

The Hydrogen Roadmap in the Portuguese Energy System – Developing the P2G case

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Abstract

The energy transition towards a decarbonized, energy secure and more sustainable economy is providing driving forces for significant challenges and opportunities on a country basis. It has been extensively argued elsewhere, that hydrogen (H₂) is an energy vector having a strategic role in the energy transition as it enables to add value to the system, namely by:

- (i) Enhancing the flexibility of the energy system, through energy storage, service to multiple sources of demand and sector coupling based on power and gas grids;
- (ii) Integrating variable and intermittent renewable energy inputs in the National energy mix;
- (iii) Contributing to a holistic and innovation-oriented ecosystem

The emergence of H₂ within low-C pathways in the energy system requires to deal with the complexity of H₂ use in its relationship with other energy sources and end use sectors. The following main question was formulated: Which hydrogen value chain configurations are more likely to be sustainable in Portugal? To answer that question system analysis tools were used, in particular: the energy analysis of the whole system, lifecycle thinking and impacts assessment, as well as technology and costs assessments.

The development of the Portuguese Roadmap for H₂ was performed and therein the evolution of the selected value chains along time and according to the technology readiness level (TRL). Among these, a top-priority value chain 'power-to-gas' was given an in-depth focus in this paper. This value chain configuration and its selected variants were discussed on the basis of the technology options and TRL identified in each main stage of the value chain, and using analytical dimensions such as the energy efficiency and green house gas emissions, among other impact categories, followed by a sensitivity analysis. Results obtained 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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