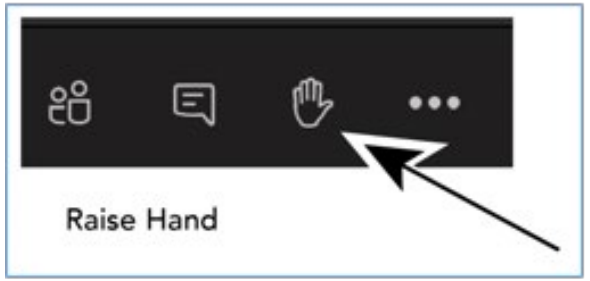
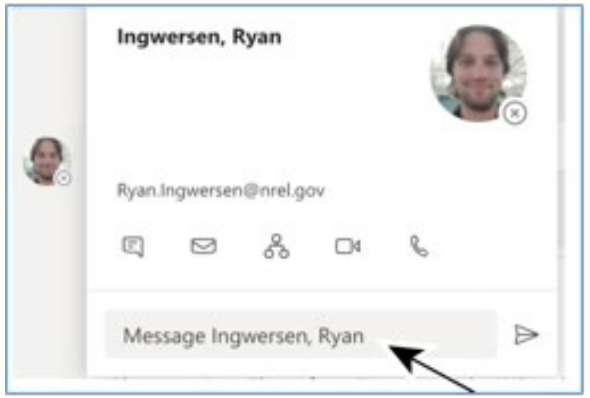

NREL
Transforming ENERGY
Thank you for joining.
ARIES Energy Storage Workshop will begin shortly.
Please mute your microphone throughout the meeting. If you wish to contact the host or presenters, please use the chat or raise your hand.

Meeting Logistics





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ARIES Energy Storage Workshop

9:00 a.m.	Welcome and Opening Remarks *Peter Green, Deputy Laboratory Director, NREL* *Kevin Lynn , Director Grid Integration, DOE*
9:10 a.m.	Overview of DOE Energy Storage Priorities *Alejandro Moreno, Acting Deputy Assistant Secretary Renewable Power, DOE* *Michael Pesin, Deputy Assistant Secretary Advanced Grid Research and Development Division, DOE*
9:25 p.m.	Introduction to NREL's Unique ARIES Research Platform and Energy Storage Capabilities *Jen Kurtz, Director Energy Conversion and Storage Systems Center, NREL*
9:45 a.m.	Three Parallel Breakout Sessions into Specific Energy Storage Research Areas
11:15 a.m.	Breakout Session Report Themes and Q&A *Jen Kurtz, Director Energy Conversion and Storage Systems Center, NREL*

Workshop Objectives

1. Provide information on the ARIES research platform

2. Get your perspective on research needs for energy storage, areas of interest for energy storage advancement, and potential opportunities for collaboration.

3. Any additional feedback you would like to share on how we can make ARIES a more valuable tool to help you achieve your goals.

Some of the most important research challenges to realizing a clean and secure energy future are at the system level.


Systems level challenges drives the need for a research platform that could support integrated research, development, and demonstration at a scale relevant to large metropolitan cities and regions.

ARIES is a research platform that can mirror the scale and complexity of the evolving energy system

- The scale of ARIES expands the research view—up to large cities and regions.
- ARIES brings opportunities and risks to the surface in the spaces where sectors meet.
- With ARIES you can accelerate the evaluation, troubleshooting, and deployment of new technologies.

What makes up the ARIES platform?

The ability to create, prove, and validate complex energy systems by interconnecting hardware and software capabilities that imitate varied renewable energy configurations.

NREL's Energy Systems Integration Facility

State-of-the art research equipment to support integrated energy research, analysis, modeling, and hardware experiments.

NREL's Energy Systems Integration Facility


Interconnected grid-scale devices and distributed energy resources for highest-fidelity experimentation.
NREL's Flatirons Campus

A team of National Laboratory experts with a depth and breadth of knowledge in energy systems integration and clean energy innovation at the leading edge nationally and internationally.

NREL's Energy Systems Integration Facility

An 8-petaflop high performance computer to break through existing limitations and achieve metropolitan- and regional-scale research resolution.

