon and Fuel Cell KTN

cenex

- Cenex working with Fuel Cell Today, Fuel Cells UK and SMMT Foresight Vehicle to develop and implement a Low Carbon and Fuel Cell Technology Knowledge Transfer Network (KTN)
- The KTN combines
  - Web portal will provide hydrogen, fuel cell and other low carbon content
    - technology, market and policy-related content
    - communicated via news, reports, links, roadmaps, benchmarking, etc
  - Community events (actual and on-line) focused on networking within and between communities to promote knowledge transfer and innovation

Low Carbon

dti

Knowledge Transfer Network

Hot Topics

Infinitely variable transmission

Fuel Cells

Fuel-tolerant engine

Biofuels

Low Carbon & Fuel Cells Portal

Welcome to the Low Carbon KTN

Low carbon technologies could change the future of our planet. But without proper guidance and links the bright ideas from industry and academia won't form products which we can use everyday. The Low Carbon KTN is here to change this,

The KTN, together with Cenex, will act as a national network connecting organisations, including technology providers and potential consumers, universities, research organisations, investors and others to form communities interested in exploiting the potential of low carbon and fuel cell technologies.

The cost of oil-derived fuels is rising, and as the demand for energy depletes oil reserves, this trend is likely to increase. Coupled with the need to reduce CO2 emissions which is providing a significant stimulus to improve engine efficiency, there will be pressures to move towards low- or neutral- carbon fuels such as bio-diesel and hydrogen. New fuels, vehicle systems and supply infrastructure need development in parallel, and a number of competing solutions are likely.

Fuel cell and other new energy drive systems require parallel development of the electric and electronic systems for energy storage, engine management and control, power generation, conversion and transmission.

News

23 March 2006
ITS World Congress 2006 - UK Steering Group Newsletter March 06

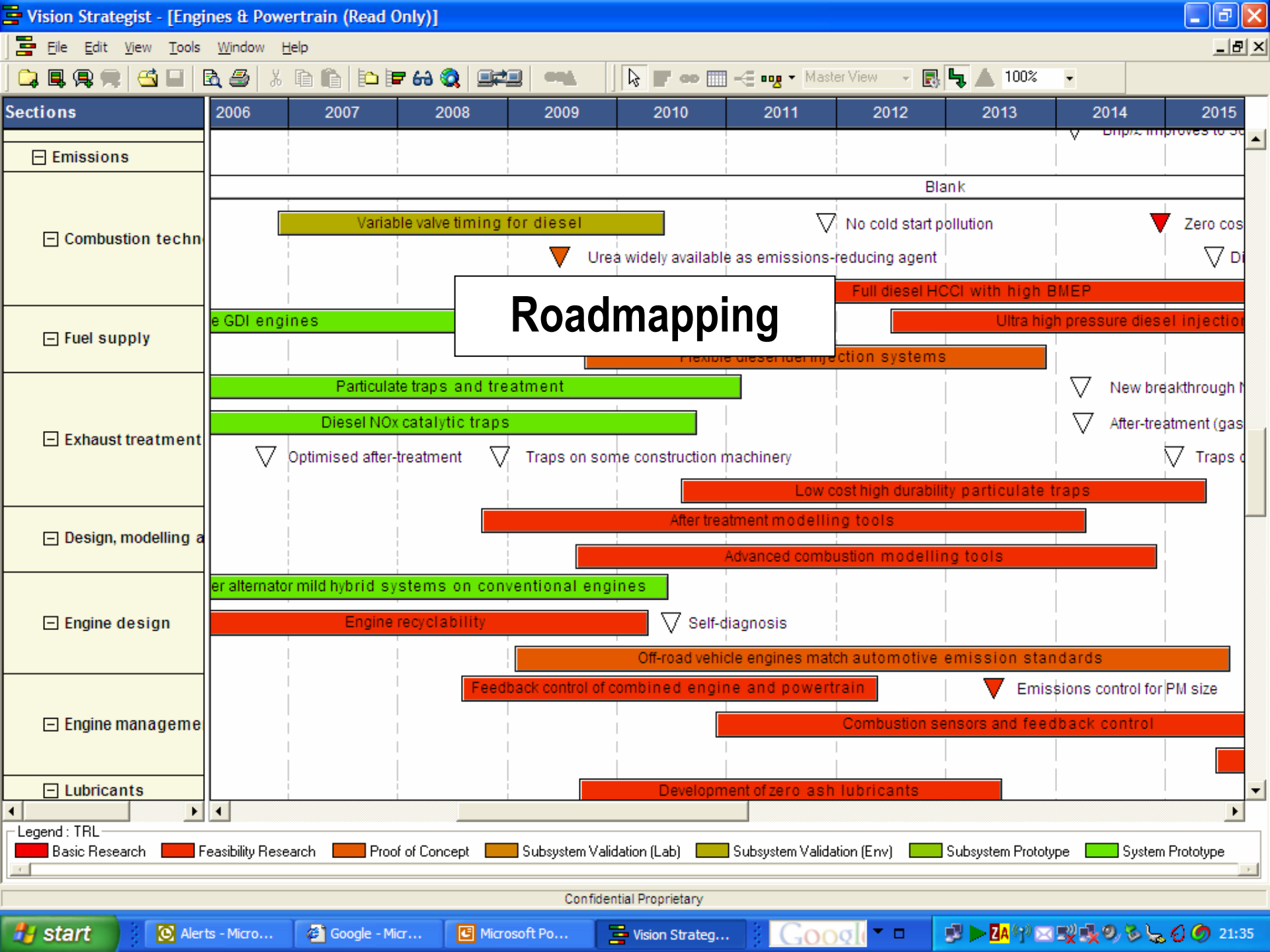
16 March 2006
RFID in Automotive Network

