

All aboard the hydrogen highway

It takes nerve to set up a business promoting alternative energy in the Middle East. Even more to try to get the oil and gas industries to take an active role



"We do not believe that hydrogen competes with oil and gas" -
Dr Homan Albaroudi

Dr. Homam Albaroudi is Managing Director of the Middle East Forum on Fuel Cells and Hydrogen Economy (MEFH) launched in early 2005. MEFH is the first company dedicated to the promotion of fuel cells and hydrogen fuel in the Middle East.

A recognised expert in the field of fuel cell thermal management, Dr Albaroudi says his aim with MEFH is to persuade the oil and gas rich Middle East region to embrace the emerging hydrogen economy. He says a better understanding of hydrogen's potential role will maximise us of the region's hydrocarbon fuels, benefit the Middle East economically, and lead to a cleaner environment for all. He speaks here to Future Fuels editor Nigel Armstrong.

Why MEFH? What was the rationale behind setting up such an organization in a region that has the world's greatest abundance of cheap, traditional energy?

This is a very legitimate question, and the one I am most faced with, because sometimes people seem to question our sanity! They ask how we dare promote a competing, alternative fuel such as hydrogen in a

region that sits on two-thirds of the world's reserve of oil and gas.

We do not believe that hydrogen competes with oil and gas, because no one thinks that the energy industry will switch completely to hydrogen and leave the traditional fuels in the foreseeable future. In fact, the best source for hydrogen, and the most feasible in the short term, based on current reforming technologies, is traditional hydrocarbon fuels such as natural gas and propane. This means that the demand for fossil fuels will only go up.

In addition, the fact that fuel cells systems have a higher efficiency than internal combustion engines and other existing power generating technologies, means the use of traditional hydrocarbon fuels will be optimum and will last longer.

We look at hydrogen fuel as another source of energy that humanity will depend on, along with other renewable energies, for its survival for centuries to come and for when the finite oil and gas finally do run out.

So to sum it all up briefly, our rationale is based on our belief that for a faster commercialisation of fuel cells that run on hydrogen fuel, we need the oil and gas industry to come on board, help build the

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necessary infrastructure for hydrogen, and share in reaping from the hydrogen economy. We need good friends in the Middle East!

What are the biggest challenges facing the adoption of the hydrogen economy concept in the Middle East? And what are the biggest opportunities?

The biggest two challenges worldwide, that every region shares, are the lack of a hydrogen infrastructure, and the high cost of the fuel cell systems so far.

Some countries such as the US have other motives like energy independence. Some consider the safety issue as a major obstacle. But with proper handling and storage, hydrogen is much safer than many other fuels that are widely in use.

There are several technical challenges, but these are manageable. We hear about technical breakthroughs and advancements all the time – such as the ability to achieve a higher power density in the fuel cell stack, enhanced reforming systems, the use of advanced materials, and very recently introducing nano-technology to achieve a better performance.

An additional major challenge, particularly in the Middle East, is the false myth that many regional policymakers and oil and gas executives have that hydrogen will replace the oil and gas, and must be resisted.

The Middle East, and particularly GCC countries, need to revisit this issue and look for the huge opportunities that the hydrogen economy may bring to the region.

Though hydrogen is the most abundant element on earth, it is always bonded to other elements to make up unique materials such as water or methane. As a result, some kind of reforming (cracking the bonds between hydrogen and other elements) is needed to get hydrogen.

The main source of hydrogen in the foreseen future will come from hydrocarbon fuels that GCC countries are very rich with.

What changes have you seen in attitude towards hydrogen energy in the Middle East market since MEFH2005 last year, since you began promoting hydrogen energy in this region?