NREL's Energy Systems Integration Facility

Designed to Help the Nation, Partners Achieve Goals

- Identify best path to reach renewable energy goals
- Look at resilience in large systems and regions to pinpoint weaknesses and optimal solutions
- Give insight into how specific energy storage technologies operate within larger systems
- De-risking technologies
- Optimized control for multiple supply and load-based assets with storage in the mix for various objectives like cost, lifetime, and resilience
- Creating flexibility and resilience with energy storage technologies

Integrated Energy Storage Opportunities

Facilitating Evolving Grid

Maintain and enhance the provision of electricity services to end users as the grid increases in complexity and diversity

Serving Remote Communities

Provide remote communities with electricity for critical and beneficial public services

Electrified Mobility

Facilitate a large-scale adoption of electric vehicles while maximizing beneficial coordination with the power grid

Interdependent Network Infrastructure

Sustain and enhance normal operations amidst short-term disruptions of energy inputs

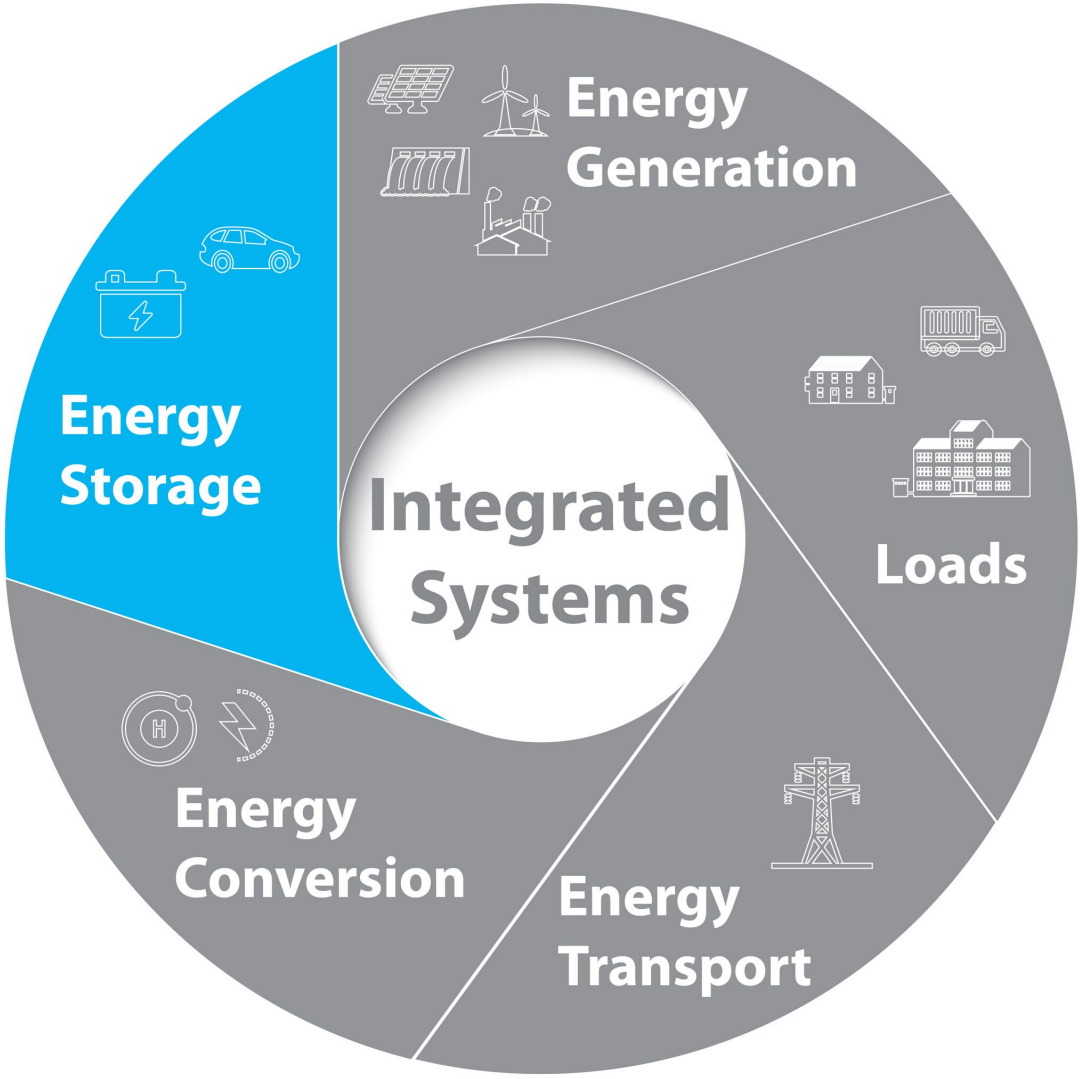
Critical Service Resilience

Maintain critical services for a sufficient duration following extended power outages

Facility Flexibility, Efficiency and Value Enhancement

Maximize the total value obtained from the process of interest.

ARIES Capabilities: Storage



Existing

- 1 MW/1 MWh Battery System
- Residential and commercial Li+ batteries
- H2 Electrolysis and 15kpsi storage
- Thermal handling for ice storage

In Progress

- MW Scale Hydrogen System (2022)
  - Electrolysis, Compression, Storage
- MW Scale Battery Emulation (2022)
- Energy storage microgrid building block power, controls and coordination (2022)
- Stationary commercial Li+ battery energy storage system (2022)

Future

- Thermal Storage (2023)
- Ultracapacitor (2023)
- Novel Large Scale Hydrogen Storage (2023)
- Flywheel (2023)
- Geothermal Storage (2025)
- H2 high pressure storage tanks (2025)

Spotlight

- Grid-interactive efficiency buildings/facilities with vehicles
- Multi-timescale storage with hydrogen
- Distribution level storage solutions

Breakout Sessions

- Three Concurrent Sessions
- 90 minutes
- Pre-registered or assigned
- Return to main meeting for wrap up