08 March 2006
Materials Innovation and Growth Team Report

Events

11 - 12 April 2006
Carbon & Alloy Steel Metallurgy and Processing

19 - 20 April 2006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Full diesel HCCI with high BMEP
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Exhaust treatment
Particulate traps and treatment
New breakthrough
Diesel NOx catalytic traps
After-treatment (gas
Optimised after-treatment
Traps on some construction machinery
Traps
Low cost high durability particulate traps
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After treatment modelling tools
Advanced combustion modelling tools
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Engine design
Engine recyclability
Self-diagnosis
Off-road vehicle engines match automotive emission standards
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Emissions control for PM size
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Lubricants
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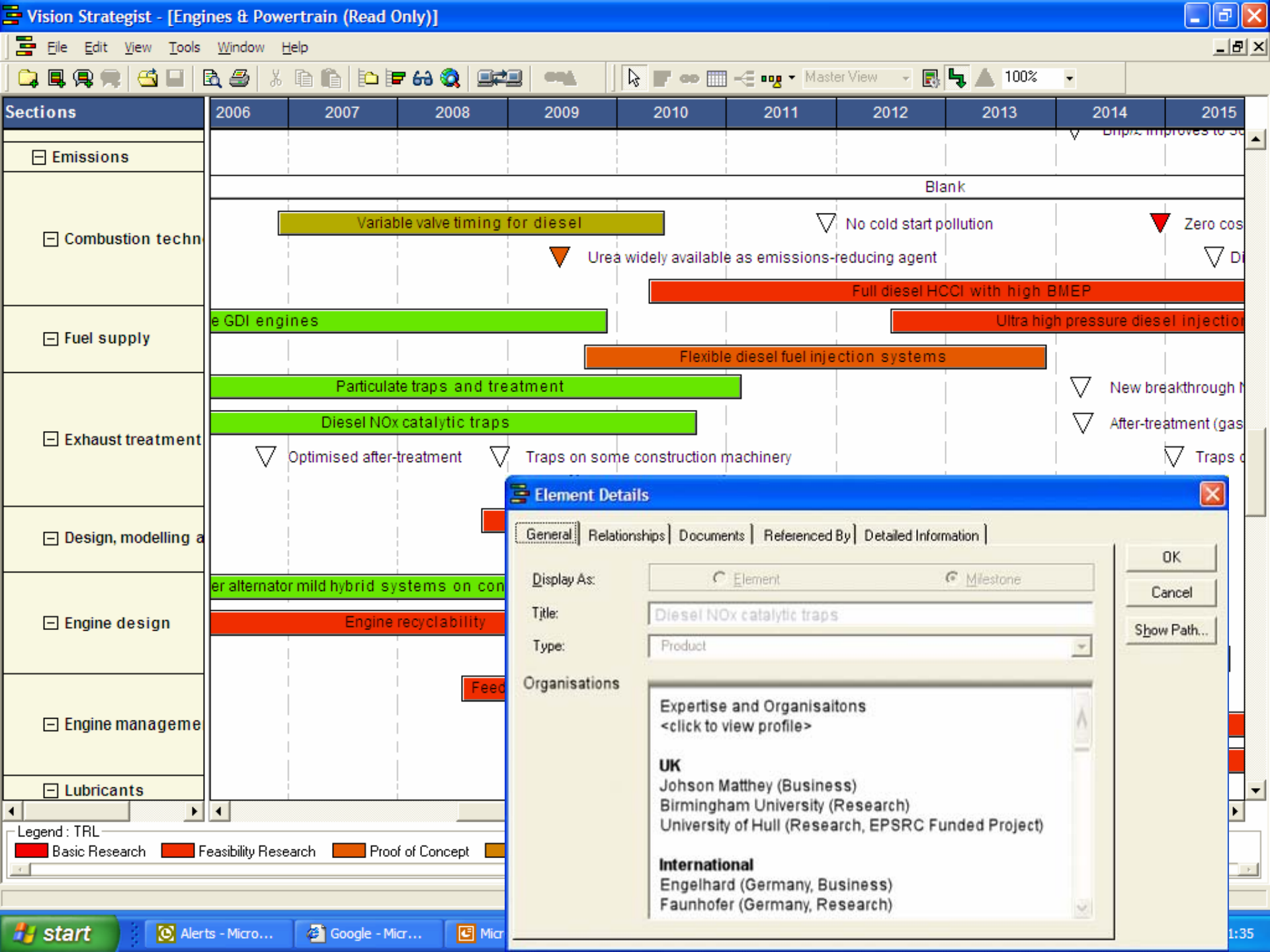
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Birmingham University (Research)
University of Hull (Research, EPSRC Funded Project)
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Current Grant Portfolio

