Some of the most important research challenges to realizing a clean and secure energy future are at the system level.
By 2050 the global population is projected to increase by approximately 20%; GDP is projected to increase by a factor of 2 –emerging economies

In the absence of sensible measures, the global energy consumption would likely increase by approximately 40%, and CO₂ missions by 60%
Advanced Research on Integrated Energy Systems – Proving out Solutions for a Decarbonized Energy System

• ARIES is a research platform developed by the National Renewable Energy Laboratory and DOE’s Office of Energy Efficiency and Renewable Energy.

• It was designed to fill a significant gap: there is no research platform that can support the nation’s transition to a decarbonized energy system.

• Without a safe environment to prove things out, we could be introducing significant risk, vulnerability, and expense to the electric grid and customers.

www.nrel.gov/aries
ARIES - a research platform to accelerate the transition to a modern energy system

- Identify the best path to reach local and national decarbonization goals
- Look at system-wide resilience to pinpoint weaknesses and solutions
- Troubleshoot and de-risk new technologies before they are connected to the electric grid
- Embed cybersecurity as a fundamental layer to all research
- Accelerate deployment by providing a research platform that can replicate the real-world
Renewable Integration Enabling R&D

Making it possible to pivot and stay ahead of the rapidly evolving energy sector and supporting research of critical importance:

- **Power electronics** to control and integrate rapidly increasing electronics-based technologies
- **Infrastructure** to adapt existing energy infrastructure for integration, safety, monitoring, and controls
- **Hybridization** to achieve enhanced coordinated capabilities beyond isolated technologies
- **Energy storage** to balance variable renewable generation and demand
- **Cybersecurity** to secure operations to prevent disruption, damage, and loss of functionality
- **Environmental justice** to demonstrate solutions, technologies, controls, integration community-scale
Renewables and Integration

What is possible for the future of renewables integrated in our energy system

Discuss priority challenges and opportunities
Panelists

Jen King
Research Engineer – Controls and Hybrids
NREL

Sairaj Dhople
Associate Professor, Electrical and Computer Engineering
University of Minnesota

Steve Szymanski
Vice President, Sales and Marketing – Americas
Nel Hydrogen

Jason MacDowell
Senior Director – Technology, Strategy & Policy
GE
Panelists

What is the possible for integrating renewable generation into our evolving energy system?
What are the requirements for integrating renewables for a decarbonized energy system?
What are the biggest challenges in your mind of putting large amounts of renewables on the grid?
Discussion

Integration Technologies

What are promising technologies or technology combinations for deployment?
How can we address the transition with an aging infrastructure and rapidly increasing demands?
Barriers

What are possible barriers to widespread deployment of renewables?
What are metrics that will determine whether we have been successful?
Thank You