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Challenges and Emerging Solutions for Electrolyser Projects in the Hydrogen Ramp-Up: Practical Insights from VNG's Project and Business Case Development

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Motivation
The European hydrogen ramp-up is progressing more slowly than anticipated, hindered by high project costs, complex regulatory requirements and uncertain industrial demand. At the same time, structural developments are opening opportunities to accelerate project viability. Targeted improvements such as simplified and more flexible electricity sourcing rules under RFNBO, and the continuation or refinement of grid-fee exemptions beyond 2029, could substantially reduce LCOH and increase operational flexibility.
Despite current industrial weakness, first functioning hydrogen use-cases are emerging. In the mobility sector, early demand combined with stable THG-quota mechanisms is already creating real markets. Some steel producers are maintaining their transformation commitments, offering credible long-term off-take perspectives. Parallel policy debates on green-gas quotas, renewable molecules in the EU market design and expanding guarantees-of-origin systems are generating new impulses that may strengthen demand and improve planning certainty. Against this backdrop, the paper examines both barriers and actionable solution pathways, informed by VNG's project development experience.

Methods
This study offers an inside view of how a gas-sector company develops hydrogen and electrolysis projects. Instead of relying mainly on quantitative modelling, the approach highlights the practical steps and decision logic used in early-stage and advanced project development. Core considerations include regulatory conditions, electricity procurement options, site and infrastructure constraints, partnership structures, and market signals relevant for commercial viability.
Analytical tools such as cost estimates, regulatory reviews and qualitative risk assessments support—but do not dominate—the process. Insights from VNG project development illustrate how companies balance operational strategies, supply-chain uncertainties and changing policy frameworks to determine whether conditions are sufficient for investment. The projects Energiepark Bad Lauchstädt and GreenRoot support an assessment of system-serving versus constant-load operating strategies.

Results
Many electrolysis projects currently struggle to reach FID maturity. Key barriers include restrictive RFNBO criteria, the expected end of grid-fee exemptions, uncertain industrial demand projections and misaligned price expectations. However, several levers can significantly improve feasibility:

Regulatory simplification: More flexible temporal matching rules for renewable electricity and extended grid-fee exemptions could reduce LCOH by double-digit percentages and enable system-beneficial, flexible operations.
Emerging demand drivers: Refineries and functioning THG-quota markets demonstrate viable demand mechanisms and provide templates for broader market development.
Industrial decarbonisation: Despite short-term economic headwinds, committed steel manufacturers continue to plan hydrogen-based processes, creating medium- to long-term off-take potential.
Green-gas quotas and lead market for green innovation: Policy discussions at national and EU level signal increasing momentum for market-creating quota systems, which could provide the demand pull needed for investment decisions.
Global CAPEX dynamics: Declining costs from Chinese electrolyser manufacturers increase competitive pressure but may also present opportunities to lower CAPEX if quality, certification and supply-chain risks

are properly managed.
System services from electrolysers: Beyond hydrogen production, electrolysers can support the electricity system by providing flexibility, demand response and ancillary services. This enhances system stability, reduces integration costs for renewables and improves the economic case for flexible, system-serving operation modes.

Overall, the combination of targeted regulatory adjustments, emerging demand niches and evolving policy instruments indicates a more optimistic trajectory for electrolysis deployment than current market sentiment suggests.

CV
Dr. Philipp Hauser has worked at VNG AG since 2021 as an advisor for scientific studies in the Green Gases division, focusing on the development of hydrogen value chains and the strategic integration of renewable and decarbonised gases. He contributes to key projects such as the Energy Park Bad Lauchstädt and the BMBF flagship initiative TransHyDE, providing energy-economic analyses and techno-economic insights for Germany's emerging hydrogen economy.
He studied Industrial Engineering at TU Dresden (B.Sc./M.Sc., 2008–2014) and subsequently served as a research associate at the Chair of Energy Economics until 2020. His academic work centred on electricity-gas sector coupling, European gas market modelling and uncertainty in energy system analysis. In 2022, he earned his doctorate (Dr. rer. pol.) from TU Dresden. His expertise spans hydrogen infrastructure, system integration, market design and regulatory frameworks.

Author: Dr HAUSER, Philipp (VNG AG)

Presenter: Dr HAUSER, Philipp (VNG AG)

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