

Accelerating Decarbonization

Using an integrated engineering approach for digital design of green hydrogen and Carbon Capture, Utilization, and Storage (CCUS) Systems

As the transition to low-carbon economies accelerates, hydrogen and CCUS technologies are increasingly recognized for their pivotal roles in decarbonization strategies. The surge in interest in environmentally friendly hydrogen production and CO₂ management options brings to light significant challenges, including scalability, cost-effectiveness, system integration, and broader acceptance.

Amidst the imminent large-scale deployment of hydrogen and CCUS infrastructures, the engineering and commissioning landscape faces heightened pressures due to evolving market dynamics and environmental uncertainties. This scenario necessitates reevaluating conventional approaches, compelling plant designers and engineering teams to prioritize expedited market delivery, enhanced engineering productivity, and streamlined workflows.

Digital twin technologies emerge as a promising solution to navigate these complexities, offering a pathway to accelerate the design, engineering, and commissioning processes. However, realizing their full potential demands robust communication frameworks and seamless integration among project teams, digital twins, and existing data-management infrastructures. The current fragmentation in simulation, engineering, automation planning, and control system interfaces poses significant barriers to extracting maximum value from digital twin applications, highlighting the necessity for a cohesive digital engineering framework.

This presentation delves into the transformative power of an integrated digital design paradigm, underpinned by high-fidelity process digital twins. This innovative approach empowers engineers to navigate the decision-making landscape with unprecedented efficiency, enabling the management of risks and the optimization of outcomes in both hydrogen production and CCUS initiatives. Central to this paradigm is the integration of insights within an Engineering Data Management System, which fosters a collaborative environment that enhances data sharing, minimizes information loss, and significantly improves quality control across interdisciplinary teams.

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Moreover, we propose a novel methodology for bridging the divide between process design and automation engineering through the reciprocal generation of automation project templates and detailed engineering data, streamlining the transfer of critical information. The culmination of this integrated digital design process is the virtual commissioning of plants, leveraging process digital twins and control systems to validate strategies and train operators within a risk-free simulated environment.

Ultimately, this presentation underscores the transformative potential of integrated digital design solutions in accelerating the deployment of decarbonization technologies, such as green hydrogen production and CCUS initiatives, fostering a more sustainable and efficient path towards achieving global climate goals.

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