

## Scenario Analysis to Assess the Competitiveness of Hydrogen in Securing the Italian Energy System

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**Abstract :** The hydrogen value chain deployment is likely to be boosted in the near term by the energy security measures planned by European countries to face the recent energy crisis. In this context, some countries are recognized to have a crucial role in the geopolitics of hydrogen as importers, consumers and exporters. According to the European Hydrogen Backbone Initiative, Italy would be part of one of the 5 corridors that will shape the European hydrogen market. However, the set targets are very ambitious and require large investments to rapidly develop effective hydrogen policies: in this regard, scenario analysis is becoming increasingly important to support energy planning, and energy system optimization models appear to be suitable tools to quantitatively carry on that kind of analysis. The work aims to assess the competitiveness of hydrogen in contributing to the Italian energy security in the coming years, under different price and import conditions, using the energy system model TEMOA-Italy. A wide spectrum of hydrogen technologies is included in the analysis, covering the production, storage, delivery, and end-uses stages. National production from fossil fuels with and without CCS, as well as electrolysis and import of low-carbon hydrogen from North Africa, are the supply solutions that would compete with other ones, such as natural gas, biomethane and electricity value chains, to satisfy sectoral energy needs (transport, industry, buildings, agriculture). Scenario analysis is then used to study the competition under different price and import conditions. The use of TEMOA-Italy allows the work to catch the interaction between the economy and technological detail, which is much needed in the energy policies assessment, while the transparency of the analysis and of the results is ensured by the full accessibility of the TEMOA open-source modeling framework.

**Keywords :** energy security, energy system optimization models, hydrogen, natural gas, open-source modeling, scenario analysis, TEMOA

**Conference Title :** ICHET 2023 : International Conference on Hydrogen Energy and Technologies

**Conference Location :** Paris, France

**Conference Dates :** December 25-26, 2023