

Advancing Your Energy Goals, Together.



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Housekeeping Slides

Webinar and Q&A Format

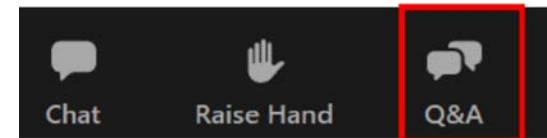
This webinar is scheduled for one hour, including the presentation and approximately 15 minutes for Q&A. If needed, the webinar will extend past the hour to answer as many audience questions as we can.

This webinar will be recorded

and streamed on the IDEA website within 24 hours of the conclusion of this webinar. Registrants will also be sent a follow-up email with links to the recording and presentation slides. A link to the presentation slides is also provided in the chat box if you want to print out and follow along.

How to Submit Questions

Please submit questions via the “Q&A” box during the presentation portion of the webinar. The Q&A icon can be found in the menu bar at the bottom of your screen. Questions will be reviewed by IDEA and posed to the presenters by the host at the conclusion of their presentation.



If you are having audio or video issues, please send a note via the Chat to our host, Jason Beal.

Today's Speakers



MICHAEL KILPATRICK
Key Segment Manager,
Duke Energy Sustainable
Solutions



WAYNE JOHNSON
Key Segment Manager,
Duke Energy Sustainable
Solutions

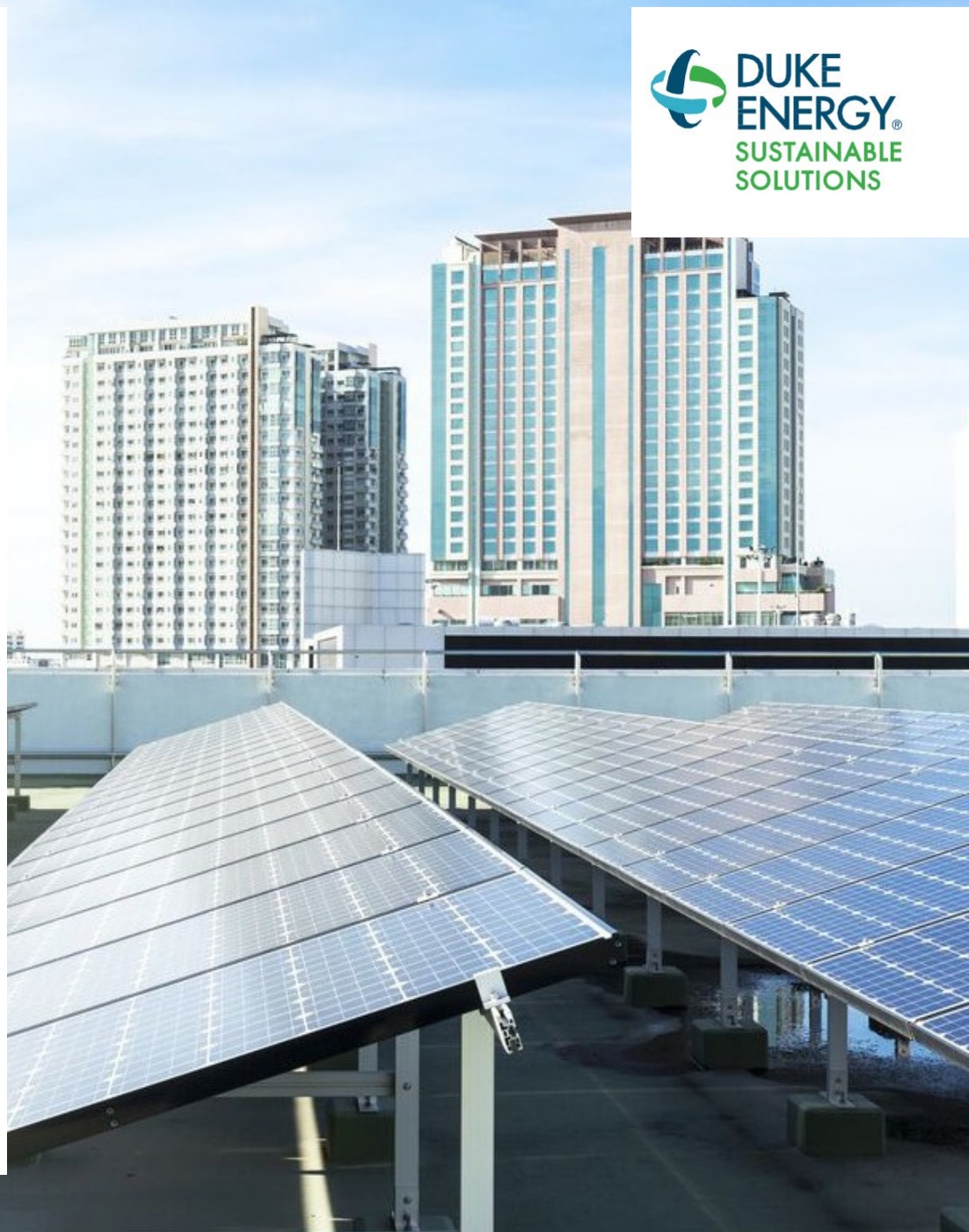


SANIYA LeBLANC
Director of Energy Innovation
Initiative; Associate Professor,
George Washington
University



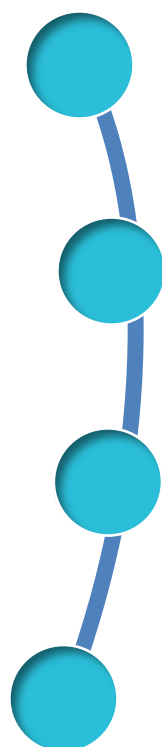
Proven. Innovative. Forward-thinking.

- 5,100 MW of renewables owned and operated
- 20+ years of renewable energy experience
- Installations in 34 states and territories
- 100+ emergency backup sites with 24/7 monitoring
- Top 20 U.S. solar developer
- 3,000+MW of wind
- 1,400+ MW utility scale solar projects



Battery Storage: Challenges and Opportunities

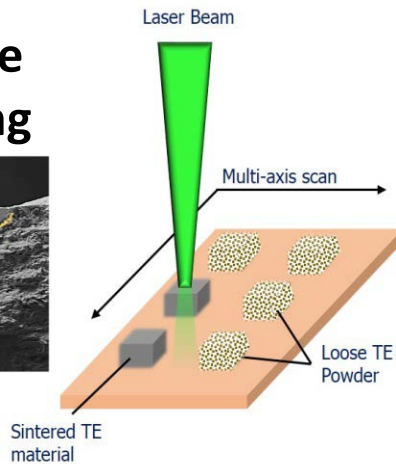
Topics of Discussion

- 
- Grid Technology Trends
 - Battery Storage Success Stories
 - Battery Storage or Thermal Storage
 - Tipping Points for Deployment



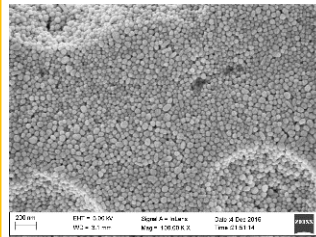
Examples: thermoelectrics, photovoltaics, sensors

