

10 March 2011

UK Hydrogen and Fuel Cell Association Response to the Electricity Market Reform Consultation

1. Introduction

This paper provides the response from the UK Hydrogen and Fuel Cell Association to the Electricity Market Reform (EMR) Consultation published by the Department of Energy and Climate Change in December 2010.

The UK Hydrogen and Fuel Cell Association (UK HFCA) aims to accelerate the commercialization of fuel cell and hydrogen energy technologies. Through the breadth, expertise and diversity of our membership, we work to trigger the policy changes required for the UK to fully realise the opportunities offered by these clean energy solutions and associated elements of the supply chain.

Fuel cells and hydrogen are 'game changing' technologies providing low-carbon solutions across transport, stationary power and beyond. The growing industry is already bringing benefits that the UK cannot afford to miss: creating new jobs, supporting UK economic growth and improved competitiveness in the energy markets globally.

This response has been produced through consultation with our members and presents the Association's response to those aspects of the consultation of most relevance to the sector.

Particular attention has been paid to the needs of the future energy and technology mix, in an area which both supports and challenges the current status quo. Our key messages are:

- A. The proposed design of the Electricity Market Reform may establish unintended disincentives for wider decarbonisation of the UK's energy mix.**
- B. Hydrogen and fuel cells offer key opportunities to build UK skills, jobs, and competitiveness in a low carbon world.**

Because of the associated supply / demand matching, low transport costs, and wide process options, we see substantial potential for a hydrogen, generation infrastructure, and widespread deployment of fuel cells, as part of a reformed electricity market.

Fuel cells offer innovative help in a range of application otherwise dependent on fossil fuel combustion. Increasing potential exists across segments of the electricity industry to apply electrolyser and fuel cell technologies. This will help to deliver the whole spectrum of UK de-carbonisation, diversity and security of supply, and fuel poverty objectives.

The EMR principles must protect the potential for hydrogen and fuel cells, and the details must ensure maximum opportunity for UK capabilities to be deployed.

2. Detailed response

2.1 General EMR issues

2.1.1. **We accept that there is a need for reform of the electricity market and welcome the Government's aims to unify the supply of energy from sustainable renewable sources, nuclear fuel and fossil fuel (and biomass) fitted with carbon capture and storage (CCS).**

We assume that this will comprise a mix of renewable energy, nuclear and fossil fuel power and CHP plants equipped with carbon capture and storage.

We also note that industry has diverse ways of using fossil fuels and, to maintain and develop the UK's industrial base, they will require substitute energy vectors and changed processes. Hydrogen storage is a key route for integrating more renewables via electrolysis, and fuel cells offer more efficient and low carbon options for the use of fossil fuels in the short term and carbon free generation moving forward.

2.1.2. **The proposed mechanisms have sufficient breadth but are not equally important.**

For large scale generation the Carbon Price Floor is seen as positive, as long as it is set at the appropriate level with relation to the EU Emissions Trading Scheme (EU ETS). Otherwise, setting the Carbon Price Floor too high may disincentivise energy sensitive investments in the UK.

The Capacity Mechanism is required to ensure that mid merit, new, low carbon, large scale generation is available in the EMR¹. As this is particularly relevant to generators with CCS, the EMR needs to minimise the cost of the CCS plant investment to electricity users.

We perceive the Emissions Performance Standard (EPS) as a backstop or policy direction indicator, rather than a critical element of the EMR.

It has been recognised that a different approach is required to stimulate the deployment of small scale, distributed electricity production, at least until the technology has matured. Correspondingly, the Feed-in Tariff (FiT) was expected to be the lead measure driving investment in low carbon generation. However, despite the intent (and the scope of the relevant primary legislation²) the FiT initiative has been restricted to *renewable* rather than low carbon generation and does not cover on-site storage of renewable power as hydrogen. As a result, it crucially excludes much fuel cell CHP which could be delivering rapid reductions in the UK's carbon footprint. It also provides no incentive for on-site storage of renewable power as hydrogen, which could, in turn, allow much more renewable

¹ To meet 3 demands, that can be concurrent.

1) the capacity shortage that could occur at the relatively short teatime peak of demand. Such shortage would be for just a few hours, and a few GW maximum

2) the capacity shortage that could occur due to the difference in demand between day and night in winter lasting, each day for about eight hours and measured around 20 GW

3) the capacity shortage that could occur at periods of low wind across the whole generation system, sometimes lasting several days and up to 25 GW if wind targets are met.

² Energy Act 2008

generation to be accommodated on the distribution network and assist the UK smart grid transition. The UK HFCA urges the government to address this critical limitation.

