

Hydrogen and Fuel Cells:

A View from the UK

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On behalf of
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- De-regulated energy market
- Excellent opportunities for carbon capture and storage in the North Sea
- Growing offshore Wind / Wave generation
- Some strong emergent companies in Fuel Cell design and manufacture (mostly PEM and SOFC)
- High population density and extensive urbanisation (which drive the need for advanced systems for public transport and community heat and power)
- The imminent (and politically accepted) requirement for extensive investment in new generating capacity
- 6 active Regional 'Clusters' driven by local carbon reduction and economic regeneration targets

Snapshot 2020

UK Energy Policy Interest

	Portable FCs for handheld electronic devices	Portable Generators & Early Markets	Stationary FCs Combined Heat and Power (CHP)	Road Transport
<i>EU</i> H2/ FC units sold per year projection 2020	~ 250 million	~ 100,000 per year (~ 1 GWe)	100,000 to 200,000 per year (2-4 GWe)	0.4 million to 1.8 million
<i>EU</i> cumulative sales projections until 2020	n.a.	~ 600,000 (~ 6 GWe)	400,000 to 800,000 (8-16 GWe)	1-5 million
<i>EU</i> Expected 2020 Market Status	Established	Established	Growth	Mass market roll-out
Average power FC system	15 W	10 kW	<100kW(MicroHP) >100kW(industrialCHP)	80 kW
FC system cost target	1-2 € W	500 €/kW	2.000 €/kW(Micro) 1.000-1.500 €/kW(industrialCHP)	< 100 €/kW (for 150.000 units per year)

Supported by economic
development schemes

Primary relevance as
enabling technologies

UK Regional Activity

The Regions are an important Implementation Route

- All have targets for economic development and carbon reduction
- Some have highly developed strategies for improved sustainability
- These are regarded as a potent source of
 - End-User opportunities
 - Finance
 - Encouragement and Coordination
- Their objectives are concerned with both Public Good and Economic Development.
- While they are largely autonomous entities, we are trying to exploit the special characteristics of each to maximise effectiveness of the whole.

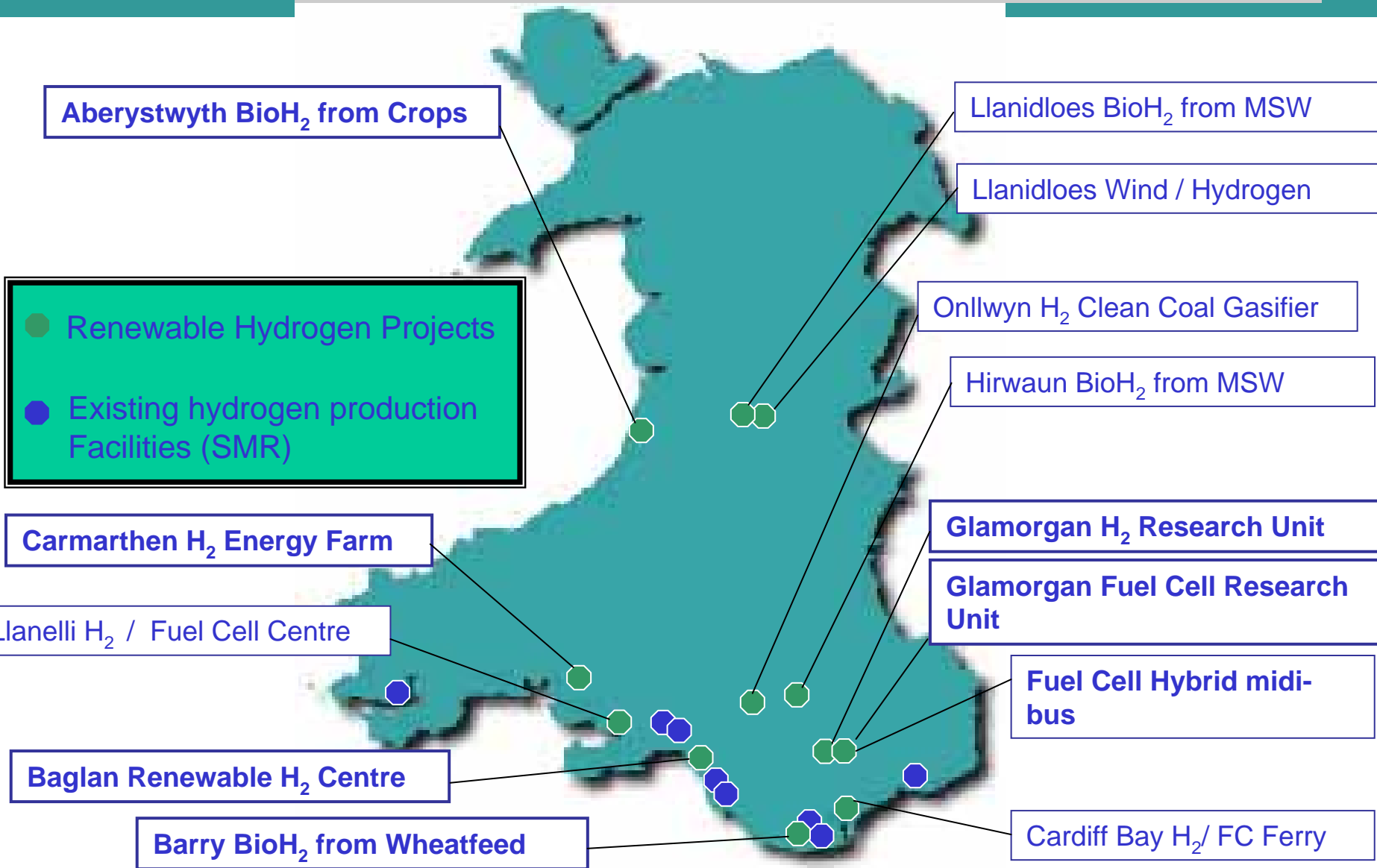
The UK Regions most prominent for their support for H2 and Fuel Cells, and their common characteristics:

- London
- E. and W. Midlands
- Wales
- Yorkshire
- N.E. (Tees Valley)
- Scotland

- Numerous active stakeholder groups
- Established vision and strategic route map for establishing hydrogen and fuel cell futures
- Programmes for co-ordination of research, development and demonstration activities
- Incubator Units to assist new entrant H2 & FC companies
 - Technical and Commercial Advice
 - Financial Assistance
- Active H2 & FC Research Centres

London is dedicated to becoming a leading early adopter of Hydrogen technology.

- London Hydrogen Partnership (formed 2002) has launched plans for vehicle deployment over the next 5 years, followed by wider deployment towards the Olympic Games 2012 and EC HYCOM initiatives. The plan is in the procurement stage, and key elements are the deployment of:
 - **10 hydrogen buses** - to fully satisfy the demands of a London bus route. The project is in the final stage of procurement with tender evaluation under way for a refuelling facility and the hydrogen buses
 - **60 non-bus vehicles** - to be operated by London's public sector fleets. Small hydrogen refuelling stations will be built in central London. A competitive procurement process is under way involving a range of vehicle types.
- Longer term, London has an aspiration to play a leading role as a deployment centre (and hence catalyst) in the commercialisation of hydrogen fuelled transport.



Projects indicated in Bold are fully funded and in progress

This region is pursuing a broadly-based Low Carbon agenda that includes

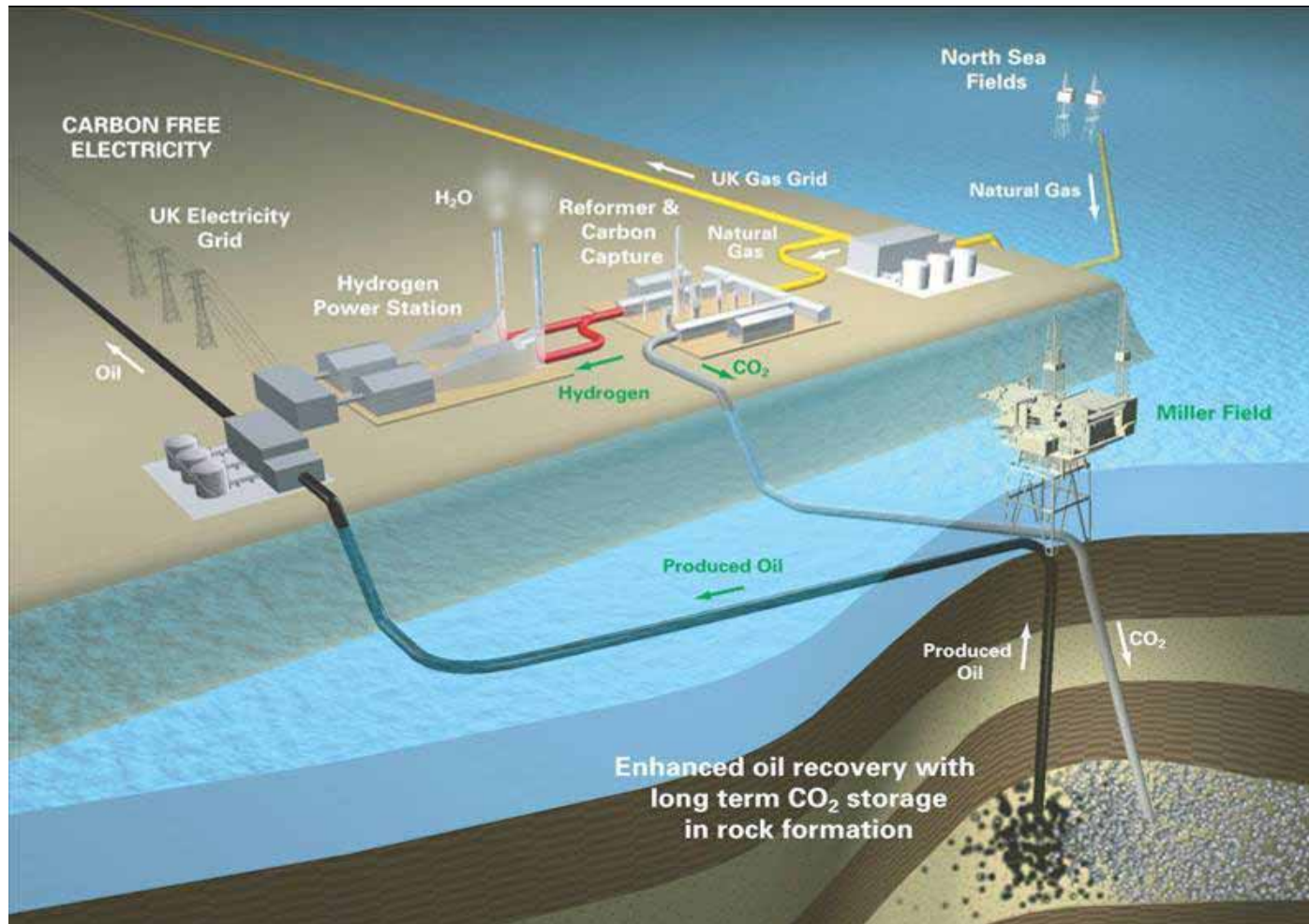
- Regeneration projects using a Low Carbon Buildings programme
- Coal Gasification and Carbon capture
- CHP 'private wire' Energy Service Companies systems in both municipal and industrial settings