Laser additive manufacturing



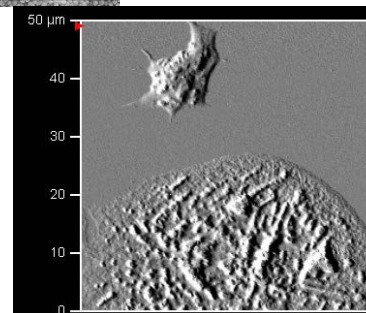
Inkjet printing

Carbon nanoparticles



**Metal &
semiconductor
nano/micro-
particles**

Biological nano-materials



Hot fluid stream

Heat exchanger

Interface material

Insulator

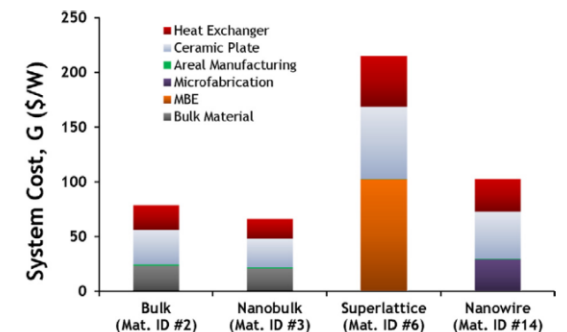
Electrical shunt

n-type

p-type

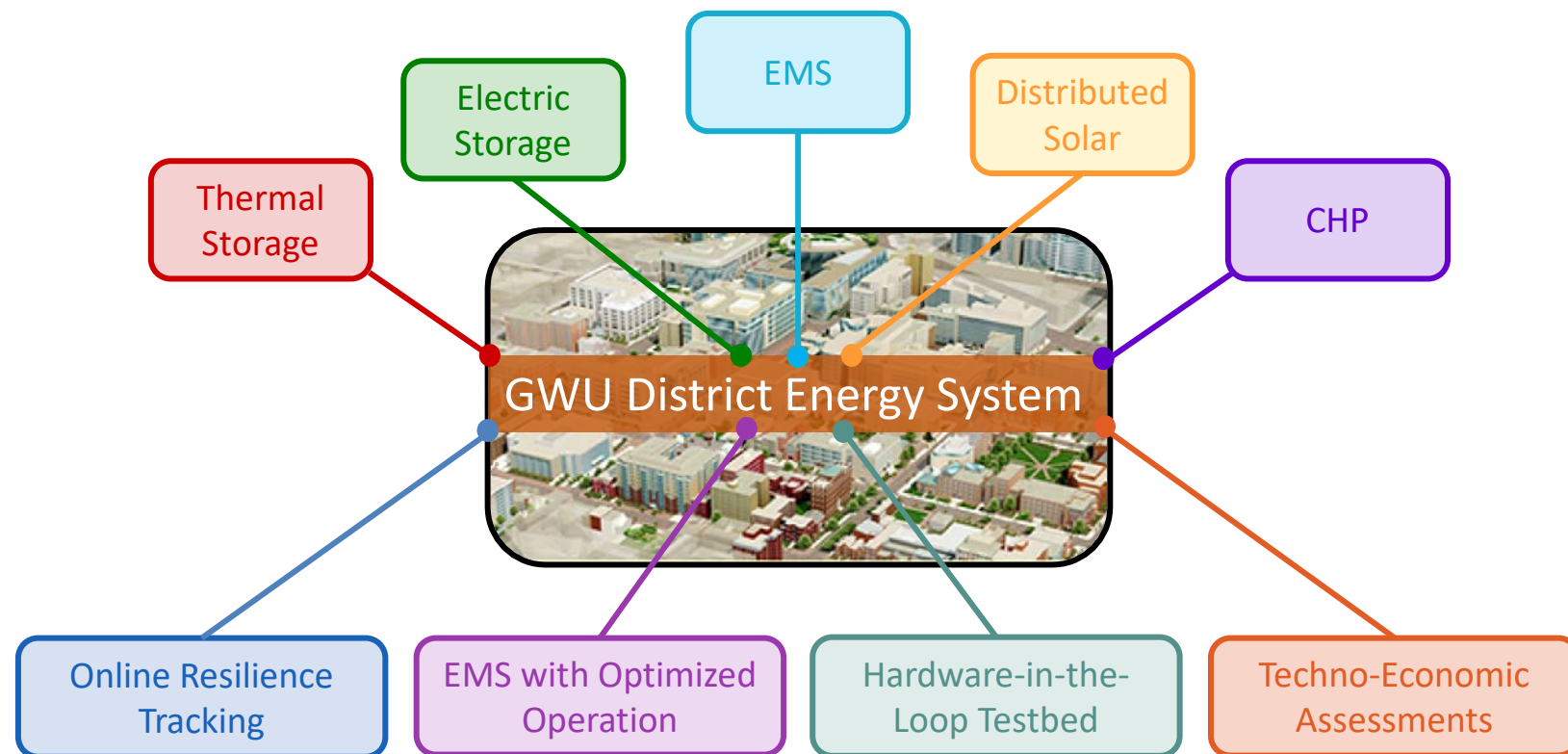
Cold fluid stream

Equivalent circuit diagram showing thermal resistances ($R_{h,h}$, $R_{boundaries}$, $R_{h,c}$) and temperatures (T_h , $T_{TEM,h}$, $T_{TEM,c}$, T_c) connected to a load resistance (R_{load}) and a voltage source ($T_h - T_c$). Heat fluxes ($q_{load}/2$) are indicated at the boundaries.