Details of Award

EPSRC Grant Reference: GR/M20877/01

POISON AND PROMOTER EFFECTS IN THE SELECTIVE CATALYTIC REDUCTION OF NOX

Principal Investigator: Dr AF Lee

Other Investigators:

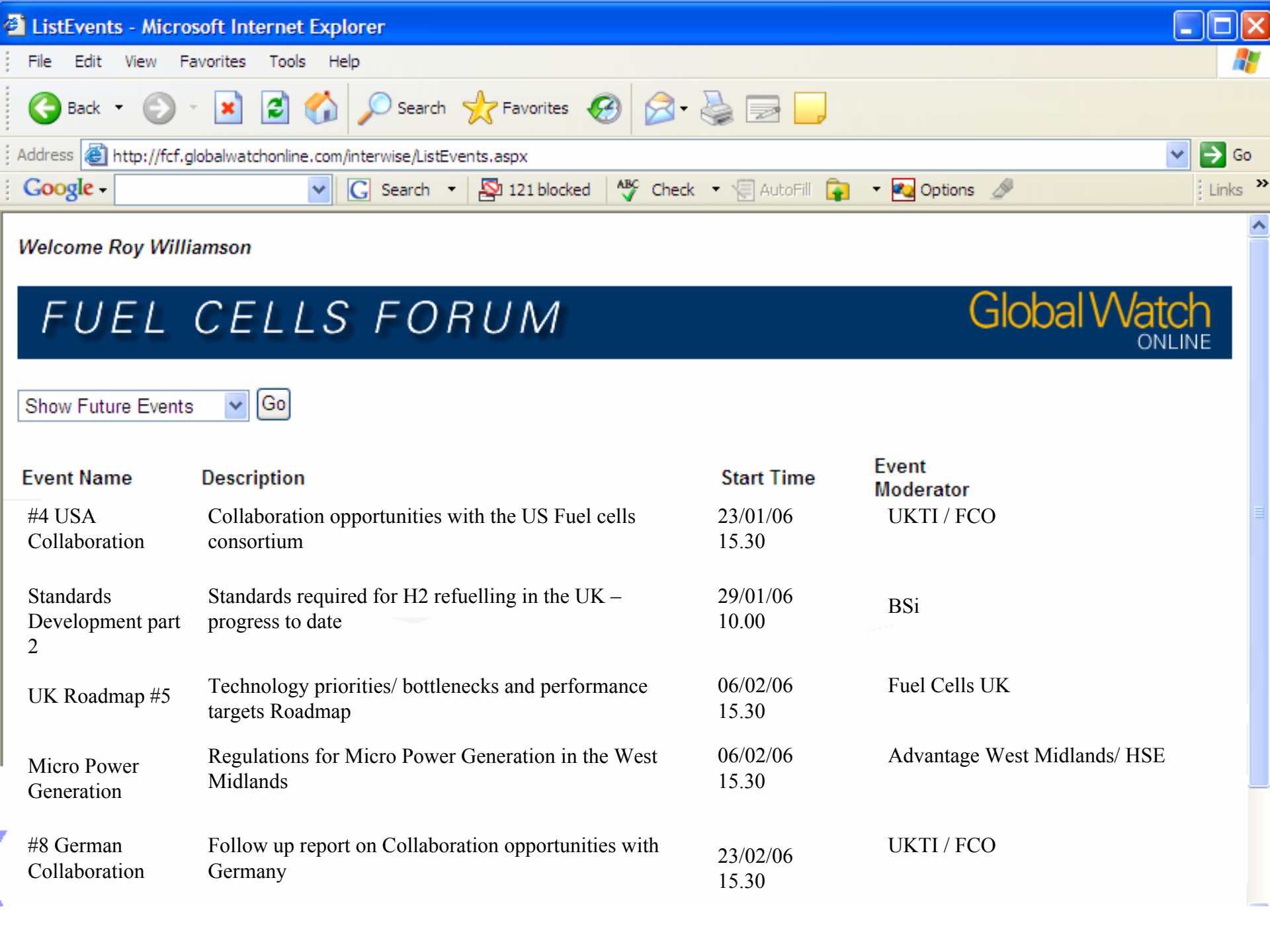
Recognised Researchers:

Project Partner:

Department: Chemistry

Organisation: University of Hull

Abstract: One of the most exciting emergent branches of heterogeneous catalysis is that of environmental pollution control. However in the challenging field of automotive exhaust emission control, it is not widely appreciated that current diesel pollution control technologies cannot attain emission legislation designated for the year 2000. This proposal will focus on modelling the selective catalytic reduction of nitrogen oxides over Pt catalysts in the presence of known poisons and potential promoter species. In particular we hope to obtain molecule level insight into the complex interdependent interactions between catalyst components and develop predictive models for the rational design of new bimetallic dispersed catalysts. A detailed understanding of the mechanisms of catalyst poisoning and promotion in NOx reduction is currently lacking. This proposal aims to fund the construction of a combined UHV chamber/ high pressure reaction cell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#4 USA Collaboration
Collaboration opportunities with the US Fuel cells consortium
23/01/06 15.30
UKTI / FCO
Standards Development part 2
Standards required for H2 refuelling in the UK – progress to date
29/01/06 10.00
BSi
UK Roadmap #5
Technology priorities/ bottlenecks and performance targets Roadmap
06/02/06 15.30
Fuel Cells UK
Micro Power Generation
Regulations for Micro Power Generation in the West Midlands
06/02/06 15.30
Advantage West Midlands/ HSE
#8 German Collaboration
Follow up report on Collaboration opportunities with Germany
23/02/06 15.30
UKTI / FCO