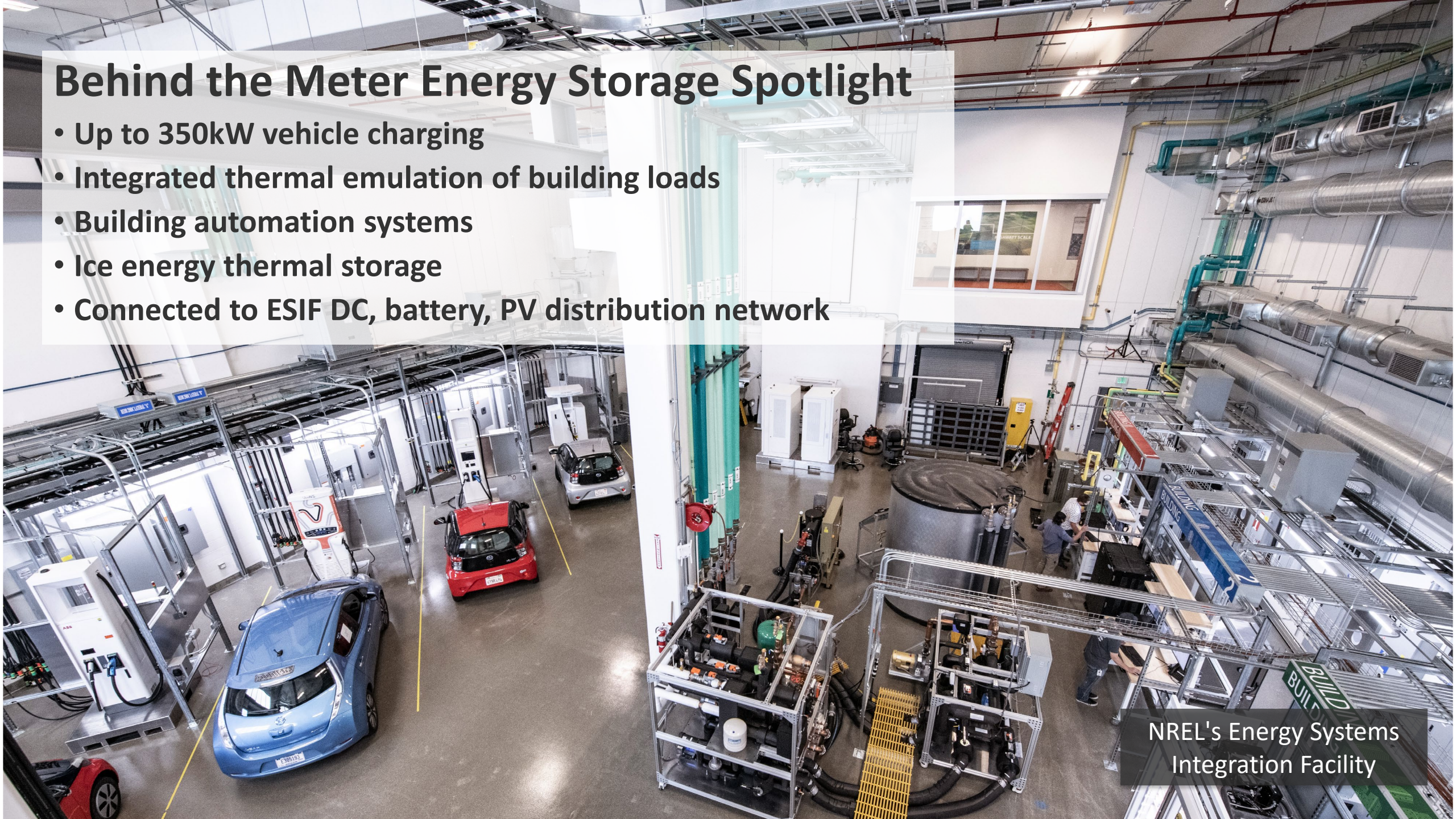
Breakout I

Grid-Interactive Efficient Buildings/Facilities Integrated With Large-Scale Transportation Electrification and Distributed Power Generation

Moderator: Tony Burrell

Behind the Meter Energy Storage Spotlight

- Up to 350kW vehicle charging
- Integrated thermal emulation of building loads
- Building automation systems
- Ice energy thermal storage
- Connected to ESIF DC, battery, PV distribution network

