Cryogenic liquid energy carriers: performance requirements for large-scale storages

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In the current effort of contrasting climate change, the energy sector is looking for alternative fuels and energy carriers or prioritizing among available ones. In particular, natural gas, ammonia and hydrogen are currently being given increasing attention [1]. In the effort to maximize energy density in storage and transport, cryogenic liquid state has been proposed. However, while consolidated and efficient storage and transport techniques are already in use for natural gas and ammonia, hydrogen technologies are not competitive or have a low technology readiness level [2]. Hydrogen infrastructures face difficulties not easily solvable which leads to big discrepancies in the state-of-the-art systems (SOA) *(Figure 1)*.

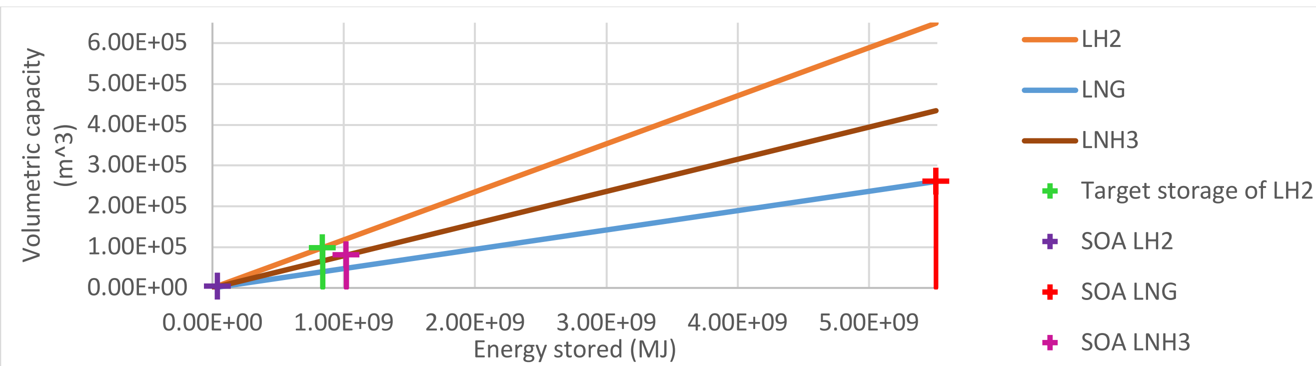

Figure 1 – Comparison of the state of the art and perspective storage capacities for onshore large-scale tanks of liquefied natural gas (LNG), liquefied ammonia (LNH3) and liquid hydrogen (LH2).

In the present work the gap to be bridged in order for hydrogen storage technologies to claim their position in the energy mix is formalized considering its current and target performances in the upscaling. To do this, a set of key target parameters is developed and applied to the three alternative energy carriers.

Keywords: *Hydrogen, Natural Gas, LNG, Ammonia, Liquefied, Storage*

[1] M. Al-Breiki and Y. Bicer, "Technical assessment of liquefied natural gas, ammonia and methanol for overseas energy transport based on energy and exergy analyses," *Int J Hydrogen Energy*, vol. 45, no. 60, pp. 34927–34937, Dec. 2020, doi: 10.1016/j.ijhydene.2020.04.181.

[2] "Clean Hydrogen JOINT UNDERTAKING (Clean Hydrogen JU) WORK PROGRAMME 2022."