Cenex as a Broker

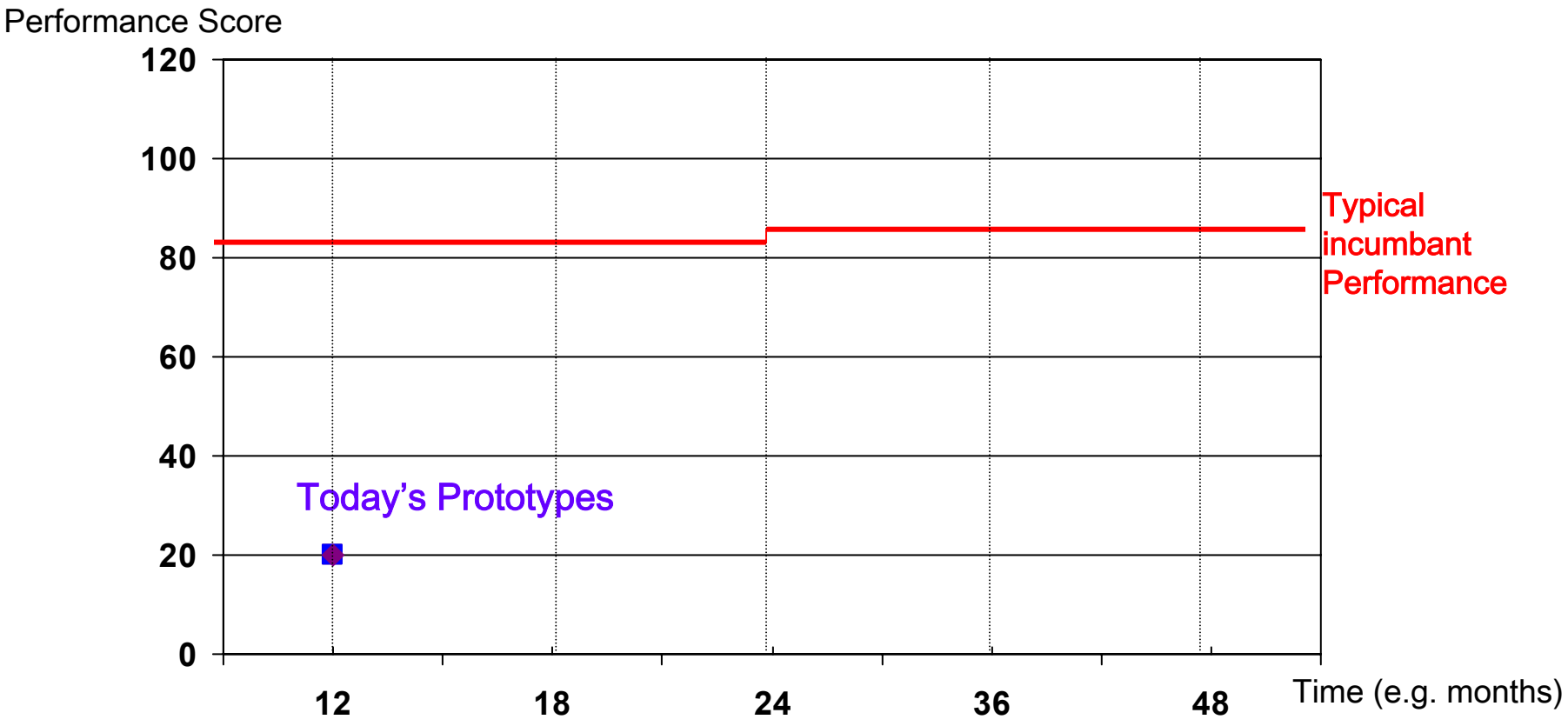
- Broker for technology demonstrations with a focus on replication
- From demand-side perspective
  - Seeking to identify target customers to form buying consortia for ‘public technology procurement’ using mechanisms such as Forward Commitments
  - Engaging with direct and in-direct sponsors
    - National and local Government, Regional Development Agencies, European Union, etc
    - Private sector (industry participants, leasing companies, investor community, etc)
- From supply-side perspective
  - Want to leverage opportunities for supply-push innovation
    - To support UK supply chain development
    - Collaborate internationally with UK supply chain working with global customer base

