



Half Day Seminar on Hydrogen Economy from the Perspective of an Engineer

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The Electrical Engineering Technical Division organised a half day seminar on “Hydrogen Economy from the Perspective of an Engineer” by inviting two experienced speakers from the industry, Professor Dato’ Ir. Dr. Wan Ramli Wan Daud and Ts. Dr Lim Kean Long on 18 March 2023. This article will focus on Ir. Dr Wan Ramli Wan Daud’s talk.

Ir. Dr Wan Ramli Wan Daud first started with the global context. The current World energy supply stood at 571.4 EJ, with energy consumption at 392.9 EJ. Almost 80-90% of the energy supply is coming from fossil fuels. Years of global warming, carbon emissions, threats from climate change, had led to COP21 Paris Agreement for all nations to strengthen the global response to keep the global temperature rise to below 2°C. Mitigation measures have been widely discussed, studied, or put into actions, for examples, energy efficiency improvement at existing industries, development of carbon capture, utilisation and storage (CCUS) technology, diversification of fuel resources with low and zero emission energy, increasing use of renewable energy (RE): biomass, biofuel, solar, wind and eventually Green hydrogen energy.

In the local context, carbon emissions from Malaysia had increased from 122.9 million tonnes of carbon (Mtc) to 257.8 million tonnes of carbon (Mtc) in 1999-2018, growing annually at 4.09%. Malaysian had proposed Intended Nationally Determined Contributions (INDC) to United Nations Framework Convention on Climate Change (UNFCCC), 2015 which is 45% reduction of per capita carbon emissions by year 2030 based on year 2005 level, with a breakdown where 35% from own initiatives and 10% from climate finance, technology transfer and capacity building from the developed countries (UNFCCC, 2015). If Malaysia were to implement its INDC, it has to reduce carbon emission by 160 Mtc in 2020, 570 Mtc in 2060 and 1000 Mtc in 2100. CO₂ concentration will then stabilise to 570 ppm by 2060 from 400 ppm in 2020. Temperature rise, meanwhile will stabilize at 2°C after year 2060. Comparatively, Malaysia’s INDC, if implemented, will be able to reduce cumulative climate damage to RM 5.264 trillion by year 2110, which is significantly less than RM40.128 trillion if Malaysia chooses to do nothing at all.

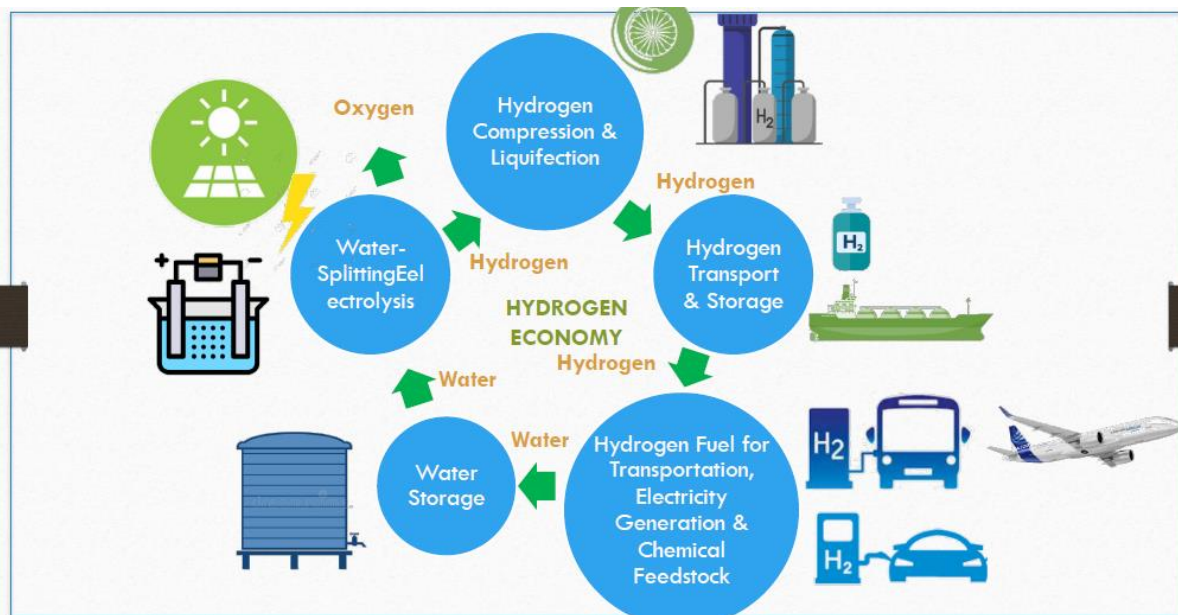


Figure 1: Simple Illustration of the Hydrogen Economy Cycle

Given the big picture, Ir. Dr Wan Ramli then introduced us to Hydrogen energy. Hydrogen is the simplest of element containing one proton and one electron. It normally exists as a diatomic gas with the formula H_2 at atmospheric pressure and $25^\circ C$. There are many myths surrounding hydrogen. He shared that most of the myths about hydrogen as a hazardous fuel have been shown to be based on misunderstanding of the hazardous events that supposedly involved hydrogen explosion or fire but in reality, did not.