Urban Combined Heat and Power with Integrated Renewables and Energy Storage Project

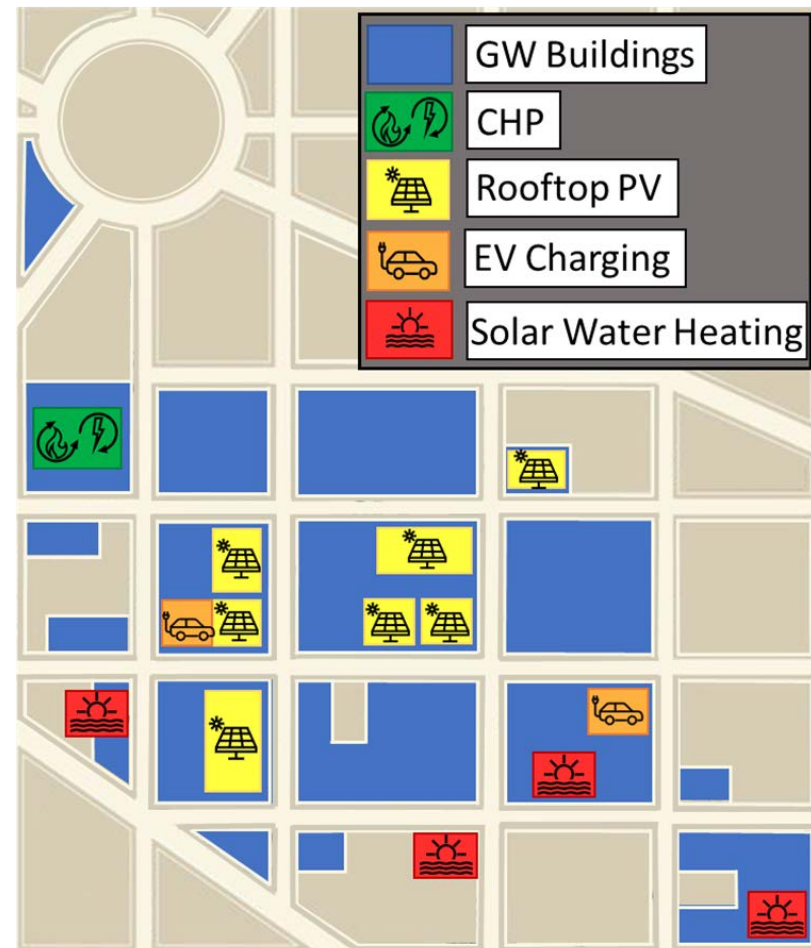
Project Goal: Determine how to effectively integrate and enhance electricity generation and energy storage components of an urban district energy system (DES), using the GWU DES as a case study.



This material is based on work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the Advanced Manufacturing Office Award Number DE-EE00009140. The views expressed herein do not necessarily represent the views of the U.S. Department of Energy or the United States Government.

GWU District Energy System

- 7.4 MW Combined Heat and Power Plant
 - Supports 2 academic and 3 residential buildings
- 52 MW solar farm (Capital Partners Solar Project)
 - 50% of GW's Electricity
- 2 electric vehicle charging stations
- 4 solar water heating systems
 - 2/3 of hot water used by 4 residential buildings
- 497 kW campus rooftop solar



Sustainable Energy Solutions

Together, providing cleaner, sustainable and resilient energy alternatives.