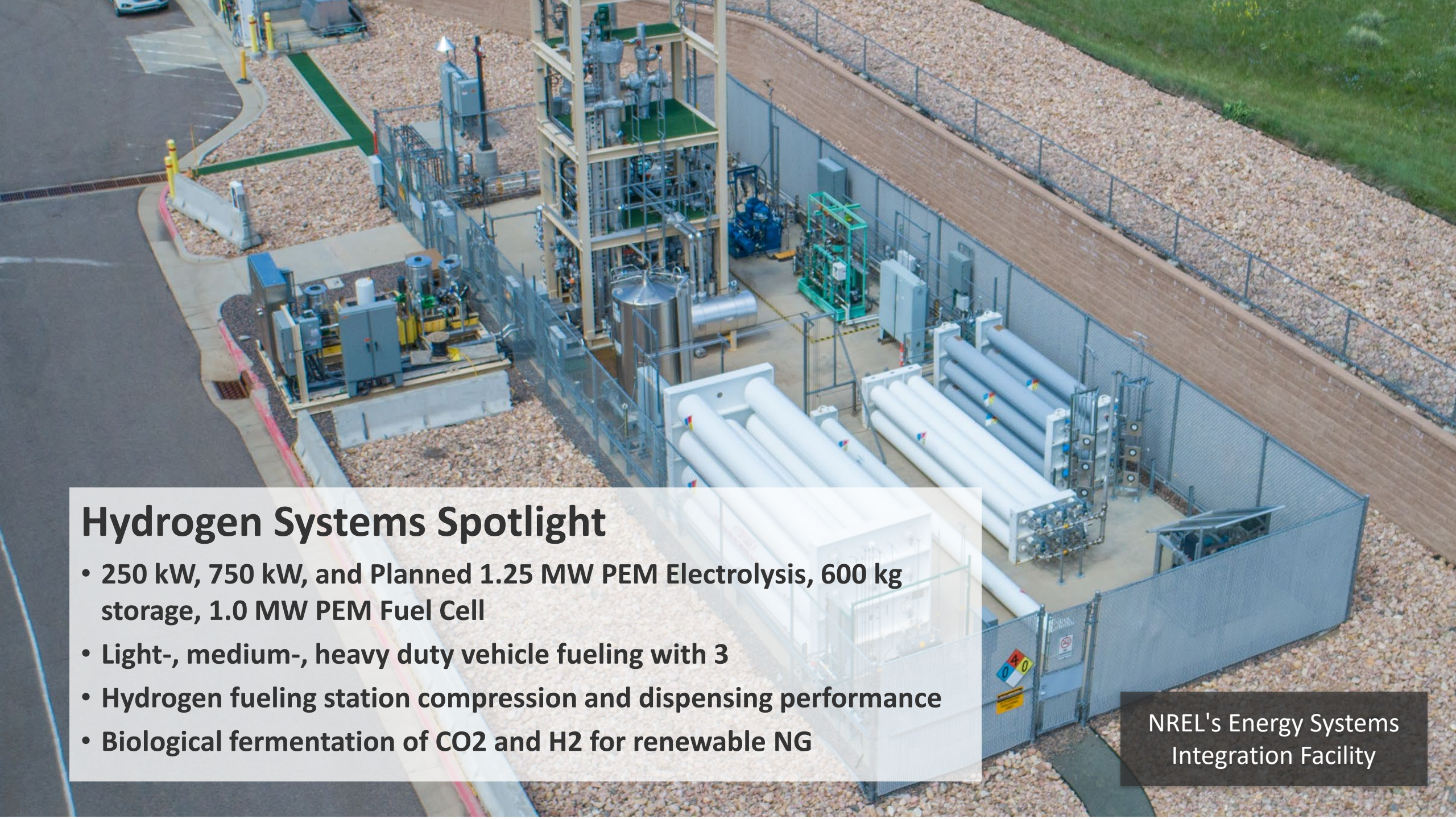


NREL's Energy Systems Integration Facility

Breakout II

Multi-timescale storage for utility-scale renewable power generation

Moderator: Rob Hovsapian



Hydrogen Systems Spotlight

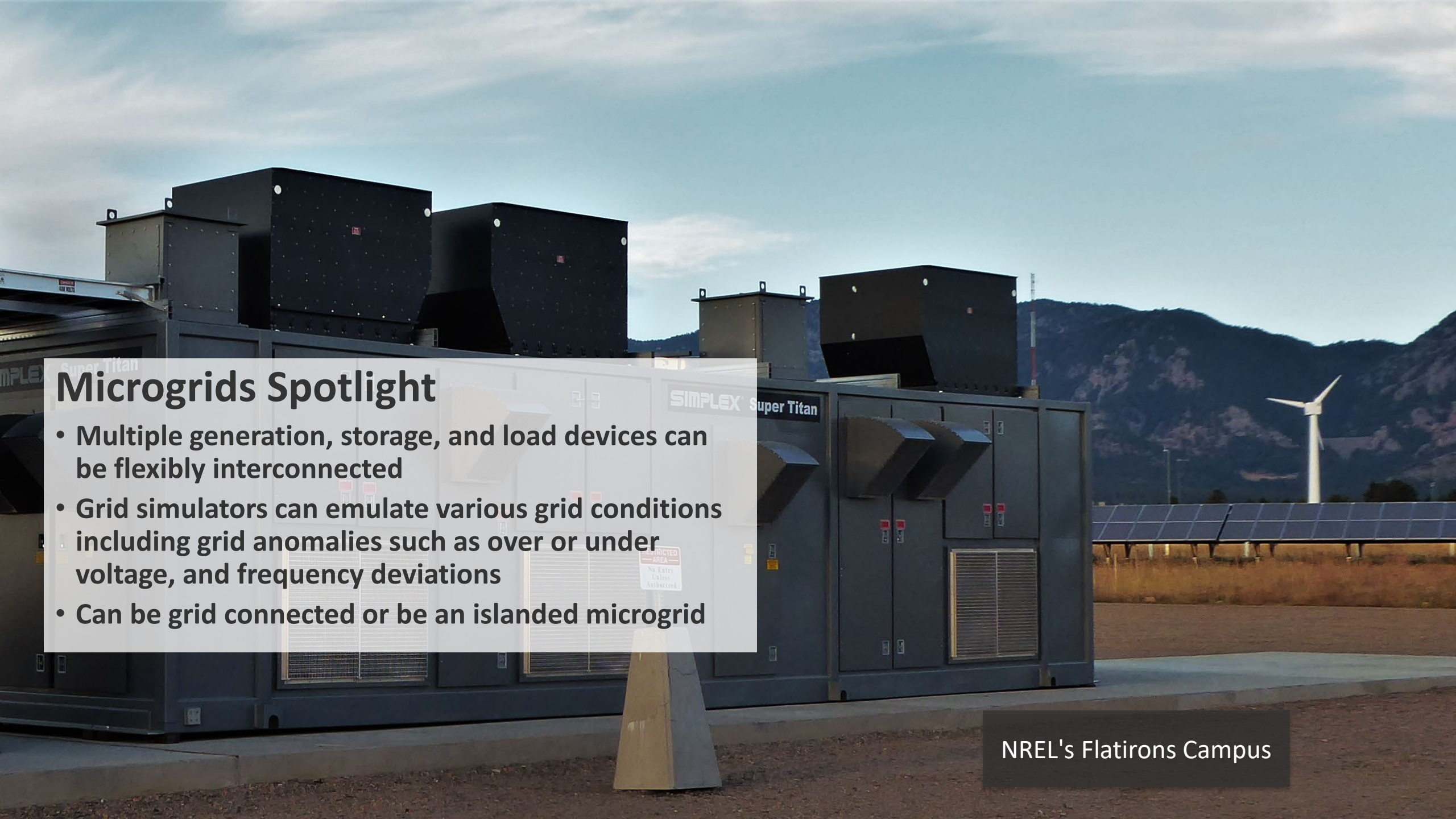
- 250 kW, 750 kW, and Planned 1.25 MW PEM Electrolysis, 600 kg storage, 1.0 MW PEM Fuel Cell
- Light-, medium-, heavy duty vehicle fueling with 3
- Hydrogen fueling station compression and dispensing performance
- Biological fermentation of CO2 and H2 for renewable NG

NREL's Energy Systems Integration Facility

Breakout III

Distribution-level storage solutions for microgrids, defense bases, and disadvantaged and remote communities

