Bewertung des technischen, ökonomischen und ökologischen Potenzials verschiedener Wasserstoffproduktionspfade in Europa und der ASEAN-Region (Masterarbeit)

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Abstract

Hydrogen is seen as having great potential as an energy vector in future energy systems. To develop a targeted strategy for integrating hydrogen into existing energy systems, an ecological and techno-economic evaluation of individual production pathways is required. This thesis, therefore, evaluates the ecological and techno-economic potential of various hydrogen production pathways in Europe and the ASEAN region. Within the framework of a life cycle analysis, an environmental impact assessment and an investigation of the levelised costs are carried out in order to evaluate the ecological and economic potential of the individual pathways. It is shown that there is a high potential of renewable energy-based pathways to reduce the GWP of the produced hydrogen compared to fossil-based pathways in the two regions, but currently still at significantly higher costs. A high potential is also attributed to the CCS technology to reduce the GWP of the fossil-based pathways at lower costs than in the renewable energy-based pathways. The results are comparable for Europe and the ASEAN region. The main differences result from the different conditions regarding renewable energies and the CO₂ intensities of the electricity mix. For example, the economic and ecological potential of wind energy-based hydrogen is lower in the ASEAN region than in Europe.

In terms of conversion and transport of hydrogen, compressed hydrogen has a higher potential for shorter road transport distances (< 200 km) and liquefied hydrogen has a higher potential for longer distances (> 500 km) from an environmental and economic point of view. However, the evaluation of conversion and transport pathways is highly dependent on the characteristics of the hydrogen economy. Regarding hydrogen-based fuels, the highest potential is seen in the synthesis of ammonia. However, the costs of renewable energy-based pathways are many times higher than the current market prices of the fuels investigated.