Fourth Annual EPRI-IEA Expert Workshop on Electricity Decarbonisation

#### An Industrial Perspective on Hydrogen Energy

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- Established in 1999
- Implements "Business-oriented" research and analysis which provide Mitsui with Longterm business vision.
- Extensive field covering economy, politics, society, industry, enterprise, technology and innovation.
- 100 employees based in Tokyo and 7 offices in the world(Washington, NY, Dusseldorf, Brussels, Beijing, Singapore)

#### CO<sub>2</sub> Emissions in Power Sector of Japan

- Based on the Paris Agreement, Japan aims to reduce GHG emissions by 26% from FY2013 toward FY2030.
- The Federation of Electric Power Companies of Japan announced the energy mix plan for 2030, under which the CO2 emissions in power sector should decrease by 35% of those in FY2013



#### "Hydrogen and Fuel Cell Strategic Roadmap" in Japan

- "Hydrogen and Fuel Cell Strategic Roadmap" was set in 2014 and revised in March 2016.
- Japan takes three-step approach toward the hydrogen society, (1) the dramatic expansion of hydrogen utilization, (2) the full-fledged introduction of hydrogen power generation and establishment of a large-scale hydrogen supply system, and (3) the establishment of a totally CO2-free hydrogen supply system.



#### Source: METI, 24th IPHE SC Meeting(2015.12)

#### Potential Resources of Hydrogen

- To realize to procure "CO2-free" hydrogen in 2040, Japan looks for clean and cost competitive hydrogen resources globally.
- The availability of CCS and CO2-EOR technology is essential to integrate with conventional hydrogen production.
- In a short term, water electrolysis powered by low-price electricity is the most promising technology to produce CO2-free hydrogen at a scale.



#### Hydrogen Supply Chain from Overseas

• Recognizing the technologies of marine transport and hydrogen combustion are the key in large-scale hydrogen supply chain, NEDO supports the four projects, two for hydrogen carrier (MCH and Liquefied hydrogen) and two for hydrogen combustion at power plant.



### Organic Hydride (MCH) as Hydrogen Carrier



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- By-product hydrogen from methanol refinery in Brunei is transported to Japan in the form of MCH.
- Decomposing MCH, take hydrogen and fuel to captive power plant at refinery complex in Kawasaki City





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#### Hydrogen Production Strategy with Electrolysis

- Economy of electrolysis depends on if its system can (1) reduce initial investment cost, (2) increase load factor with intermittent input, and (3) scale up plant capacity
- At production site, low-price electricity must be available at high rate.



#### Industry Perspective on Hydrogen Supply Chain

- Technology for hydrogen transport across the sea using MCH/toluene cycle and liquefied hydrogen will be proven in the beginning of 2020's, as well as hydrogen combustion at gas power plant. However, the commercialization by private sectors depends on the government incentive scheme supporting fuel cost.
- Decarbonisation of hydrogen production process is essential so that hydrogen resources without CO2 emissions should be secured globally.
- In a short term, electrolysis is the most promising technology with lowprice electricity at high availability. Still, technology on scaling-up capacity and system integration with variable renewable energy must be developed.
- In a mid-to-long term, **CCS and CO2-EOR** can be solutions, which should require the strong support by the governments to realize.

## Thank you very much!

