

Day-2 International Conference of Green Hydrogen 2023

Plenary Session-3: Japanese Perspective

Speakers: Mr. Atul Kumar Tiwari (Secretary, Ministry of Skill Development and Entrepreneurship)

Dr. Eiji Ohira (Strategy Architect- Fuel Cell & Hydrogen, Advanced Battery & Hydrogen Technology Department, NEDO, Japan)

Key Highlights of the session:

1. Day-2 of the ICGH-2023 started with the plenary session, where Mr. Atul Kumar Tiwari, Secretary, Ministry of Skill and Development and Entrepreneurship talked about the importance of skilling, up-skilling and re-skilling. He mentioned that with the help of Skill demand analysis many job roles have been developed. By Dec 2023, 40 more hydrogen job roles will be developed. Green Hydrogen Courses will be released with IIT.
2. Japanese perspective on Green Hydrogen were presented by Dr. Eiji Ohira, a Strategist Architect at NEDO, Japan where pursuit of new options such as Hydrogen, ammonia, CCUS/ carbon recycling to promote more renewables options were discussed. They have a 2050 vision to position hydrogen as a new energy option. Prioritizing a strategic areas
(Electrolysis, Hydrogen supply Chain, Fuel Cells, Power generation, etc.).
3. He discussed their short, mid and long term goal to promote hydrogen in Japan by 2050. Their Comprehensive approach where first Fundamental/Applied Research, Secondly Field test/ Demonstration and thirdly Regulation, code and standard certification. He mentioned that they have gas based economy in Japan and they would like to make Hydrogen but by importing the same from other countries.
4. They revised the strategy in 2023
 - Target hydrogen production- 12MMT by 2040
 - Definition of low carbon hydrogen- <3.4 kg CO₂e/kg H₂
 - Plans in place to promote hydrogen- supply side and demand side

Plenary Session-4: Australian Perspective

Speakers: Mr. Pankaj Agrawal (Secretary, Ministry of Power) and Ms. Sarah Storey (Charge d affaires, Australian High Commission)

Key Highlights of the session:

1. Mr. Pankaj Agrawal, Secretary, Ministry of Power highlighted the promising advancements in green hydrogen.
2. Strong strategy relationship in place between India & Australia- Green Hydrogen Task Force formed
3. Australia's Climate Change Framework 2022
 - Net Zero by 2050, AUSD 20 billion to rewire the nations electricity grid
 - GHG reduction by 43% of 2005 levels by 2030
4. Budget 2023-24- Hydrogen head start programs (AUSD 2 billion) and H₂ hubs initiatives (AUSD 5.6 billion)
5. Australia's Hydrogen Projects
 - 100+ announced green hydrogen & green methanol and ammonia projects

- 15+ projects reached final investments decisions
- AUSD 230-300 billion investments are in the pipeline

6. They have global collaborations with Japan, Korea, Singapore, UK, US, India, Germany and so on..

Session 3A: Hydrogen Infrastructure & Compatibility

Speakers: Mr. Sunil Kumar, Joint Secretary, MoPNG, Government of India (Session Chair)

- Mr. Rajiv Agarwal, Director – Technical, Engineers India Ltd
- Dr. C Kannan, Executive Director – R&D, Indian Oil Corporation Ltd
- Mr. Abhinav Arora, Vice President – EPC Projects, HAL Offshore Ltd
- Dr. Hubert Mäncher, Managing Director, Magnum

Key Highlights of the session:

1. Highlighted main concerns or gaps for the transportation of pure hydrogen through pipelines, such as suitability of existing equipment, materials required for construction, development of gas turbines for pure hydrogen, leak detection systems, and the standard codes & regulations.
2. The session further discussed the damage mechanisms of hydrogen in metals at high & low temperatures, trapping due to diffusion, blistering, embrittlement, cracking, and fissures due to reactions at high temperatures.
3. Studies by IOC R&D highlighted the interplay between environmental variables, materials & stress mechanisms in understanding hydrogen embrittlement
4. Screening methodology for the evaluation of in-service pipelines is the need of the hour
5. Studies in Germany propose the transport of hydrogen in existing CNG pipelines with a mixing ratio from 15% to 25% to utilize existing infrastructure to save capital costs.
6. The need for professional tools like 'Computational Pipeline Monitoring' for monitoring of in-service pipelines based on specific algorithms & conventional measuring devices for flow, temperature, and pressure was also raised.

