

# **Assessing green hydrogen support mechanisms in coupled electricity and hydrogen markets under Cournot competition**

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## **Abstract-**

**Green hydrogen is expected to play an important role for decarbonizing hard-to-abate sectors but faces regulatory, economic, and operational barriers. In the EU, strict renewable energy usages requirements and temporal and geographical criteria constrain green hydrogen production and complicate integration with electricity markets. Support mechanisms (SMs), such as premiums and quotas, aim to boost hydrogen production, yet their impacts on coupled electricity-hydrogen systems remain underexplored. This paper extends a previous joint electricity-hydrogen Cournot equilibrium model to represent and analyze the impact of different green hydrogen production SMs. Different SMs lead to different equilibrium models that were solved using equivalent quadratic optimization problems and applied to real-size Iberian case studies. Results reveal how different SMs influence hydrogen and electricity prices, production and emissions, highlighting trade-offs among stakeholders. The findings provide guidance for designing balanced policies that stimulate green hydrogen while minimizing unintended consequences and offer flexible tools to assess regulatory and economic interactions in emerging hydrogen markets.**

**Index Terms-** Hydrogen subsidies; Hydrogen economy; Green hydrogen; Cournot equilibrium; Support mechanisms

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