

5. Fuel cells' position in the renewable landscape

1. Fuel Cells UK's position

1.1 Fuel Cells UK believes that:

- a. Fuel cells have a key role to play in the future energy landscape, whether this be in terms of minimising carbon emissions, increasing energy security or managing and delivering renewable power.
- b. The Government has made moving towards a low carbon economy a key future policy objective. However, if the UK is to realise its obligations to reducing carbon emissions a clear commitment must be made to support the full range of low carbon technologies.
- c. Thus, a policy which promotes both low carbon power generation and renewables is to be recommended.

2. Fuel cells' role in the renewable energy landscape.

- 2.1 The current shift in energy policy, driven by an increasing awareness of the environment, energy security and diminishing fossil fuel resources, is leading to radical changes in the energy landscape and these changes are bringing their own unique challenges. Two key challenges for the UK are carbon reduction and energy security.
- 2.2 Fuel cells are unique in their flexibility of application and efficiency, and are proven to reduce carbon emission in a range of applications, from transport to microgeneration.
- 2.3 They also offer significant benefits in terms of energy security, and can be powered using a wide range of fuels from waste ammonia to natural gas and hydrogen.
- 2.4 Furthermore, as the UK moves towards greater adoption of renewable energy, there will be a strong demand for energy storage and power management solutions to tackle challenges associated with the intermittent nature of some renewables and constraints associated with the electricity grid. It is these challenges that fuel cells are perfectly placed to answer.

3. Minimising carbon emissions

- 3.1 Despite challenging targets for renewable energy production, fossil fuels will continue to provide much of our electricity for many years and minimising harmful emissions from these sources needs to be a priority. It is important to realise that, even if the UK meets its share of the EU renewable energy target (expected to be 15%), a significant proportion of the UK's energy will continue to be derived from fossil fuels. Thus, a policy that mitigates the impacts of existing power generation technologies and promotes all low carbon power solutions will be vital if the UK is to deliver on its commitments under Kyoto.
- 3.2 A key area where fuel cells can add benefit is in Combined Heat and Power (CHP) microgeneration. Recent research, supported by BERR, has indicated that if adequate support is provided, fuel cells could help cut CO₂ emission by 5% in the future and provide 18% of the UK's energy demands. This saving is driven by the high efficiency of fuel CHP units (80%–90% compared to ~35% for traditional generation).
- 3.3 Another key area where fuel cells offer significant benefits is in transport. In 2004, 27% of CO₂ emissions were produced by the transport sector. Results from a full lifecycle analysis, comparing CO₂ emissions from a traditional petrol internal combustion engine, with CO₂ emissions from a hydrogen powered fuel cell vehicle, estimated that the internal combustion engine accounted for 170g/km, while the fuel cell system produced from 0g/km (when fuelled by renewably generated hydrogen) to 85g/km (when fuelled by hydrogen generated using fossil fuels).

4. Management and delivery of renewable resources

- 3.1 The challenges around the management and delivery of renewable resources are a function of their particular characteristics. Traditional fossil fuel based energy generation

Fuel Cells UK Position Paper

could be easily managed in terms of location and hence grid access, as well as power output, to ensure that it matched demand. Conversely, many renewable energies, such as wind farms, wave or tidal, must be located near a favourable resource and consequently are frequently located in areas with little or no grid system, while the unpredictable resource results in intermittent in power delivery, potentially generating significant power output when demand is low.

- 3.2 Fuel cell systems can address two important issues here - the ability to store energy (to cope with intermittent production) and the ability to manage and deliver power (to help overcome grid constraints).
- 3.3 **Energy Storage:** Fuel cells, in partnership with electrolyzers and hydrogen storage systems can help to address situations when electricity production from renewables exceeds demand, using excess electricity to produce hydrogen, which can then be stored and converted back into electricity in a fuel cell to meet demand.
- 3.4 **Grid Constraints:** Fuel cell systems also offer solutions to issues associated with grid constraints, deferring capital investment in new infrastructure, particularly if they are used in conjunction with a battery in a hybrid system.
- 3.5 Power outputs and loads associated with some renewable energy projects, particularly wind, can create problems for the grid since they can create significant fluctuations in frequency, either overloading the system if frequencies are too high or dropping off the grid if frequencies are too low. Managing this output with a fuel cell / battery hybrid system will smooth power outputs, reducing thermal loads, voltage variation, frequency variation and fault currents, so allowing the same cables to carry more power without the need to upgrade.
- 3.6 An alternative to this approach would be to transport the hydrogen directly from the point of production to the point of use and have either a large fuel cell power station close to the point of use, or many microgeneration systems to utilise the hydrogen fuel source.
- 3.7 An example of a working fuel cell installation is the PURE Project on Unst in the Shetland Islands. The system consists of two 15kW wind turbines, a high pressure hydrogen electrolyser, high pressure hydrogen storage device and a fuel cell. An inverter is used to convert the DC output from the fuel cell into AC which provides power and heating for five businesses on the island. The stored hydrogen is also used to power fuel cell / battery hybrid vehicles.

5. Summary

- 5.1 Fuel cells offer carbon reduction and renewable energy support across the entire energy landscape, with applications from transport and microgeneration to storage and distribution.
- 5.2 In addition, they offer flexible and adaptable solutions to many key challenges and can work in conjunction with other technologies, such as batteries, to maximise benefit.
- 5.3 There is clear need for further investment if the full benefits of the technology are to be realised. A long term view needs to be taken to ensure that the solutions are available as the UK moves towards a low carbon economy.