Massive hydrogen transportation, distribution and utilization: techno-economic and environmental analysis.

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Liquid hydrogen, Liquid Organic Hydrogen Carrier (LOHC), Ammonia, and Synthetic Natural Gas (SNG) technologies are physically/chemically convert hydrogen to higher energy density form and enabling large-scale hydrogen storage and transport. In this study, conceptual hydrogen supply chains that apply these technologies are designed. Conditioning/Re-conditioning processes which are the step of physical/chemical conversion of hydrogen were designed with process simulation and applied to the analysis. The hydrogen supply costs of each chain are calculated by Levelized Cost of Hydrogen (LCOH) and the CO2 emissions of each chain are calculated by Life-Cycle Assessment (LCA). As a result, the Conditioning/Re-conditioning processes take high percentage of LCOH and CO2 emissions. Especially, Utility costs such as heat source for reactor temperature are the major factor of the results. The sensitivity analysis is performed by changing energy consumptions of Conditioning/Re-conditioning processes and converting hydrogen production to one produced through renewable energy. From this result, it indirectly suggests which technology has a better prospect.