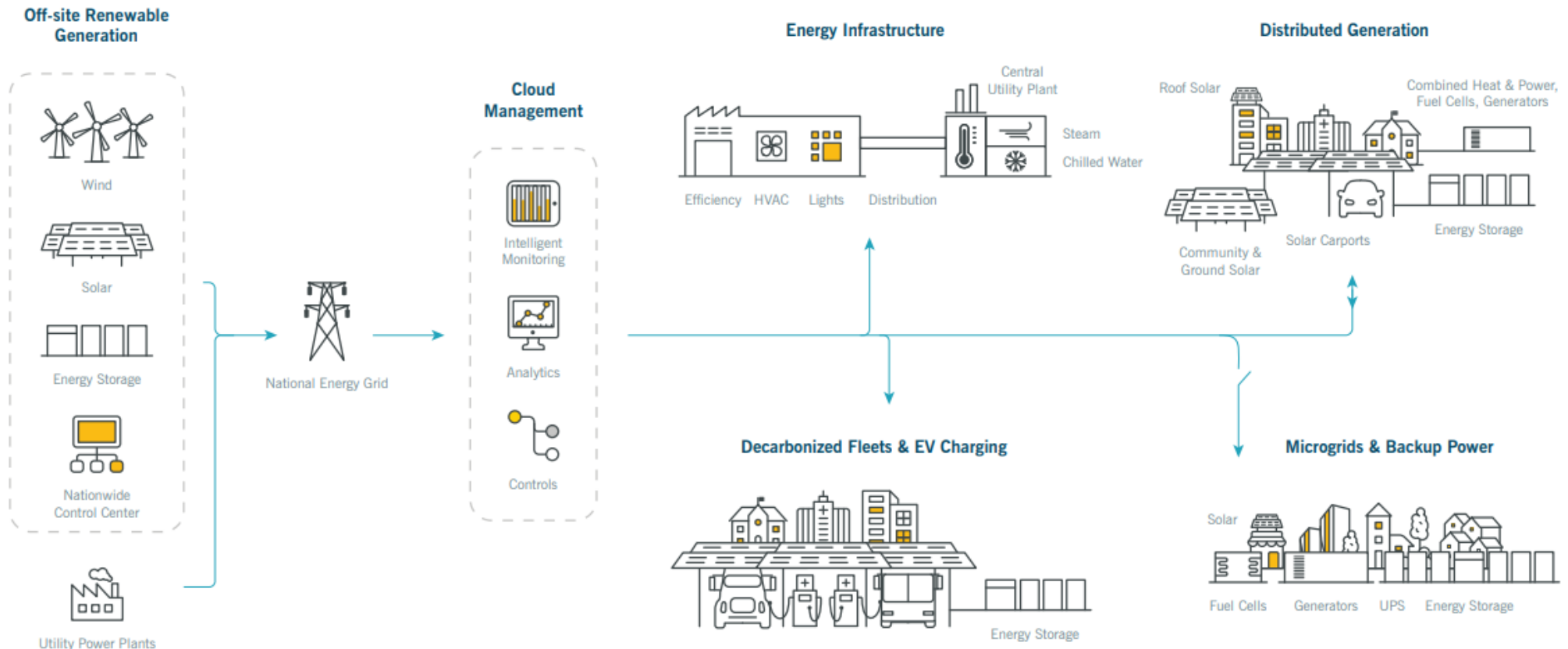


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Emerging Technology Application and Training Center



**EMERGING
TECHNOLOGY
OFFICE**

Energy Storage



- Improved efficiencies and enhanced reliability, in some cases enabling us to defer future grid investments that otherwise would be required.
- Ability to store and dispatch energy at strategic times along the energy grid.
- Increased grid flexibility to help manage continued growth of intermittent resources on our system – like solar energy.
- Energy security and back-up power for critical services to the community - like hospitals, universities, emergency shelters and the military - while also serving to enhance grid operations.



Mt. Holly Microgrid

Energy

Duke Energy partners with Honeywell to test emerging battery technology

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A Duke Energy employee working at its massive battery storage project at the NoTress Wind power plant. CHS/ES L H/8819

By John Downey - Senior Staff Writer, Charlotte Business Journal
Oct 26, 2021, 1:00pm EDT

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Technology

Industry

Utilities

Topic

Renewable Energy

Topic

Duke Energy Corp.

Company

Honeywell International Inc.

Company

Eos Energy Storage LLC

Company

Tom Fenimore

Person

More

Two Charlotte-based giants are joining up to test a new battery technology that could have major implications for energy infrastructure.