2.1.3. Recognising carbon value and impact on UK competitiveness

The UK has been a consistent supporter of market forces establishing a CO₂_{eq} cost per tonne within the EU ETS. Whilst as businesses we support a transparent market, it is now widely recognised that distortions by national interests have given a weak cap and do not (and will not until at least the 2020's) produce a market price in line with the social cost of greenhouse gas emissions. Indeed, Europe may require a broader duty on embodied carbon coming into the EU, and a duty rebate on low embodied CO₂ products leaving the EU, to ensure that there are no carbon leakages and that there is a level playing field for our globally competitive industries.

The carbon floor price will give the right signals sooner rather than later. Simple mandating and banning current emissions is not considered, as new technologies have not yet reached desired economies of scale and achieved a simple competitive advantage with fossil fuel use.

Unless there are active market distortions, the EMR will set implied carbon costs beyond just electricity generation. This will determine whether there is new growth and increased UK competitiveness, or continued taxation of industry and consumers to add to general revenue.

2.1.4. The cost of reserve capacity can be reduced by pre-combustion CCS

There are a number of short to inter-seasonal problems with the electricity markets that will cause low availability of plant that has historically been identified as baseload. There are other discussions of the value of import and export of power, and explicit storage options. These are mostly not sufficient in scale by themselves, have round trip efficiency losses, are reliant on other countries interests, and do not consider cross-sector energy substitution.

The intermediate step of producing hydrogen in the IGCCT electricity generation process is extremely cost effective in time shifting electricity supply and, because of a value to carbon, offering decarbonised energy when required for industrial, transport, and heat users at material scale economies.

A key issue for the EMR is that it may inadvertently stop power generators enabling the supply of hydrogen as a decarbonised field vector to other sectors by a narrow definition of eligible means of earning capacity reserve incentives.

2.1.5. The impact of wind generation on communities and on the electricity grid can be improved by cross-sector transfer of energy

Wind and solar power sources are readily available for implementation in a range of settings, and their increased application can be accommodated by deploying energy storage in the power system. In the windiest regions, prioritising effort to better capture these variable renewable resources makes most sense; indeed, there are numerous locations worldwide where the renewable resource is ample but, without energy storage, its variability will limit implementation. When such storage is achieved via water electrolysis, the

stored hydrogen will avail numerous cross-sector applications for heat, power and transport. Our members work across sectors and are keenly aware of the problems faced by remote and rural communities in gaining value from wind farms.

We see hydrogen and fuel cells opening up the possibilities to engage communities and to allow them derive full value from local renewable energy. For example on the Isle of Lewis, the Lewis Castle College (part of the University of the Highlands & Islands) has a hydrogen laboratory and green space, the Island of Unst in Shetland has a wind hydrogen system able to supply transport and heat as well as electricity, the Hydrogen Office in Fife shows the opportunities for modern hydrogen energy systems in commercial settings, and ITM Power's electrolyser-based van refuellers are currently being trialled (with two vans fitted with hydrogen internal combustions engines) at 21 commercial companies across the UK

In certain settings, where businesses or communities wish to decarbonise their local transport fleets, where the grid is weak or close to its limit in conveying more renewable power and where significant fuel poverty exists, the case for the use of hydrogen is even stronger. As uncertainty around transport and heating fuel costs grows, it may be that providing electricity units, rather than cash incentives to communities will enable more adaptive and entrepreneurial solutions to develop. Our members need such niches to develop as well as the more centralised (conventional wisdom) approaches

2.1.6. Inland and distant fossil power and industrial plants, together with their infrastructure may become stranded assets unless served by decarbonised hydrogen.

The current design of the EMR will cause loss of use of existing UK assets because of locational problems. For existing power and industrial plants sited at inland locations, it may be difficult to warrant the expense and the environmental impact of providing long, onshore pipeline connections for relatively small annual tonnages of CO₂. This could mean, besides coal plants remote from CO₂ storage, that even existing or new inland fossil fuel powered gas plants will become unattractive assets, with consequent local imbalances of power and gas transmission capacity. However, if CCS is employed with pre-combustion capture, and hydrogen is piped to these more isolated or smaller power plants and industrial plants, then they and the associated infrastructure will maintain their full value.

2.2 Hydrogen and fuel cells offer key opportunities to build UK skills, jobs, and competitiveness in a low carbon world

2.2.1. A reformed electricity market and adequate CO₂ value will provide hydrogen that is a competitive energy vector.

Renewable energy in weak grid and off grid locations is already an attractive electrical source and for charging small electrical storage and for conversion and storing as hydrogen for transport and heat.

We see some transfer of this to grid applications. As the penetration of intermittent renewable generation grows and if the scale of base load nuclear

power increases, we foresee sector shifting of electrical energy to heat and transport, with hydrogen as an important step in that process. We must not overlook the commitments of nearly all major OEMs in the car industry to deploy fuel cell electric vehicles in 2015 and must work to ensure sufficient clean hydrogen is available to encourage these manufacturers to deploy their vehicles in the UK.

