Title: The Role of Turquoise Hydrogen in Renewable Energy Scarce Countries

Synopsis

Among 101 countries, Singapore was ranked 34 in Energy Trilemma Index 2021, in which the country scored D in Energy Security unveiling its vulnerability in energy security. Along with energy security and environmental sustainability, the speaker will share the energy plan of the country and the importance of emerging low-carbon alternative energy including hydrogen in addressing the local and global issues. Hydrogen Economy has been emerged strongly as a vision not only to decarbonize the global economy but offering energy security solution as hydrogen can be derived from almost any hydrogen containing sources such as water. When hydrogen is oxidized to produce energy, it releases water as the sole by-product. Hydrogen Economy is not an easily understood concept, not to mention the challenges in implementing it at scale because it involves two separate supply chains, i.e., the hydrogen supply and the energy conversion system supply. Only when the two supply chains are met with affordable costs of hydrogen and energy conversion system, then hydrogen economy can fully take off. In a renewable energy scarce country such as Singapore, the use of renewable energy to produce hydrogen is limited, while importing hydrogen from overseas is not cost effective at present. Currently, steam methane reforming (SMR) is one the most popular and cost-effective hydrogen production technologies globally. However, the process emits significant amount of CO_2 that go against the carbon reduction intent. Carbon Capture and Sequestration (CCS) is not always implementable in country such as Singapore due to its geographical constraint. The alternative is to split methane (or natural gas) into turquoise hydrogen and solid carbon, producing no or negligible CO_2. The splitting process is either by direct thermal decomposition of methane or by catalytic decomposition of methane, generally known as methane cracking or methane pyrolysis. This keynote speech is focused on methane cracking technology, including its challenges and opportunities.

About the Speaker

Dr CHAN Siew Hwa is a Fellow of Academy of Engineering, Singapore (SAEng), a Fellow of ASEAN Academy of Engineering and Technology (AAET), President's Chair in Energy and a professor in Nanyang Technological University (NTU). He joined NTU in 1991 after obtaining his PhD and subsequently working as a post-doctoral researcher at Imperial College London. He leads the hydrogen and fuel cell research at Energy Research Institute @ NTU. Since 2017, he has been appointed as Senior Vice President of China-Singapore International Joint Research Institute in China-Singapore Guangzhou Knowledge City, focusing on incubation and commercialization of technologies. Dr Chan has been active in serving academic & research communities and industries such as Singapore's covering focal point for the Sub-committee on Sustainable Energy Research (SCSER) under the ASEAN Committee of Science, Technology, and Innovation (COSTI), Ministry of Trade and Industry (MTI) Singapore's Future Energy Technology (Hydrogen) Watch Group, Governing Board of Centre for Hydrogen Innovation at National University of Singapore , Advisory Board of Total SA and Sydrogen Energy, etc. He is also active in commercialization of technologies including 12 technology licensing. Dr Chan was a Director of Maz Energy Pte Ltd (2004 – 2022) with core business in nitroparaffin-based

fuel additives and founded Xin Xiang (Guangzhou) Hydrogen Technologies Co., Ltd., which is a tech-company manufacturing key components of PEMFC. He has published ~300 refereed journal papers with total citations of >15K and h-index of 64. He was a recipient of NTU's Teacher-of-the-year, Nanyang Award (Research Excellence), Nanyang Award (Innovation Entrepreneurship), George-Stephenson Medal from IMechE, UK, Outstanding Scientific Achievement from International Association of Hydrogen Energy (IAHE), USA, Star of Innovation Talent award from Guangzhou government, World's Most Influential Scientific Minds from Thomson-Reuters, etc.