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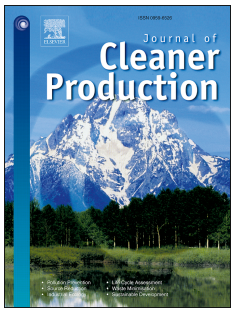

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Christina Wulf, Markus Reuß, Thomas Grube, Petra Zapp, Martin Robinius, Jürgen-Friedrich Hake, Detlef Stolten

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Life Cycle Assessment of hydrogen transport and distribution options

Christina Wulf[1)], Markus Reuß[2)], Thomas Grube[2)], Petra Zapp[1)], Martin Robinius[2)], Jürgen-Friedrich Hake[1)], Detlef Stolten[2)]

1) Forschungszentrum Jülich, Institute of Energy and Climate Research - Systems Analysis and Technology Evaluation (IEK-STE), D-52425 Jülich, Germany
2) Forschungszentrum Jülich, Institute of Energy and Climate Research - Electrochemical Process Engineering (IEK-3), D-52425 Jülich, Germany

Executive Summary

Renewably produced hydrogen offers a solution for mobility via fuel cell electric vehicles without emissions during driving. However, the hydrogen supply chain, from hydrogen production to the fueling station – incorporating seasonal storage and transport – varies in economic and environmental aspects depending on the technology used, as well as individual conditions, such as the distance between production and demand. Previous studies have focused on the economic aspects of varying technologies and elaborated application areas of each technology, while environmental issues were not specifically considered. To address this shortcoming, this paper presents a life cycle assessment of three supply chain architectures: (a) liquid organic hydrogen carriers (LOHCs hereinafter) for transport and storage; as well as (b) compressed hydrogen storage in salt caverns, together with pipelines; and (c) pressurized gas truck transport. The results of this study show that the pipeline solution has the least environmental impact with respect to most of the impact categories for all analyzed cases. Only for short distances, i.e., 100 km, is truck transport better in a few impact categories. When considering truck transport scenarios, LOHCs have higher environmental impacts than pressurized gas in seven out of 14 impact categories. Nevertheless, for longer distances, the difference is decreasing. The seasonal storage of hydrogen has almost no environmental influence, independent of the impact category, transport distance or hydrogen demand. In particular, strong scaling effects underlie the good performance of pipeline networks.

Keywords

Transport and Distribution, Hydrogen, Liquid Organic Hydrogen Carrier, Pipeline, Life Cycle Assessment