**Engineering Trust in the Energy Transition: Risk, Reliability, and the Path to Safe Hydrogen Systems**

January, 2026

Professor Katrina Groth
Professor & Director, Reliability Engineering
Professor Mechanical Engineering
Director, Center for Risk and Reliability
University of Maryland, USA

Safety and reliability are foundational to public trust, and without trust, the energy transition cannot succeed. While hydrogen technologies hold enormous promise for decarbonizing the global energy system, unresolved safety and reliability challenges can impede their development, deployment, and societal acceptance. The widely anticipated, global adoption of hydrogen technologies therefore requires that the risks associated with those technologies be rigorously investigated and mitigated early in the lifecycle.

Quantitative risk assessment (QRA) and reliability engineering provide powerful, proactive tools to anticipate and address potential failures before they happen – and learn from failures and near misses when they happen. Risk-informed decision making enables minimizing failures, downtime, maintenance costs, property damage, injuries, and fire and explosion hazards, while also protecting public confidence and avoiding costly litigation.

This keynote highlights how advances in QRA and reliability analysis have enabled, and will continue to enable, advances in critical hydrogen energy systems, including fueling stations, electrolyzers, material handling equipment, buses, aviation, and beyond. Drawing from real-world experience and recent research, the talk emphasizes: 1) early insights that can meaningfully improve the safety and reliability of hydrogen systems, 2) the central role of risk and reliability engineering in engineering trust in hydrogen and other advanced energy technologies, and 3) the opportunity for the research and engineering community to accelerate progress toward a safe, resilient, and trusted energy future.