Session 3B: Hydrogen Infrastructure & Compatibility

Speakers: Mr. K R Jyothish, Principal Secretary, Transport Dept., Govt. of Kerala (Session Chair)

- Mr. Ghanshyam Prasad, Chairperson, Central Electricity Authority
- Mr. Kapil Maheshwari, Executive Director & CEO, Welspun New Energy Ltd
- Mr. Anirudh Gautam, Executive Director, RDSO - Indian Railways
- Mr. Shardul Kulkarni, Chief Executive Officer, Deesha Power Solutions

Key Highlights of the session:

1. Transport holds 70% of diesel consumption. The blending of hydrogen-derived derivatives with diesel has great potential.

2. Presented the need for indigenous component manufacturing and H₂ generation (upstream), Conversion and distribution (midstream), and end use (downstream). For long-range transport, cryogenic tanks may be considered.
3. To ensure round-the-clock renewable electricity availability pumped storage hydropower, batteries with different chemistry are to be considered.
4. Methanol and DME are good carriers for hydrogen transport in view of the cost associated with the transport of gaseous hydrogen or liquid hydrogen.
5. Indigenous development/manufacturing of components present in the hydrogen value chain is essential.
6. To increase hydrogen demand, in addition to refining fertilizer sectors, the use of hydrogen for power generation may also be considered.
7. India-centric Life cycle assessment of different transport modes of hydrogen to be carried out.
8. The session also discussed H₂ characteristics, risks during H₂ logistics & transportation, and strategies for risk mitigation.
9. Que to wider LEL-HEL band compared to natural gas (NG), the probability of fire is ~6 times higher than NG. Although the probability of a hydrogen leak is less but severity is high.
10. Central Electricity Authority highlighted and the government is taking steps to ensure the availability of green power to all green hydrogen and ammonia production plants
11. To tackle the intermittent nature of renewable energy (RE), pumped hydro storage and nuclear may need to be focused.
12. Taking steps to waive off license requirements for laying dedicated interstate transmission lines. Focus on SEZ development to balance supply and demand.

Session 3C: Codes, Standards & Regulations

Speakers: Mr. Rajeev Sharma, DDG Standardization-I, BIS (Session Chair)

- Mr. Arun Mittal, Executive Director, Oil Industry Safety Directorate
- Dr. S S Thipse, Sr. Deputy Director, Automotive Research Association of India
- Dr. R Venugopal, Joint Chief Controller of Explosives, PESO
- Mr. Jonas Moberg, CEO, Green Hydrogen Organisation, Switzerland

Key Highlights of the session:

1. Safety aspects of Hydrogen - Production, Transport and Storage
2. The session highlighted the physical and chemical attributes, the safety of Hydrogen, and misconceptions. Risk and prevention of accidents from Hydrogen Hazards
3. For hydrogen automotive applications, critical components for codes development are identified as Fuel Quality, Fuel system components, Storage & Hydrogen Dispensers
4. Process of GH₂ production - presents complex scenario of Carbon footprint accounting (Carbon emissions in manufacturing of RE systems like SP panels, wind turbines)
5. Green Hydrogen Standards to cover three aspects: Safety, Emissions & wider environmental and social perspectives
6. Brief on EU pathways for producing renewable green hydrogen | Direct RE, Grid Connected 90 % RE share | Grid connection with emission intensity in bidding zone is less 18gCo₂eq/MJ| Renewable

7. Methods for hydrogen production pathway (upcoming regulations by IPHE, iREC, ISO), standards, Project testing, project accreditations & certifications

Session 3D: Hydrogen Valleys / Hubs / Clusters

Speakers: Mr. Nikunj Bihari Dhal, Addl. Chief Secretary, Dept. of Energy, Govt. of Odisha (Session Chair)

- Mr. Parag Sharma, Founder & CEO, O2 Power
- Dr. R K Malhotra, President, Hydrogen Association of India
- Mr. Rolf Behrndt, Senior Hydrogen Advisor, The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany
- Ms. Malini Dutt, Acting Trade and Investment Commissioner - India, Investment NSW, India

Key Highlights of the session:

