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Opportunities and Challenges in Liquid Hydrogen Storage

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Extended Abstract

In the past few years there has been a very significant drive worldwide towards transitioning to a hydrogen energy system where hydrogen as an energy carrier is produced by a primary energy source such as solar energy. In the United States, the US Department of Energy has made a strategic shift towards implementing such an energy system in all aspects of the economy and has taken concrete steps towards achieving highly ambitious targets in that effort. The Hydrogen Shot aims at reducing the cost of clean hydrogen to $1 per kilogram by 2031. This program seeks to catalyze innovation and scale in the hydrogen supply chain, stimulating private sector investments and supporting demonstration projects to overcome existing hurdles in hydrogen deployment [1]. Once hydrogen is produced, it needs to be stored for later use. Liquid storage is attractive especially in the transportation sector. However, there are challenges associated with liquid storage such as thermal stratification, self-pressurization, sloshing, flashing, and heat leak through the supports [2-6]. The purpose of this presentation is to outline some of these challenges while at the same time identify the opportunities that liquid storage provides. Transitioning to a hydrogen economy is an important component of the overall policy of decarbonizing the energy sector in the United States and achieving the goal of net-zero energy.

References

[1] US DOE. (2021). Hydrogen Shot. Available: https://www.energy.gov/topics/hydrogen-shot
[2] S.A. Sherif, N. Zeytinoglu, and T.N. Veziroglu, "Liquid Hydrogen: Potential, Problems, and a Proposed Research Program," *International Journal of Hydrogen Energy*, vol. 22, no. 7, pp. 683-688, 1997, https://doi.org/10.1016/S0360-3199(96)00201-7
[3] S. Gursu, M. Lordgooei, S.A. Sherif, and T.N. Veziroglu, "An Optimization Study of Liquid Hydrogen Boil-Off Losses," *International Journal of Hydrogen Energy*, vol. 17, no. 3, pp. 227-236, 1992, https://doi.org/10.1016/0360-3199(92)90131-F
[4] S. Gursu, S.A. Sherif, T.N. Veziroglu, and J.W. Sheffield, "Analysis and Optimization of Thermal Stratification and Self Pressurization Effects in Liquid Hydrogen Storage Systems-Part 1: Model Development," ASME *Journal of Energy Resources Technology*, vol. 115, no. 3, pp. 221-227, 1993, https://doi.org/10.1115/1.2905997
[5] S. Gursu, A.A. Sherif, T.N. Veziroglu, and J.W. Sheffield, "Analysis and Optimization of Thermal Stratification and Self Pressurization Effects in Liquid Hydrogen Storage Systems-Part 2: Model Results and Conclusions," ASME *Journal of Energy Resources Technology*, vol. 115, no. 3, pp. 228-231, 1993, https://doi.org/10.1115/1.2905998
[6] Gursu, S., Sherif, S.A., Veziroglu, T.N., and J.W. Sheffield, "Analysis of Thermal Stratification and Self Pressurization in Liquid Hydrogen Storage Systems," in *Proceedings of the XVIIIth International Congress of Refrigeration*, vol. I, Montreal, Quebec, Canada, August 10-17, 1991, pp. 118-122, 1991.