Public Technology Procurement - Forward Commitment Proposition

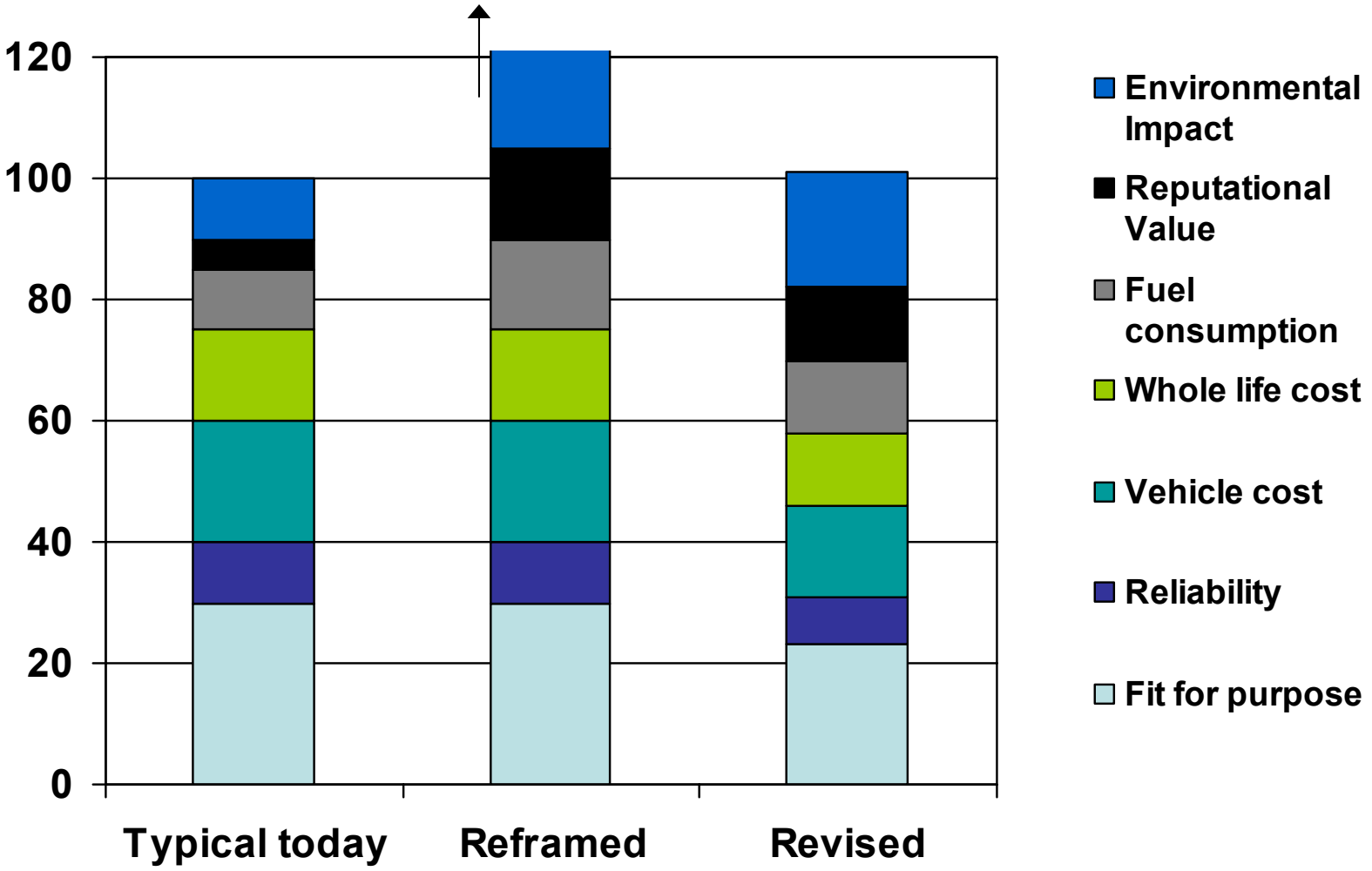
- An organisation commits to purchase a pre-defined quantity of a product\technology currently under development but not yet available as a commercial offering
- The commitment is for a future date and is based on a specified product performance being achieved
- The supply of a product meeting this performance specification within the agreed timeframes and framework triggers the Forward Commitment
- The Forward Commitment is for a quantity of product sufficient to encourage supplier investment to ensure economies-of-scale
- The Forward Commitment is enacted within the usual framework and practices of public procurement (i.e. not illegal)

- Being trialled via a low carbon van exemplar project, with a view to using for hydrogen and fuel cell projects