1. Cost-effective technologies for CUS along with Carbon Credits and incentives for CCUS projects will make Blue Hydrogen to compliment Green Hydrogen usage
2. Management of Hydrogen Valley/ Hubs require unique type of efforts including operations, maintenance, consulting services.
3. Case study of Germany- Project Clean Hydrogen Coastline to create a hub, with an electrolyser capacity of upto 400 MW by 2026
4. 60 km H₂ pipeline - replace existing NG consumption by 1/3rd (570 million m³ of NG p.a)
5. Challenges for Hydrogen valleys: Offtake for Mobility, Offtake for Green Ammonia for shipping and power
6. Australian perspective for green hydrogen with public private partnership based on various incentives to reduce the cost of GH₂ to <\$2.80/kg was also covered
7. Policy Interventions for GH₂ project -regulatory support and finances and subsidy on hydrogen production cost
8. Reducing the indirect taxes on equipment/utilities/assets of GH₂ project
9. Provision of land: Govt to make revenue land accessible to GH₂ project

Plenary Session-5: Perspective of the International Energy Agency

Speakers: Mr. Rajat Kumar Mishra (Secretary, Department of Fertilizers, Govt. of India) and Dr. Uwe Remme (Head, Hydrogen and Alternative Fuels Unit, Energy Technology Policy Division, International Energy Agency, Germany)

Key Highlights of the session:

1. Hydrogen demand to jump fivefold by 2050, expanding beyond refineries and the chemical industry
2. By 2050, electrolysers accounting for ~70% of global production, and NG with CCUS for ~30%.
3. Low-emission hydrogen could reach 20-36 MMT per year by 2030 with major contribution by rise in electrolyser manufacturing capacity to 125 GW per year.
4. Renewable hydrogen could become cost competitive (solar PV, wind and electrolysers will also bring down the cost of hydrogen)
5. Annual exports could reach 12 MMT of hydrogen by 2030, but some challenges remain

- in regulation, infrastructure, demand creation, value for exporters and trade rules
- Existing and planned certification systems and regulatory frameworks in the countries like Canada, US, UK, France, china and Australia can enable certain interoperability and minimise market fragmentation.
 - Collaborations will Intensify international cooperation for hydrogen trade and to accelerate the development of hydrogen infrastructure.

Session 4A: Start-ups in Hydrogen

Speakers: Ms. Manmeet K Nanda, Joint Secretary, DPIIT, Government of India (Session Chair)

- Mr. Siddharth Mayur, Founder & Managing Director, H2e Power
- Mr. Sunil S. Nair, Co-Founder and Director, Magic Myna Pvt Ltd
- Mr. Vamsi Krishna, Chief Executive Officer, Vyara Green Energy
- Dr. Suruchi Rao, Chief Executive Officer & Co-Founder, Ossus Biorenewables
- Dr. Satyajit Phadke, Co-Founder, Hydrovert Energy

Key Highlights of the session:

1. New market opportunities promote developments in the hydrogen energy value chain
2. Startups are imperative for translating the solutions to applications at an expeditious rate
3. MNRE | SIGHT (STRATEGIC INTERVENTIONS FOR GREEN HYDROGEN TRANSITION) for indigenous development of electrolyzer and other Gh2 production pathways is a welcome step
4. Key startup strategies/developments include:
 - Indigenization of stack and system technology for electrolyzes and fuel cells
 - Indigenization of fuel cell drones
 - Production of bio-hydrogen from wastewater

Session 4B: Hydrogen Strategies & Policies

Speakers: Mr. Sanjay Dubey, Principal Secretary - Energy & NRE, Govt of Madhya Pradesh (Session Chair)

- Mr. Ajay Yadav, Joint Secretary, Ministry of New & Renewable Energy
- Mr. Ruud Kempener, Office of Kadri Simson, Commissioner - Energy, EU (Virtual)
- Dr. R. K Malhotra, President, Hydrogen Association of India
- Mr. Rajnath Ram, Adviser- Power and Energy, NITI Aayog
- Dr. Deepak Yadav, Council on Energy Environment & Water (CEEW)

Key Highlights of the session:

1. India - Goals of GH2 mission
 - 5MMT GH2, 60-100 GW Electrolyser capacity, 125 GW RE capacity of GH2 generation and associated transmission network
 - USD 100 billion in investments

- 600,000 jobs
- 50 MMT CO2 emissions averted
- 2. 5 areas for policy framework in EU:
 - Financing and investment
 - GH2 definition
 - Creation of markets
 - R&D and pilot project
 - International co-operation
- 3. H₂ generation target of 7 MT/yr by 2030: RE investment \$ 200-300 billion
- 4. 22% solar and wind contribution in primary energy mix of EU in 2022 expected to grow to 40-50% by 2030