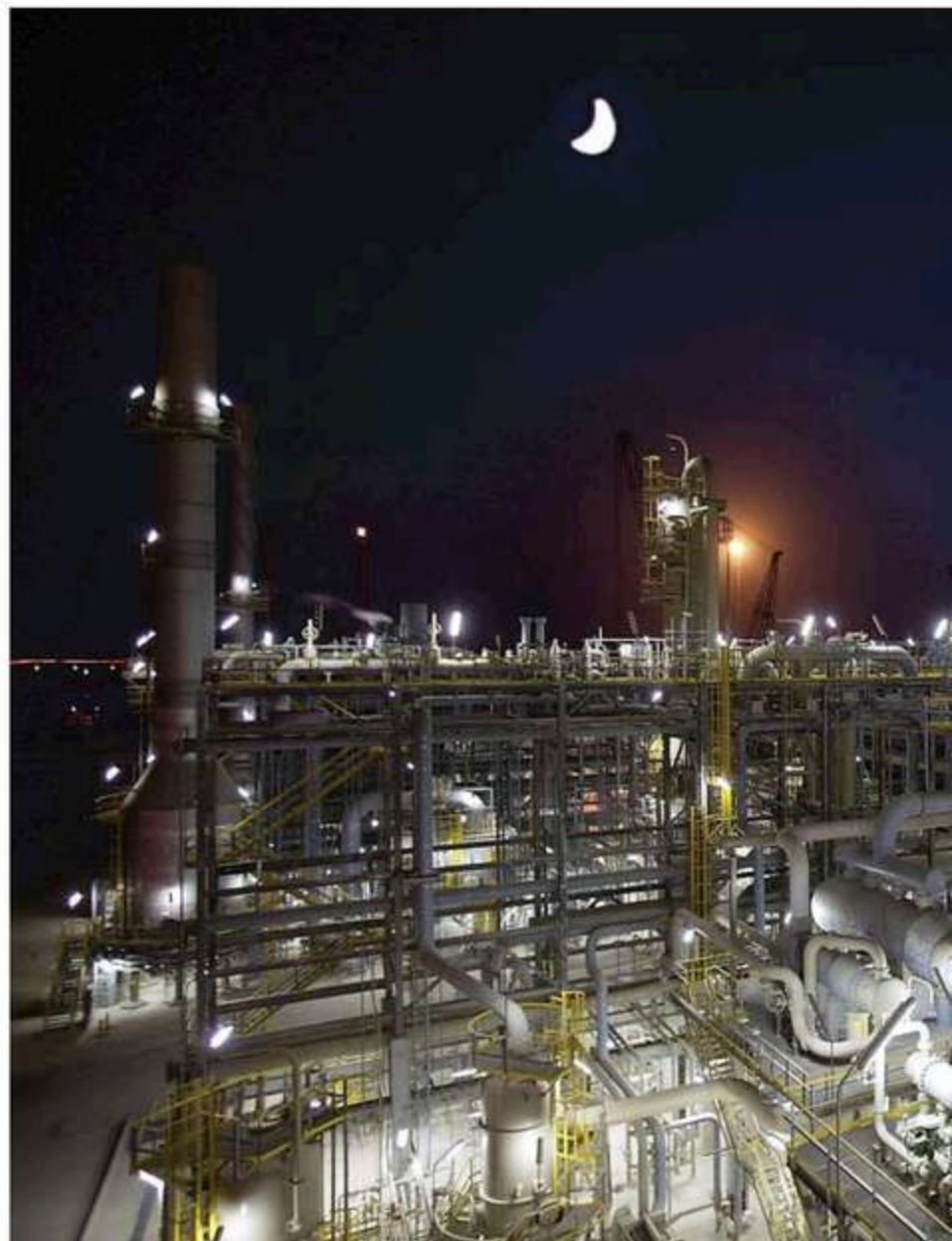
I would say the success was on two fronts, the first one is in the Middle East as more and more policy makers, energy executives, engineers, and academicians became more aware of the facts and

myths of hydrogen. This happened through the course of many meetings, presentations, seminars, and the annual conference.

Education seems to work. The event helped build bridges between researchers, academicians, businesses in the region and their counterparts, and companies worldwide. We already have a few technical papers from regional institutions that are submitted for presentation in this year's event in Bahrain.

Having a regional event on fuel cells and hydrogen gave a boost to R&D activities and a forum for the exchange of ideas in the region. A few individuals who attended last year's conference were encouraged and have started Emirates Hydrogen Society, the first society of its kind in the region.

The other front is an increasing interest in the region from fuel cells companies worldwide that resulted in two companies opening offices in a couple of GCC countries in recent months, and more are planning to expand in the region. These business relations will bring regional investors and businesses into the picture, which will push hydrogen fuel and fuel cells further.



There are already talks on pilot projects for hydrogen buses, and I am aware of a very recent couple of fuel cells installations as backup systems for a major regional telecommunications company. These are just a few successes since last year.

What is your forecast for uptake of hydrogen energy over fossil fuels in this region?

I believe there will not be a noticeable effect in the short term since the potential fuel cells applications that will go to market first in mass volume will most likely be for cell phones, laptop computers, and similar IT and electronics devices. The fuel cells systems will compete with the battery market in the short term.

In the following stage (five to 20 years), I believe stationary applications such as buildings, houses, and even small, distributed power generation, will be the main market for fuel cells particularly in regions like China and India.

Natural gas and propane will be the main source of hydrogen, which may have a positive effect on gas-producing countries and companies. The real effect

will be in the long term (more than 20 years) when the transportation applications are expected to hit the market in large volumes.