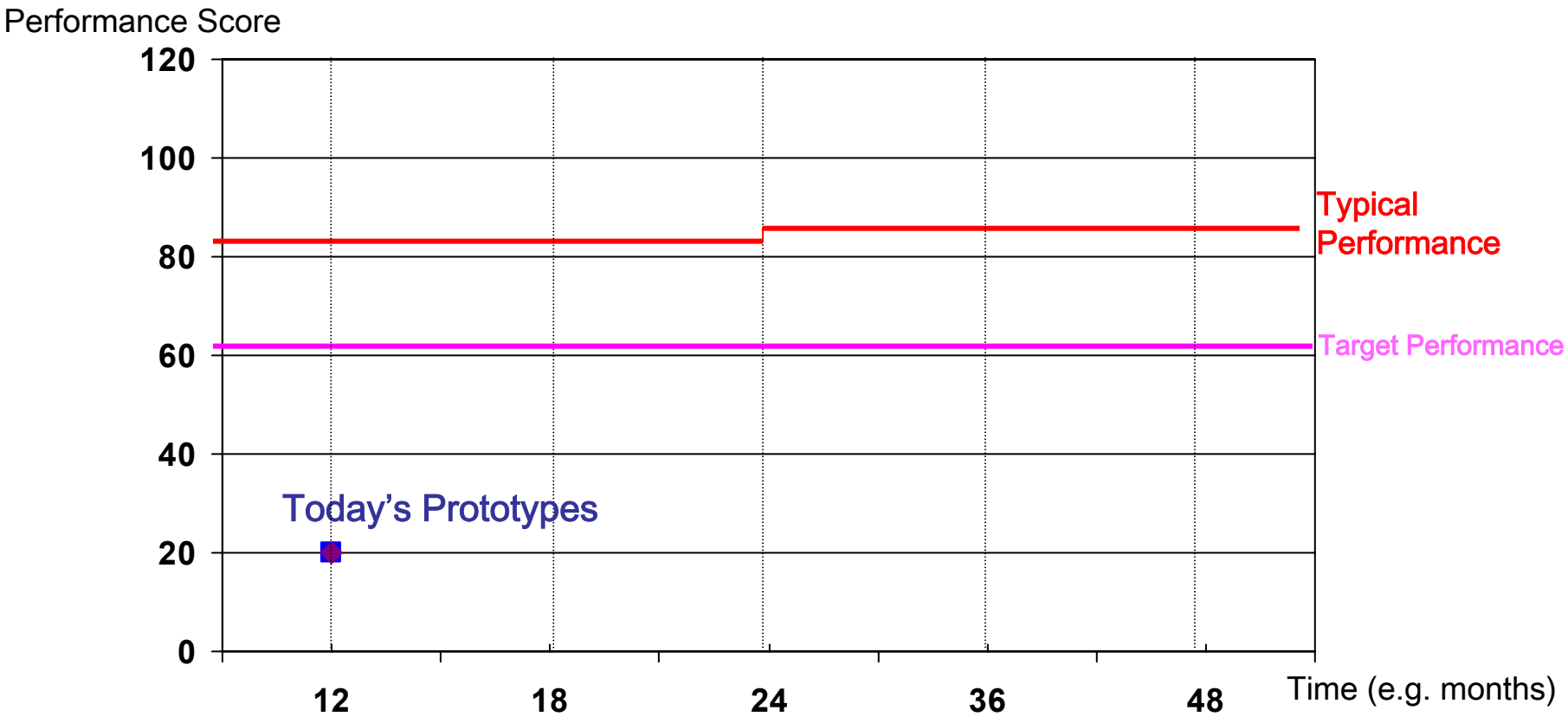
Today's Low Carbon Vehicle Options Don't Meet 'Required' Performance Targets



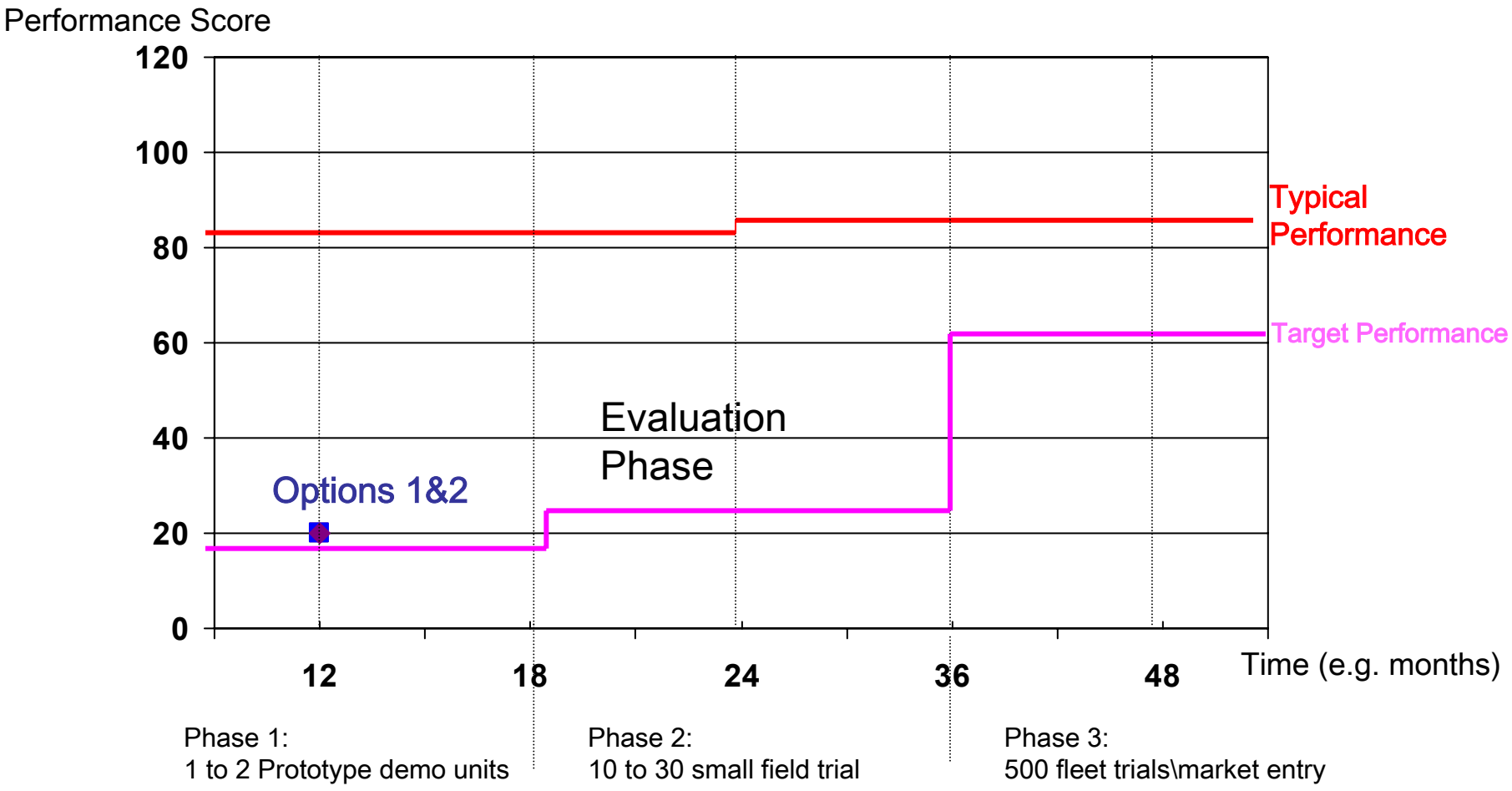
Customer Requirements Can Be Refocused e.g. on Environmental Performance Criteria



