

Digital Technologies for Hydrogen Production

Drive lower levelized cost of hydrogen through the integration of production with end-use

Hydrogen is pivotal in decarbonizing advanced economies, with growing interest in sustainable hydrogen production and utilization technologies. However, challenges like scaling up, reducing costs, integration into wider systems, and building confidence persist. As the industry strives to find the best solutions to these challenges, focusing on minimizing the levelized cost of hydrogen (LCOH), several areas are being explored, in addition to improvements in production technologies. This includes integrating production with end-use and valorizing the electrolysis-produced oxygen, recovering energy from waste heat streams, or finding additional uses for excess renewable energy to enhance overall process economics.

The integration of green hydrogen with downstream processes is in the demonstration phase. Optimization of by-products and waste energy stream integration is crucial but must be fine-tuned for specific cases. To ensure economic viability and efficiency, a deep understanding of system interactions is essential for safe and reliable operations.

Digital process twins offer a virtual environment for testing these interactions, aiding in process design, integration, and real-time optimization. This research illustrates how digital process twins can explore integration concepts in the hydrogen value chain.

Examples include:

- Using electrolysis-produced oxygen.
- Harnessing electrical energy from waste heat streams.
- Adjusting operating strategies for downstream process efficiency during surplus renewable energy generation.

This comprehensive understanding, embedded in digital tools capable of real-time interaction with operating plants, empowers companies to pursue net-zero emissions confidently while reducing risks.

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