



Contribution ID: 342

Type: **Invited Oral**

M4Or1A-05: [Invited] Liquid Hydrogen for Sustainable Energy Systems: Latest Development, Challenges and Opportunities

Thursday 22 May 2025 11:00 (20 minutes)

Fossil fuels and their low efficiency and emissions have impacted our climate and energy resilience. The focus on Net-Zero targets and general awareness of the negative impacts of emissions on climate change and sustainability triggered a paradigm of new energy sources for electricity generation. Expanding our reliance on renewable energy sources requires large scale energy storage. Liquid Hydrogen (LH₂) is emerging as an effective way of storing the excess energy generated by renewable sources to use as a fuel for electricity production, transportation, and industrial energy needs. Economical production, distribution, and use of LH₂ are still in their infancy. The cryogenic technologies to produce and store LH₂ economically are under development. This paper highlights the latest research and development of LH₂ technologies and the technology gaps that need to be addressed through R&D to enable commercial LH₂ technologies to penetrate everyday life. Hydrogen liquefaction through magnetocaloric refrigeration and transportation and dispensing using tube trailers, cryogenic tanks, and chemical carriers will be highlighted. Furthermore, pressurized tanks, cryogenic vessels, material-based storage, LH₂, cold/cryo-compressed storage, and geological caverns are also covered under storage.

Keywords: Electrolyzers, Electrocatalysts, Cryogenic, Liquefaction, Cryopumps

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Session Classification: M4Or1A - [Special Session] Transportation V: Materials