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analyst view

Fuel Cells in Future Energy

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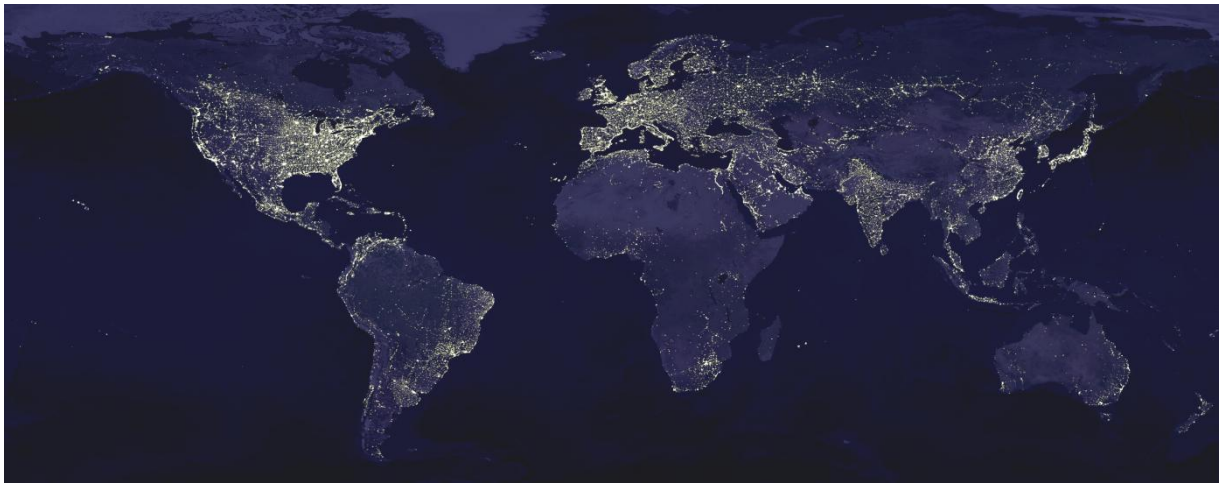

NASA Visible Earth

Any standpoint on where the global energy supply is headed is sure to elicit heated debate. Without getting into this, it is relatively uncontroversial to say that the 'era of easy energy' is drawing to a close and we are likely to feel the pinch sooner rather than later, probably before 2050 rather than after it. Whether the pinch will be delivered by climate change, spiralling global energy demand, peak oil or a combination of these factors is, like the timing, an open question.

Substitute energy sources are, of course, already being employed. Natural gas is emerging to take over from oil but it is also a finite resource and we need to take care to use it in a more sustainable way than we did oil. Renewable energy sources will help solve our emissions problem and are also (by definition) resources we are unlikely to exhaust: the sun will continue to shine, the wind will continue to blow, etc. – but they are not nearly as easily harnessed as oil, or as versatile.

To mitigate the economic impact of these issues we need to decouple global economic growth from energy consumption, not just from carbon dioxide emissions. Preferably, we also need to develop a substitute energy system that is as 'easy' as the oil economy is. The first condition dictates much greater energy efficiency, from the way that we convert the energy to its usable form to the way that we consume it, and the second dictates the use of energy carriers that are flexible and versatile.

As energy costs rise, the relative advantage of the high energy conversion efficiency of fuel cells will grow and the business case will strengthen accordingly (and this will occur alongside the expected reductions in manufacturing cost). In addition to being more efficient in end-use, fuel cells can also facilitate increased efficiency in harnessing energy. In previous Analyst Views we have discussed how excess energy from variable renewable sources can be used to generate hydrogen by electrolysis.

In addition to the flexibility this allows, capacity utilisation of the installed base is increased – just as important a consideration as grid integration.

In addition to better efficiency, fuel cells also allow for cleaner use of natural gas: when fuelled with natural gas the high-temperature variants naturally produce a very pure stream of carbon dioxide as waste, which facilitates efficient carbon capture. Arguably, with appropriate technology, the best treatment for any hydrocarbon (whether coal or biomass) will be to gasify it to produce syngas, use the hydrogen in a fuel cell and sequester the carbon dioxide. If hydrogen produced by steam methane reforming with integrated carbon capture is used in vehicles the emissions burden per unit of energy will be significantly lower than for petroleum, while all the convenience of rapid refuelling and range is retained.

The flexibility of fuel cells will be another significant plus: they can be used with liquid or gaseous fuels derived from biomass, waste or renewably-driven electrolysis to convert stored energy to electricity, heat or motion as required, in a way that parallels the convenience of oil. The technology also offers unmatched versatility in the range of scales at which it can be used and the fact that it lends itself to 'intelligent' distributed generation.

The future energy system will see a host of solutions employed, using energy carriers from a variety of sources. I believe fuel cell technology will be key in creating a fully integrated system that operates in the most flexible and efficient way.

Marge Ryan Market Analyst
margeryan@fuelcelltoday.com
www.fuelcelltoday.com