Contribution ID: **35** Type: **Apresentação regular**

Decision support system for sustainable implementation of hydrogen supply chains in Brazil

Hydrogen is a key element in the global transition toward a low-carbon economy, with green hydrogen offering significant potential to decarbonize industries and energy systems. This study aims to develop a decision support system for the optimized implementation of a Hydrogen Supply Chain (HSC) in Brazil. Key aspects identified in the literature will be addressed, including the need for efficient optimization models, the integration of the social pillar of sustainability, and the notable lack of research focused on Brazil as a study area.
The proposed decision support system is structured in two stages. The first formulates the HSC as a Mixed-Integer Linear Programming (MILP) problem, considering decisions related to facility location, production capacity, transportation, and hydrogen storage, while integrating uncertainties in input availability and demand. The second stage employs a Mixed-Integer Nonlinear Programming (MINLP) model to more accurately represent the nonlinearities of hydrogen production processes, thereby improving decision-making precision.
Preliminary results indicate that economies of scale play a critical role, reducing both financial costs and greenhouse gas (GHG) emissions compared to alternative scenarios. The study underscores the importance of aligning production strategies with regional renewable energy resources to enhance cost-effectiveness and sustainability.

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Session Classification: Session 5.2 - OR in Energy 2