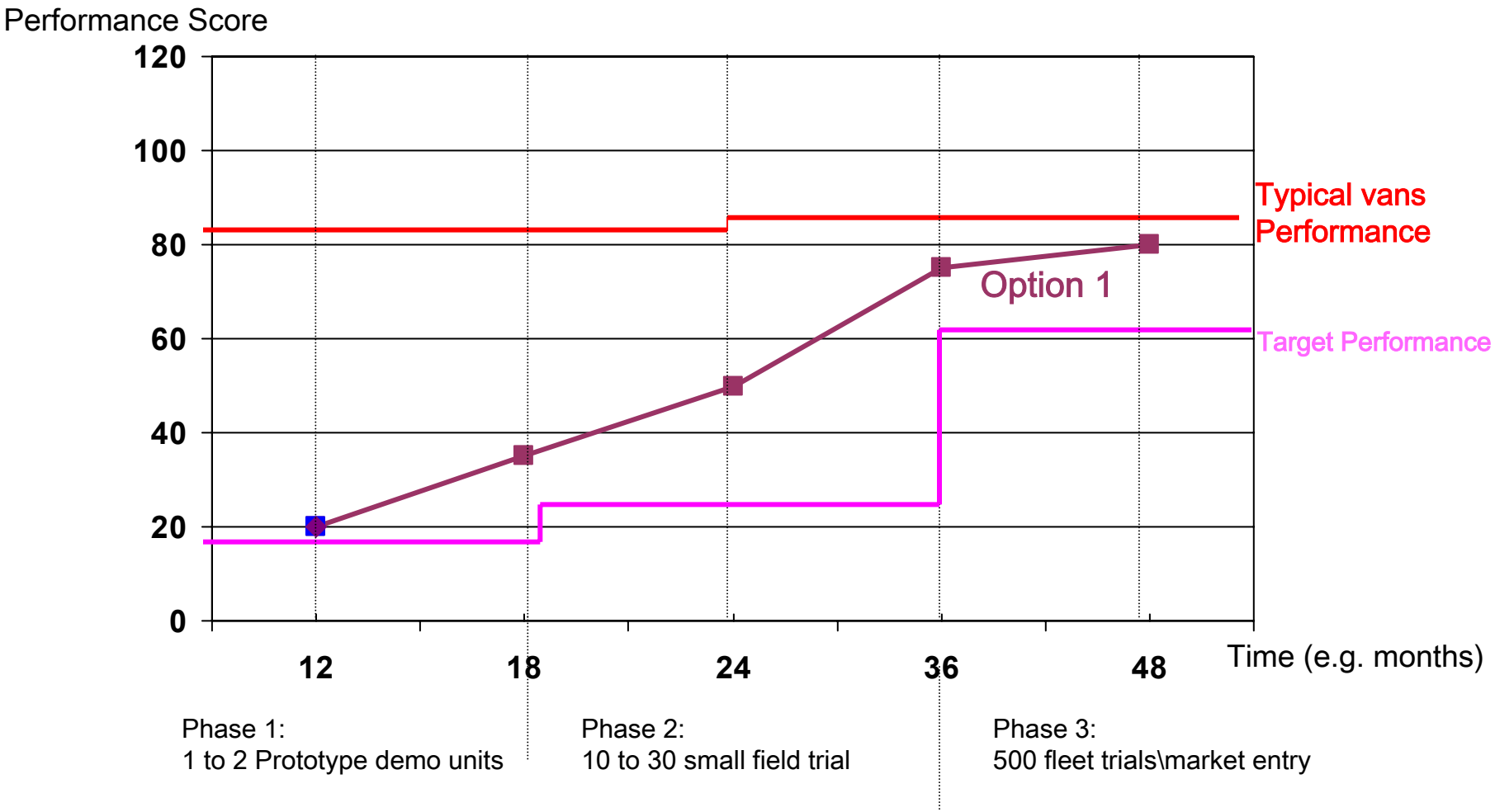
Revised Performance Targets Help But How to Progress Beyond Prototypes?