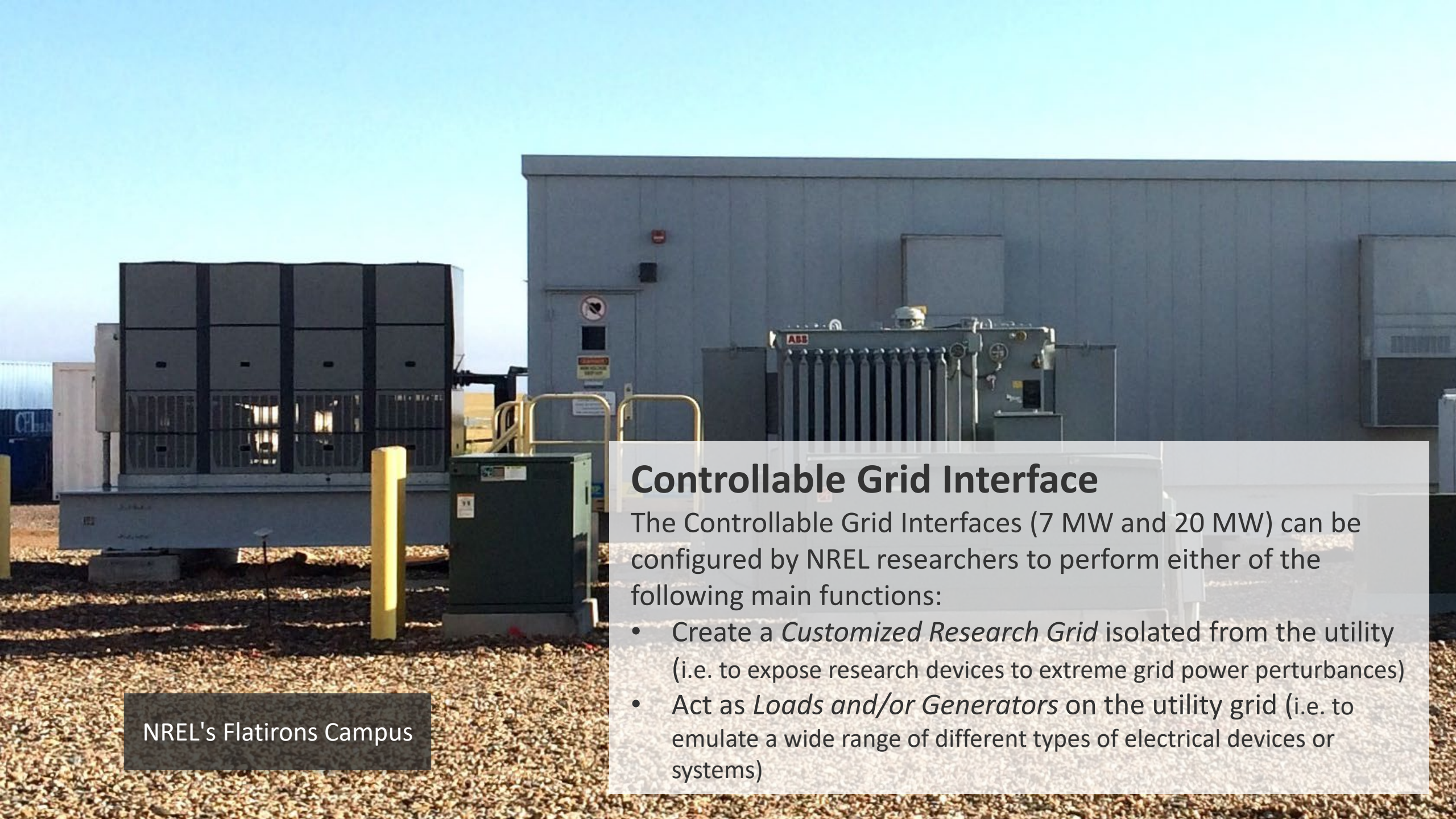
Moderator: Ben Kroposki



Microgrids Spotlight

- Multiple generation, storage, and load devices can be flexibly interconnected
- Grid simulators can emulate various grid conditions including grid anomalies such as over or under voltage, and frequency deviations
- Can be grid connected or be an islanded microgrid

NREL's Flatirons Campus



NREL's Flatirons Campus

Controllable Grid Interface

The Controllable Grid Interfaces (7 MW and 20 MW) can be configured by NREL researchers to perform either of the following main functions:

- Create a *Customized Research Grid* isolated from the utility (i.e. to expose research devices to extreme grid power perturbances)
- Act as *Loads and/or Generators* on the utility grid (i.e. to emulate a wide range of different types of electrical devices or systems)

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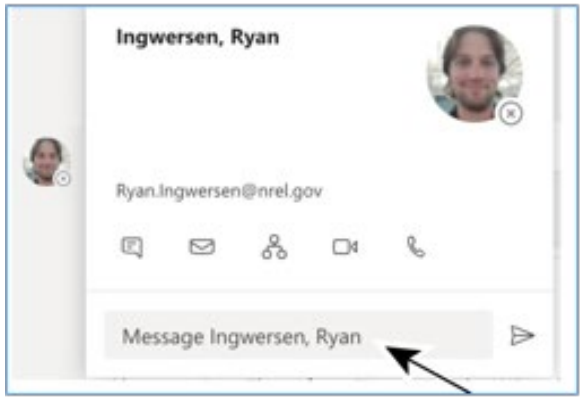

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Breakout Sessions

- Report Themes
- Q&A

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Contact

Email: aries@nrel.gov
Web: nrel.gov/aries