Session 4C: Green Financing

Speakers: Mr. Tobias Winter, Director, Indo-German Energy Forum (Session Chair)

- Mr. Pradip Kumar Das, Chairman & Managing Director, IREDA
- Mr Ajoy Choudhury, Director - Finance, REC
- Ms. Surbhi Goyal, Senior Energy Specialist, World Bank
- Mr. Mudit Jain, Head - Research, Tata Cleantech Capital Ltd
- Mr. Kumar Bibhu, Vice President, SBI Capital Markets Limited

Key Highlights of the session:

1. India needs ~US \$80-100 Bn investment for the set targets of green hydrogen ecosystem by 2030.
2. Additional investment would be required for supporting infrastructure for storage and transportation.
3. Cash flow is an important aspect in the next 2-3 years for accelerated development.
4. Green hydrogen will play an important role in rural electrification.
5. Green H₂ main financing challenges include cost parity with grey hydrogen, managing multiple projects, limited global manufacturing capacity, project completion risk, performance risk and policy challenges.
6. Possible mitigation mechanisms suggested – managing interdependencies and ownership of infrastructure across the value chain, selection of reliable technology, performance guarantee from EPC contractors, long term agreement with stable tariff, harmonization of policies across the value chain.
7. Large shift in the responsibilities of lenders for financing into green hydrogen projects as it requires cash flow after commissioning as well.

Session 4D: Strengthening R&D Ecosystem

Speakers: Mr. S Bharathan, Director - Refineries, HPCL (Session Chair)

- Dr. Chitra Rajagopal, Director, Center of Excellence - Process Safety, IIT Delhi (Virtual)
- Dr. C S Gopinath, Outstanding Scientist, National Chemical Laboratory

- Mr. Andrew Stokes, Senior Adv.- Innovator Support, Energy System Catapult, UK

Key Highlights of the session:

1. The session covered unique properties of hydrogen and associated challenges to handle it safely.
2. Quantitative risk assessment (QRA) is an integral part of hydrogen system safety analysis.
3. R&D in QRA is required to identify gaps in hydrogen safety.
4. There is a need to undertake consortium based approach with different countries to accelerate hydrogen safety studies, protocols and standards
5. Need to drive down the production cost through target based approach
6. Harmonization in targets for Efficiency, durability and performance need to be aligned globally
7. AEM, Sea Water electrolysis and biomass pathways need to rigorously pursued
8. The session also covered the inter-relation of electrolysis pathway considering all variables- capex, electricity price, plant efficiency and plant load factor.

Summary of Technical Sessions

Speaker: Dr. SSV Ramakumar (Director - R&D, Indian Oil Corporation Ltd)

Key Highlights of the session:

The comprehensive summary included the insights gained from these sessions, paving the way for further advancements in the sector of Hydrogen.

Panel Discussion on Carbon Emission Associated with Green Hydrogen Production

Speaker: Dr Vibha Dhawan, Director General, The Energy and Resources Institute (TERI) (Session Chair)

- Mr. Pulak Prakash, Director - Sales & Strategy, Bureau Veritas, CIF South Asia Region
- Mr. Amrit Singh Deo, Senior Managing Director, FTI Consulting
- Mr. Uwe Remme, Head, Hydrogen and Alternative Fuels Unit, Energy, Technology Policy Division, IEA
- Dr. S Venkata Mohan, Chief Scientist, Department of Energy & Environmental Engineering, CSIR-Indian Institute of Chemical Technology (CSIR-IICT)
- Mr. Jonas Pferdekemper, Project Manager, Global Hydrogen Competence Centre, TUV
- Mr. Frank Wouters, Senior Vice President New Energy, Reliance Industries Ltd
- Mr. Vish Iyer, Global Chief Commercial Officer, Jakson Group

Key Highlights of the session:

1. The future of Carbon-free and Green Hydrogen-led projects, turning the face of technology while pushing it towards a greener tomorrow.

2. The current categorization of carbon based on color still lacks verification, so in order to understand the exact definition of Hydrogen, businesses would need quantification.
3. Common emissions standards are varied in the methods of production
4. Local regulations emerging, impact cross-border trading. Emission savings are treated as the only KPIs for Green Hydrogen Production
5. The certification process and capacity need to be accelerated in terms of measurement, reporting, monitoring, and verification
6. Hydrogen Certification schemes are still evolving to develop more commercial-scale of hydrogen project
7. New ground - standards untested against in real applications due to limited commercial scale projects