One of the largest scale and most cost effective shifts we envisage is that associated with the application of pre-combustion CCS. The primary energy vector arising from removing carbon from biomass, waste, coal, oil and gas is hydrogen. The rich hydrogen feed for gas turbines is well proven, and if the pure CCS part of the process is matched by the carbon value, then hydrogen becomes a substitute energy vector for a wide range of primary energy resources (including a role as a valuable source of carbon-free hydrogen fuel for fuel cell transport and other applications).

The importance of economies of scale for CCS means that support for the current CCS demonstration projects must follow through into support for CO₂ infrastructure and general deployment. Fortunately, the UK has competitive advantages in CCS and we urge the Government to help ensure that continues to be the case.

2.2.2. Development of new hydrogen infrastructure will attract additional investment.

Enabling commercial activity, wayleaves, and sufficient scale and vision for new infrastructure is a classic way of helping new investment to locate and grow. New CO₂ infrastructure has shown how it influences the location of new investment.

Similar opportunities have already been realised in Teeside, the region which historically benefited from hydrogen pipelines and storage, and where new advanced gasification technology will be used to process municipal solid waste and generate base-load, renewable power for more than 50,000 homes, as well as renewable hydrogen for mobile and stationary energy applications. This first such investment in Europe will create 500-700 construction jobs and 50 permanent positions in the region. This and other areas could grow based on new hydrogen sources, such as large scale pre-combustion CCS, to reach new demand for low carbon, low cost hydrogen across sectors.

2.2.3. Industrial processes and transport can be decarbonised by hydrogen.

There is uncertainty as to whether industrial energy users will use more electricity, substitute primary fuel, or use onsite CCS. For example, steel making could become more electricity intensive, more hydrogen intensive, or more reliant on onsite post combustion CCS. General industrial needs for heat will be met by piped hydrogen which is decarbonised (by CCS or from renewable sources), and may benefit from more efficient processes and direct use of hydrogen as a chemical.

As described above, the implementation of pre-combustion CCS would provide large point sources of carbon-neutral hydrogen for distribution to fuelling stations. Fleet transport and rail may also pick up usage directly and support re-fuelling points. Decarbonised electricity (from CCS, nuclear or renewables with

storage) can be used provide a back-up source of hydrogen, with home hydrogen production via electrolysis, particularly advantageous when using overnight tariffs.

2.2.4. The CO₂ from heat problem

The size and seasonal variation in the UK's use of natural gas for heating is the major decarbonisation challenge in the coming decades, and should not be damaged by proposed EMR measures.

There is no single answer to this problem; a combination of energy efficiency measures, effective utilisation of biomass, exploitation of the UK's wind and marine energy resources, deployment of coal and gas reserves and support for the development of new technology options will all be required.

Assuming we see fuel cells used for CHP, house insulation improvements, effective SMART meters and grid management, use of heat pumps / heat storage, reasonable distributed generation, and retention of natural gas storage and HTS to meet peaks, the ability to de-carbonise heat will still need development of de-carbonised hydrogen infrastructure serving industrial and commercial users, and domestic users.

Fuel cells as combined heat and power installations, initially fed by natural gas (or biogas), enable a route to delivering rapid reductions in CO₂ emissions³. In later years, as hydrogen becomes available, fuel cell CHP operating on this fuel could replace natural gas. Much of the technology underpinning natural gas and hydrogen fuel cells is common and, thus, cost reductions delivered through the roll-out of the former will also accrue to the latter. With the help of hydrogen, the opportunity to tackle fuel poverty across transport, heat and power in islands and areas without natural gas will come sooner.

2.2.5. Fuel cells are coming into competitive markets

It has been a long haul, but we are getting closer to fuel cells that are competitive in stationary power applications (for example, in the telecom power sector). Medium scale stationary systems are available today, with over 90MW of CHP and CCHP plants installed worldwide. Fuel cells will also soon be competitive with domestic boilers when CHP-enabled. Linked in hybrid mode with batteries, fuel cells are being trialled by almost all major international car companies as way forward for providing low emission vehicles of long range. Our members include UK based and owned companies able to provide evidence to support those key applications for a decarbonised UK.

The EMR must ensure that these key innovations find a home market in the UK which will allow the industry to showcase its products to the world.

³ A typical fuel cell CHP system, operating at 40% electrical efficiency and using the byproduct heat can deliver carbon savings in excess of 40% when compared with the current UK grid/gas boiler equivalent

3. Conclusion

Because of the associated ability for supply / demand matching, low transport costs, and wide process options, we see substantial potential for hydrogen generation, storage and infrastructure, as part of a reformed electricity market.

Fuel cells are delivering high-efficiency, low-carbon solutions across a range of applications, including stationary power at a variety of scales and transport, and will play a key role in helping the UK achieve its de-carbonisation, diversity, security of supply, and fuel poverty objectives

The EMR principles must protect the potential of hydrogen and fuel cells, and the details must ensure maximum opportunity for these UK skills to be deployed.