He brought us to different terms of hydrogen, in colour, as normally referred in the industry in describing how hydrogen is sourced. Grey hydrogen from fossil fuel and Blue Hydrogen from fossil fuel with CCS/CCU both create low carbon clean energy. On the other hand, Green Hydrogen from Renewables creates Zero Emission Clean Energy. After sharing the size of the global hydrogen economy, Ir. Dr. Wan Ramli spoke on the cost of green hydrogen production, electrolyser's market demands and cost of hydrogen. He later dwelled into the different types of electrolysers and provided a manufacturing cost comparison between the electrolysers. Followed by the electrolyser system manufacturing cost. The different types of fuel cells and their respective applications were also introduced.

Economies of scale due to large domestic and international markets has provided a strong growth in global fuel cell shipments in terms of MW at 20% per year. Most of growth observed in year 2018 was due to fuel cell cars, but stationary applications also grew significantly. If global industry is to grow competitively across wider range of applications, it must reduce cost of input factors and manufacturing cost and strengthen supply chain for a range of different technologies. Clearly there is growing opportunity for Malaysia to take part in fuel cell components manufacturing, initially for export, taking advantage of its cheaper skilled and knowledge workers.

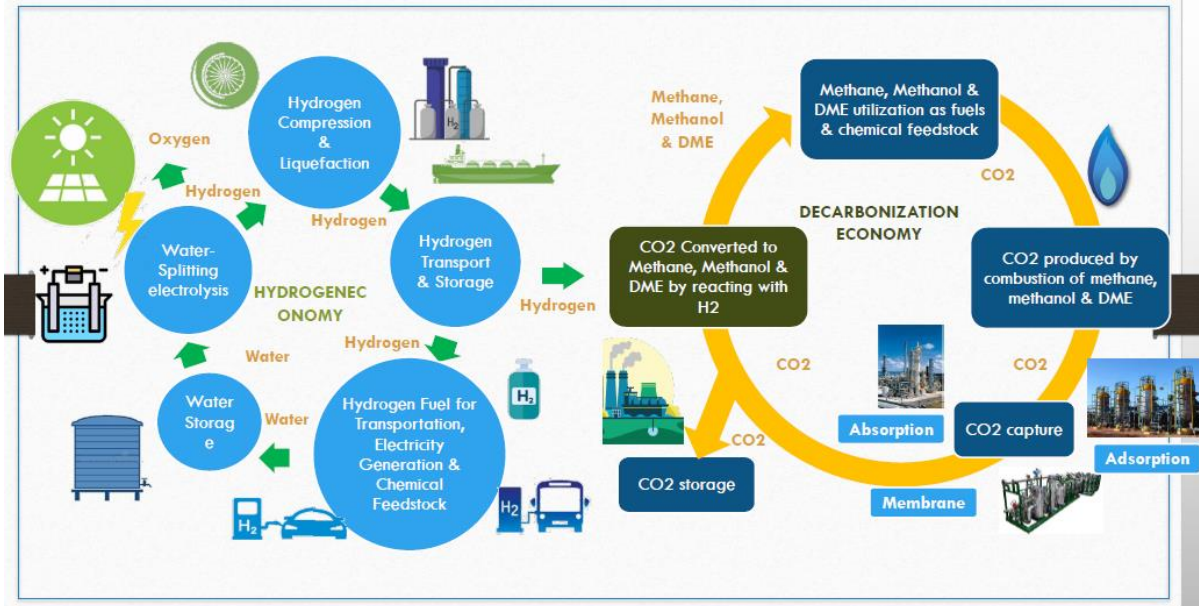


Figure 2: Two Circular Intertwining Economies

The proposed hydrogen economy roadmap for Malaysia was discussed together with citing proposed green hydrogen and fuel cells demonstration projects in Malaysia. The methodology of establishing hydrogen economy in Malaysia was also mentioned. Ir. Dr Wan Ramli also stated several research undertaken by several local institutions of higher learning on green hydrogen, fuel cells and electrolyser products. He also revealed potential hydrogen production sites and the distribution network in Malaysia. He gave examples of some initiatives undertaken by local multinational organizations. He also shared the background to the hydrogen supply to Japan. Next, he displayed the South East Asia's and Malaysia's first hydrogen refuelling station in Kuching Sarawak. The Malaysia-Japan collaboration project H2ORNBILL was also brought to light.

In his concluding remarks, he mentioned that the Malaysian Government is committed to reduction of carbon emission intensity by 40% in 2040. Hydrogen Economy offers the best solution to meet Malaysia carbon emission target.