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The hydrogen roadmap in the Portuguese energy system – Developing the P2G case

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HIGHLIGHTS

- The P2G strategy requires value chain assessment along its main lifecycle stages.
- Value chain maturity is determinant for technology performance and environmental impact.
- Currently, electrolysis/biomass gasification as alternative to SMR only when specific conditions are provided.
- The P2G strategy is a promising storage technology but each approach is case-sensitive.

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ABSTRACT

The planning and implementation of the Portuguese energy transition towards a decarbonized, energy secure and more sustainable economy is providing driving forces for significant challenges and opportunities on a country basis. The emergence of hydrogen (H_2) within low-carbon pathways in the energy system requires to deal with the complexity of H_2 carrier in its relationship with energy sources and end use sectors. In the frame of mainland Portugal energy system, different value chain configurations were analysed and assessed using energy analysis, lifecycle thinking and impacts assessment, as well as the technology and costs analysis, within an approach to the Hydrogen Economy. The Portuguese Roadmap for H_2 was developed taking such an approach and therein the evolution of the selected value chains along time. Among these, 'power-to-gas' (P2G) combined with the gas grid is given an in-depth focus, as it was prioritized as the top value chain to answer the research question: how sustainable would be the hydrogen production and end use in Portugal within the P2G value chain? This P2G value chain with a particular focus on heating applications is discussed on the basis of the technology options and technology maturity identified in each main stage of the value chain, using analytical dimensions such as the energy efficiency and greenhouse gas emissions, among other impact categories, followed by a sensitivity analysis. The obtained results enable to show how case-sensitive that approach is and that a multi-decisional process is required to assist the planning stage.

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