

KDN PP 11720/4/2013 (032270)

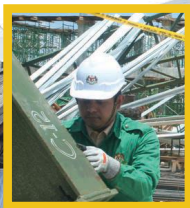


LEMBAGA JURUTERA MALAYSIA
BOARD OF ENGINEERS MALAYSIA

THE
VOL.76
OCTOBER-DECEMBER 2018

INGENIEUR

MAGAZINE OF THE BOARD OF ENGINEERS MALAYSIA



FORENSIC ENGINEERING



Hydrogen Based Economy – Are We Ready?

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The Hydrogen Economy refers to the use of hydrogen in delivering energy. The elements of a hydrogen based economy are similar to that of the conventional fossil fuel based systems where issues such as production of hydrogen, delivery, storage, conversion technology, applications of such systems, safety issues, codes and standards dominate the feasibility and sustainability of the hydrogen based economy. The vision of Hydrogen Economy stems from the need for clean energy, which is energy that does not pollute the environment. The concept has been around for quite some time but has been hampered mostly by economic reasons and relatively little understanding of the benefits of this system. It took decades for the transition from a coal based energy system to the current fossil fuel based one and it is expected that the scenario will not be much different for the hydrogen based economy.

The world's energy landscape is now in transition from a carbon based system to a hydrogen based economy. Leading the way is Japan with its ambitious plans and vision for the creation of a Hydrogen Society. Such a transition requires appropriate planning and solid support from policy makers, public and industry players. Hydrogen and fuel cells are seen as the key solutions to the world's growing concerns about energy security, energy supply and environmental issues especially greenhouse gas emissions.

Malaysia is blessed with a large amount of fossil fuel reserves and it will still remain the dominant energy source for some time to come.

Nonetheless, efforts in securing other sources of energy, particularly renewable energy, are ongoing and actively supported by many Government policies. Hydrogen economy comes into the picture by providing a sense of security to the nation's energy mix. The Government has also committed to a 40% reduction in the emission of greenhouse gases by 2020 compared to the levels in 2005. The use of hydrogen in fuel-cell systems has proven to be a source of clean technology where the system converts chemical energy from hydrogen rich fuels into electrical power and only emits water as its by-product. The technology has been commercially available but its use is not widespread due to economic consideration, lack of infrastructure and public awareness. Nevertheless, it suits the aspirations of the Government despite the need for a strategic roadmap and the long haul transition to a hydrogen economy and to minimise any disruption to the existing eco-system.

The economic point of view is always the deciding factor in any business venture. The production of large quantities of hydrogen for the purposes of transportation and power generation via fuel-cell technology is a very challenging task. In Malaysia, the commercial application of fuel cells in transportation and power generation is non-existent except in some small scale demonstration projects by local universities. Hydrogen itself does not exist naturally but is produced from other sources like biomass and fossil fuels in a steam reforming process and also by splitting water through electrolysis.

In this aspect, Malaysia is not far behind as several power plants in operation are employing gasification processes which produce hydrogen as a gaseous product. The existence of these mature technologies would support the supply of hydrogen in the market whilst the application of fuel-cells in transportation such as in fuel-cell cars, buses, ships and even in stationary power plants, would spearhead the demand for hydrogen. It will not be long before hydrogen dominates the transportation sectors as companies are now investing heavily in fuel-cell cars. Most Japanese automobile companies already have their respective fuel cell car projects. Toyota recently launched its Mirai which is very competitive in terms of efficiency, fuel consumption and low emission rates. To facilitate the realisation of this vision, the Japanese Government has introduced a subsidy programme of up to 3 million yen for every purchase of a fuel-cell vehicle. For Malaysia to achieve its vision of a sustainable and pollution free society, this technology must be promoted extensively and incentives should be given to the players involved.

The delivery of hydrogen to the mass market is one of the factors that needs to be looked into. Even though it requires extensive capital investment, infrastructure and distribution systems must be put in place. Current hydrogen delivery methods in Malaysia include tube trailers transporting the gas in the form of compressed and liquid hydrogen. In the future, pipelines carrying hydrogen to the distribution centres or power generation plants are expected to be built. Petrol stations will be substituted with hydrogen filling stations. Such scenarios are already happening in Japan where the Government has supported the development of 100 self-service hydrogen refuelling stations. It has been reported that companies such as Air Liquide of France, and JX Nippon Oil and Energy Corp, Tokyo Gas Co and Iwatani Corp of Japan are actively participating in building these infrastructures. It is also very interesting to see if efforts by Iwatani Corp seeking a partnership with 7-Eleven Japan will bear fruitful results for the possible development of hydrogen refuelling at their convenience stores. The cost of each refuelling station is understandably high and thus the priority is to reduce this construction cost and it is possible that the cost may be reduced



Photo 1: A typical hydrogen refuelling station during a visit to Kyushu University, Japan in 2012.

through integration with existing petrol stations. A typical hydrogen refuelling station is depicted above. The picture was taken during a visit to Kyushu University in 2012.

Another promising application of fuel cells is in stationary power generation plants in residential and commercial buildings. It was reported that 100,000 fuel cells for homes and office use have been installed in Japan and the statistics are rising with the support from the Ministry of Economy, Trade and Industry of Japan. Though it might take years before Malaysia completely forgoes fossil fuels in power generation, the immediate next step could be the blending of hydrogen with liquefied natural gas (LNG) in conventional power stations. Even though it may be small steps, it is necessary to stimulate the development of hydrogen economy in the country. The success of this programme will depend on the commitment of all stakeholders and the introduction of attractive policies by the Government. Most of the research and development programmes are currently being conducted by local universities through collaboration with foreign institutions. For instance, Centre of Hydrogen, Universiti Teknologi Malaysia has been working together with researchers from Japan, Germany and Canada in this field. The Centre is the authority in hydrogen and fuel cell research and development, with an excellent track record in publication, research facilities and the development of human capital. ■