It is hard to speculate what kind of effect, positive or otherwise, this may have on the oil and gas industry because first, the automakers keep delaying their starting time for the mass production of fuel cells cars - currently they're saying 15-25 years from now - and also no one is sure yet where the hydrogen will come from to supply the expected huge demand from millions of fuel cells cars.

The technology to extract hydrogen from oil is well known, but it is more expensive and complicated to extract it from natural gas. Hydrogen comes from other sources, such as biomass. And maybe, to a lesser extent, coal could be a serious competitor to oil and gas in making hydrogen, in the long term and in certain geographical regions, but not in the worldwide market.

The oil and gas industry may need to invest in R&D for hydrogen reforming early on to prove, and maybe to push, the concept that it is a viable alternative. It will be interesting to see, if we live long enough, the effect of the hydrogen economy on the oil and gas industry in the global market.

What other benefits can hydrogen fuel cells offer the Middle East?

The Middle East can continue leading the world's energy sector, regardless of whether it's in oil, gas, or something else. The main source of income to the GCC countries is oil and gas so far, and any disruptive technology such as fuel cells or alternative fuel like hydrogen may affect the welfare of the region if policy makers keep a neutral stand, or bet on the world addiction to fossil fuels.

I would recognise and applaud two recent initiatives in the region that have a forward thinking and clear vision in this matter. First, the Energy City Qatar in Qatar, and second, Al Masdar initiative for renewable energy in Abu Dhabi.

If a hydrogen economy will be a nonrenewable economy at least for the foreseeable future, because hydrogen made from fossil fuels is far cheaper than hydrogen made from renewable energy, what are the alternatives to making hydrogen from fossil fuels and at what stage of development are they?

The main source of hydrogen in the foreseeable future will come from the hydrocarbon fuels the GCC countries are rich with





Qatar's
\$2.6 billion
Energy City
is a forward-
thinking
initiative

Most worldwide programmes for generating hydrogen from renewable sources are still either in the R&D stage or, at best, pilot projects. A heavy investment in R&D is needed to come up with a technically sound solution that is also economically feasible.

The question is who is going to fund such work, and why? I would say for decades to come, hydrogen in mass production will still be generated from fossil fuels. But the Middle East is very rich in solar energy, which may mean that the Middle East will be a winner in all cases!

Fuel cells hold the promise of readily available fuel and lower emissions. But if auto makers are 10-15 years away from making them commercially realistic in consumer automobiles, when will we get to the stage when they supersede the internal combustion engine, and what are your thoughts on the transition?

There are several fleet fuel cells cars from Japanese automakers that are on roads at this time, in addition to other cars from GM, Ford, and European automakers.

California is working on a hydrogen highway where fuel cells cars can readily get fuel, as long as they drive close to this particular highway. GM is working to be the first automaker to produce one million fuel cells cars per year that run on hydrogen.

Many experts believe the first market for fuel cells cars will be China, because China's infrastructure for transportation is not developed yet, and hydrogen infrastructure can be integrated early on. These are just a few programs and plans.

Also, automakers have been seriously affected by the high price of oil, and the strict environment laws they need to meet, or will need to meet in the near

future. Many believe that very successful hybrid cars are just an intermediate stage toward fuel cells cars.

All in all, I would expect to see fuel cells cars available to customers, as we see hybrid cars these days, in 15-20 years. The internal combustion engine will be with us for a long time, and may never be completely replaced.

It seems that the EU and the US are beginning to diverge in the most basic aspect of how a society is organised: its energy regime. While the EU is looking to the future and energy alternatives, the US seems to be desperately holding onto the past in its pursuit of energy solutions based on hydrocarbons, whether from fossil fuel or biofuels. Where does this leave the Middle East?

Though I agree that the EU is more progressive in renewable and alternative energy than the US, I would not categorise the US policy toward renewable and alternative energy as holding onto a past that is based on hydrocarbon.

There are many initiatives in the US at the federal, state, and even city and county levels that deserve applause. But they are not enough, and much more needs to be done.

Regarding the Middle East, my observations suggest that no trend has been formed yet in either direction. There are few good initiatives in the region, but they do not form a trend.

I would say that in the next few years, with Kyoto on the horizon and more environment awareness, we will start to see more and more interest in renewable and alternative energy that will hopefully form a positive trend in the adoption of renewable energy as a strategic energy goal in the Middle East.

The MEFH2006 exhibition and conference will be held in Bahrain on December 5 and 6. For more information, visit www.me-fuelcells.com