- Increased use of renewables: wind, hydro, solar, wave and tide.
- Exploit existing options for increased production and develop the hydrogen infrastructure.
 - Development of options for dealing with the intermittency of renewables
 - Use of the salt cavities to store Hydrogen?
 - Use of reversible fuel cells?
- Low carbon fuelling infrastructure for transportation, including marine
- Extended use of Bio Fuels including increased capacity and range

H₂ and Fuel Cell Plans are in progress, with an emphasis on stationary applications:

- **Integrated supply chain from fuel to product with service for small units**
- **1kW to 50kW Fuel Cell Applications**
 - CHP for domestic and light industrial
 - Surface transport development activities including buses, trams, road vehicles and forklifts
- **Fuelling and infrastructure projects in progress**
 - Exploit existing options to increase production, and develop the hydrogen infrastructure.
- **Large energy systems that include fuel cells with a capacity of over 200kW**
 - Community Heat and Power
 - Industrial Applications

Peterhead/Miller Field Project – DF1

- BP Miller Field – Oil field in the North Sea
- Peterhead Power Station – uses natural gas from the St Fergus gas terminal in turbines to produce electricity. Owned and operated by Scottish and Southern Energy
- DF1 – Decarbonised Fuels 1
- Natural gas will be reformed at the Peterhead site to produce hydrogen and CO₂
- Hydrogen used as fuel for gas turbines, 340MW
- CO₂ fed by an existing pipeline into the Miller field to extend oil recovery and store the carbon geologically
- Sanction expected end 2006



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