

Jennifer Kurtz, Ph.D.



Director, Energy Conversion and Storage Systems Center and Advanced Research on Integrated Energy Systems

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Reducing the Risk of Deploying Hydrogen Technologies through Large-Scale R&D

Jennifer Kurtz, Daniel Leighton, and Katie Hurst
jennifer.kurtz@nrel.gov

Abstract

Achieving decarbonization goals with clean hydrogen technologies is an international focus. Programs, such as H2@Scale, have identified promising hydrogen pathways through analysis and modeling. Large-scale, integrated R&D is now needed to further reduce deployment risk of these pathways and hydrogen deployments.

One way to demonstrate what is possible with large-scale hydrogen infrastructure and systems is to utilize the U.S. Department of Energy's Advanced Research on Integrated Energy Systems (ARIES) at the National Renewable Energy Laboratory. ARIES is a realistic research environment designed to support the transition to a decarbonized energy system. ARIES does this by studying system-wide resilience to pinpoint weaknesses and solutions and troubleshooting new technologies before they are added to the energy system at a large scale.

ARIES can demonstrate hydrogen technologies at kilowatt to megawatt scales using hardware and larger scales with a virtual emulation environment. Cybersecurity and integration with the grid provide the basis for integrated, holistic R&D to identify failures and vulnerabilities of hydrogen systems. Examples of R&D include evaluating the use of hydrogen to support a 100% renewable grid, validating hydrogen production cost and durability, and verifying the feasibility of a tightly coupled hydrogen electrolyzer system with renewables for green steel or ammonia.

By combining expertise in analysis, modeling, experimentation, and demonstration, we can remove barriers and introduce new ideas for the hydrogen markets. Through partnerships across research institutions, industry, academia, and government, we can reduce risk and accelerate the integration of hydrogen technologies into our future energy system.