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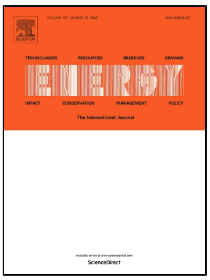

Considering environmental impacts of energy storage technologies: A life cycle assessment of power-to-gas business models

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Considering environmental impacts of energy storage technologies: A life cycle assessment of power-to-gas business models

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Keywords

Renewable Energy Storage, Power-to-Gas (P2G), Environmental Impacts, Life Cycle Assessment (LCA), Business Models

Abstract

The Power-to-Gas technology offers a promising answer to store energy efficiently and in high amounts. Renewable energy is thereby transformed into gas, which is then transported and stored using the existing infrastructure for natural gas. A quite new approach is to store energy from volatile renewable sources in the forms of hydrogen or methane in pore spaces of geological formations. Besides its technical and legal feasibility the environmental impacts of an implementation have to be considered before large-scale deployment is tackled. In the frame of the demonstration project alternative business models were developed and evaluated regarding their environmental effects using the methodology of Life Cycle Assessment (LCA). The conducted Life Cycle Impact Assessment clearly shows that, regardless of the implemented business model, the source of energy is the key factor for the environmental performance of a Power-to-Gas plant. This means that background processes dominate the foreground processes. The LCA includes sensitivity analyses for relevant parameters and results for different environmental impact indicators. Additionally, further potential to increase the efficiency of Power-to-Gas plants and involved units was uncovered. The outcomes of this innovative approach regarding the storage of renewable energies are from outstanding importance for the strategic development of future energy systems.

Abbreviations

AEC, Alkaline Electrolysis Cell; BM, Business model; LCA, Life Cycle Assessment; P2G, Power-to-Gas