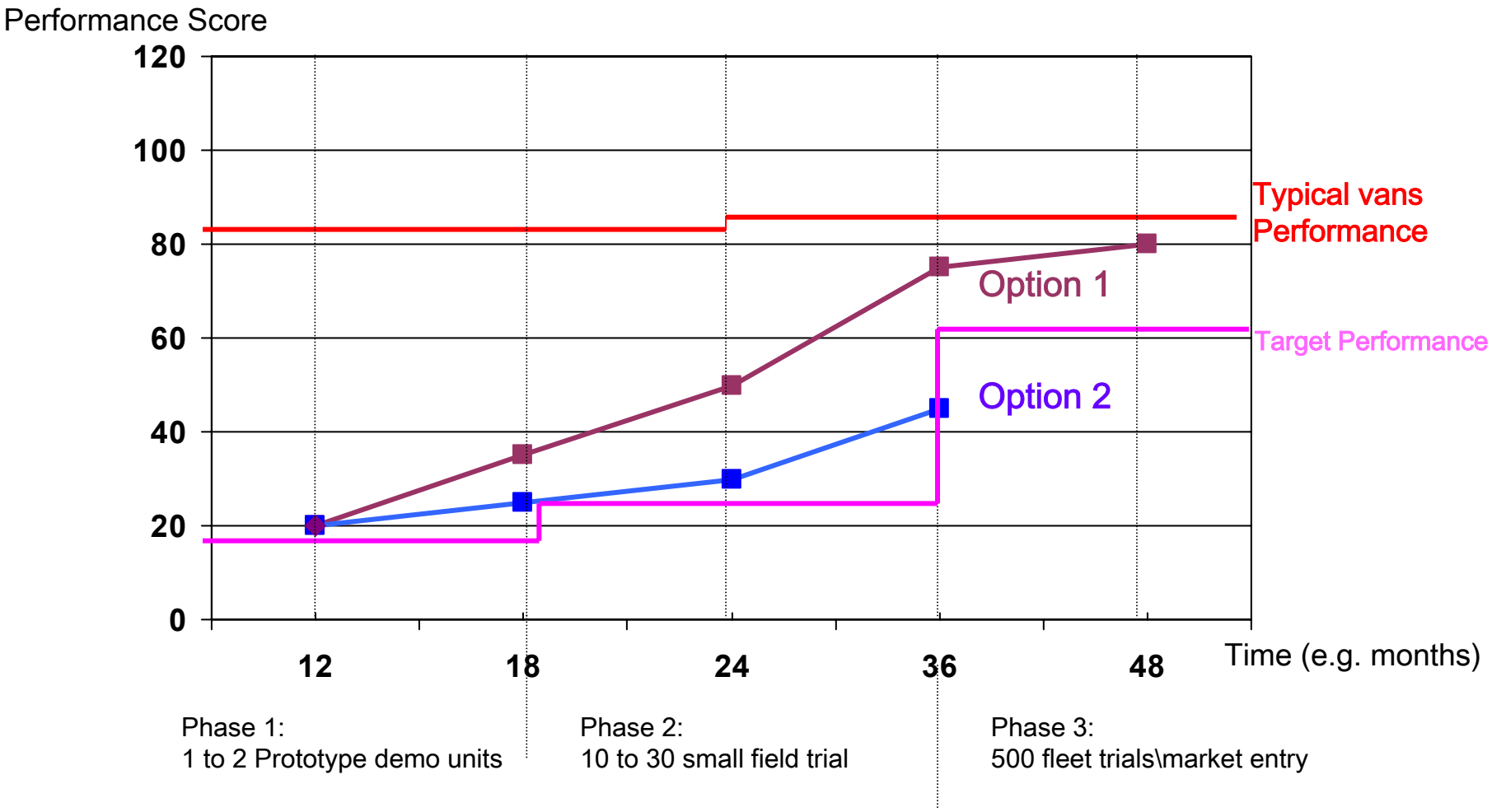
Forward Commitment Provides Development Time Toward a Recognised Commercial Opportunity



Meeting Performance Targets Triggers Forward Commitment



Failure to Meet Performance & the Forward Commitment Doesn't Happen



Value of Brokerage Role

- For hydrogen and fuel cell projects value in having independent broker focused on bringing stakeholders together to work through potential barriers to implement (and replicate) demonstration projects
  - Independent but knowledgeable, informed about technology, market and policy developments
  - Capable of securing shared expectations between potential technology providers and technology users
  - Skilled at project development (including sourcing funding) and project management for both public procurement and technology demonstration
  - Capable of project managing the independent testing in Forward Commitment Projects

- Focus on overcoming inertia due to ‘risk’ issues
  - e.g. from industry perspective, each project poses actual and ‘opportunity’ cost\resource issues, often lack recognisable ‘customers’ and are typically complex and time consuming to develop and require ‘creative financial thinking’ to fund

Conclusions

- Cenex new and unique public-private partnership focused on promoting UK innovation in low carbon and fuel cell technologies
- Cenex not an R&D centre – instead innovation delivery via
  - KTN
  - Brokerage role
- KTN seeks to promote knowledge transfer within and between communities interested in low carbon and fuel cell technologies to speed innovation through technology dissemination
- Brokerage for projects focused on demonstration in context of public technology procurement with the objective of replication (via Forward Commitment projects, etc) – demand pull tool for technology development
- Cenex contact point for international collaboration on transport projects

Thank you for your attention

www.cenex.co.uk

Robert.evans@cenex.co.uk