Improved modeling of socio-technical systems for hydrogen value chain

Introduction

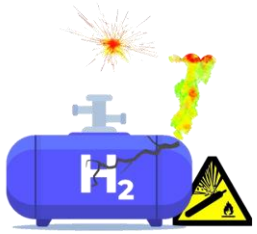
The need for a sustainable energy source is on the rise as fossil fuel reserves dwindle and the impacts of climate change become more evident. Hydrogen is emerging as a potentially clean and sustainable energy carrier. For viable integration of hydrogen into the energy value chain, the hydrogen systems should be safe. It is important to realize that hydrogen systems are complex socio-technical systems. Human and or operational aspects plays a crucial role in preventing catastrophic events. These aspects serve as safety barriers to prevent, control, and or mitigate undesired events. However, there is a challenge to correctly quantify these aspects. This requires an absolute study towards improved modeling and quantification of socio-technical systems for hydrogen value chain

Primary objectives

- Assessment of hydrogen systems while considering socio-technical factors.
- Innovate modeling techniques to enhance risk detection, inspection, and maintenance of hydrogen systems.
- Develop optimum and safe test procedures for hydrogen experiments.

Secondary objectives

- Develop ad-hoc models to identify critical points of failure in hydrogen systems.
- Study and analyze emerging risk to enhance hydrogen system reliability and resilience



Hydrogen Hazard

Secure Hydrogen value chain

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Estimated progress of the PhD project:

Just started ...	< 50 %	> 50 %	Almost done ☺

Publications

- Subedi, A., & Thapa, B. S. (2023). Compendium of Fundamentals of Hydrogen Technology (I). Kathmandu University.
- Subedi, A., Campari, A., Singh Thapa, B., & Paltrinieri, N. (2023). Safety Evaluation of Hydrogen Pipeline Transport: an Approach Based on Machine Learning. Chemical Engineering Transactions
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- Collina, G., Subedi, A., Campari, A., Singh Thapa, B., & Paltrinieri, N. (2023). Lesson learned from H2-related incidents: criticality of maintenance operations. In SYMPOSIUM SERIES.
- Ghimire, R., Niroula, S., Pandey, B., Subedi, A., & Thapa, B. S. (2024). Techno-economic assessment of fuel cell-based power backup system as an alternative to diesel generators in Nepal: A case study for hospital applications. I.J. of Hydrogen Energy
- Niroula, S., Chaudhary, C., Subedi, A., & Thapa, B. S. (2023). Parametric Modelling and Optimization of Alkaline Electrolyzer for the Production of Green Hydrogen. IOP Conference Series: Materials Science and Engineering
- Subedi, A., & Thapa, B. S. (2022). Parametric modeling of re-electrification by green hydrogen as an alternative to backup power. IOP Conference Series: Earth and Environmental Science

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