UNIVERSITÄT ZU KÖLN

ewi Energiewirtschaftliches Institut an der Universität zu Köln

Titel:
Take-or-Pay Contracts and Stochastic Modeling: Navigating Hydrogen Uncertainties in Europe's Future Energy System

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Abstract:

"The role of hydrogen in a climate-neutral energy system hinges significantly on uncertainties such as weather variability, demand (variability), and hydrogen import prices involving trading modalities and contractual obligations. In the first part of the presentation, we explore the impact of Take-or-Pay (TOP) rates in long-term hydrogen contracts on the European energy landscape by 2050. Building upon the comprehensive numerical model HYEBRID optimizing generation, storage, and infrastructure investments across the power and hydrogen sectors, our study reveals that varying TOP rates induce substantial shifts in cost-minimal infrastructure requirements. These findings underscore the necessity of considering import flexibility in energy system planning reliant on hydrogen imports.

The second part of the presentation introduces the groundwork for a second study, which expands the analysis through a stochastic modeling approach. By explicitly integrating stochastic elements into the existing HYEBRID framework, the aim is to deepen our understanding of how stochasticity influences the reliability and resilience of a future European energy system focusing on the hydrogen sector. This approach could investigate the interaction between stochasticity and TOP rates or provide a risk assessment of major uncertainties of the future hydrogen sector in Europe. Potential uncertainties may include weather patterns, hydrogen import prices or demand variations and responses."