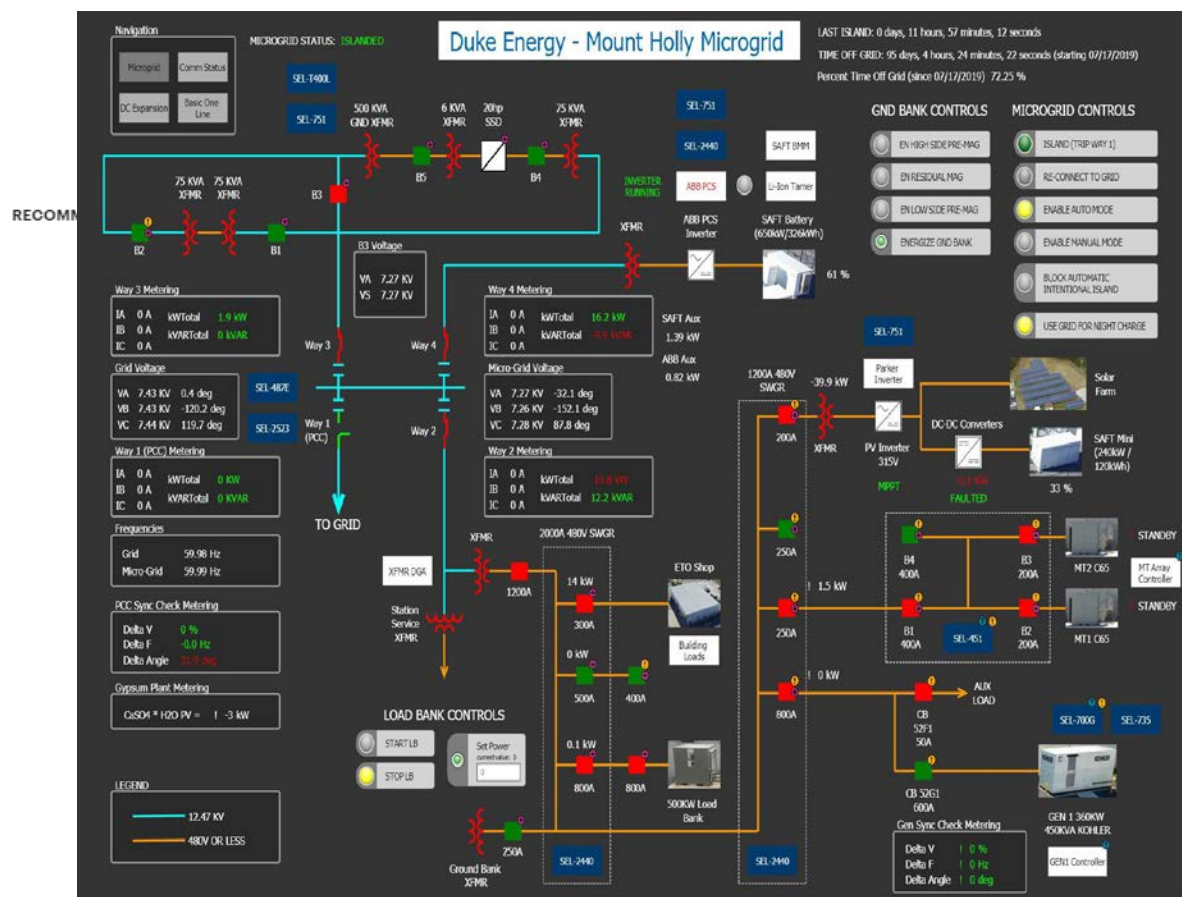
Duke Energy (NYSE: DUK) will test a new 12-hour flow battery technology developed by Honeywell International (Nasdaq: HON) at its Emerging Technology and Innovation Center in Mount Holly.

The battery would, for instance, allow solar energy produced during sunlight hours to be stored and dispatched in the evenings and early mornings – key for a utility like Duke that increasingly finds its peak power demand shifting to early winter mornings. It can also store power from any source against the possibility of outages and could be particularly useful in microgrid applications.

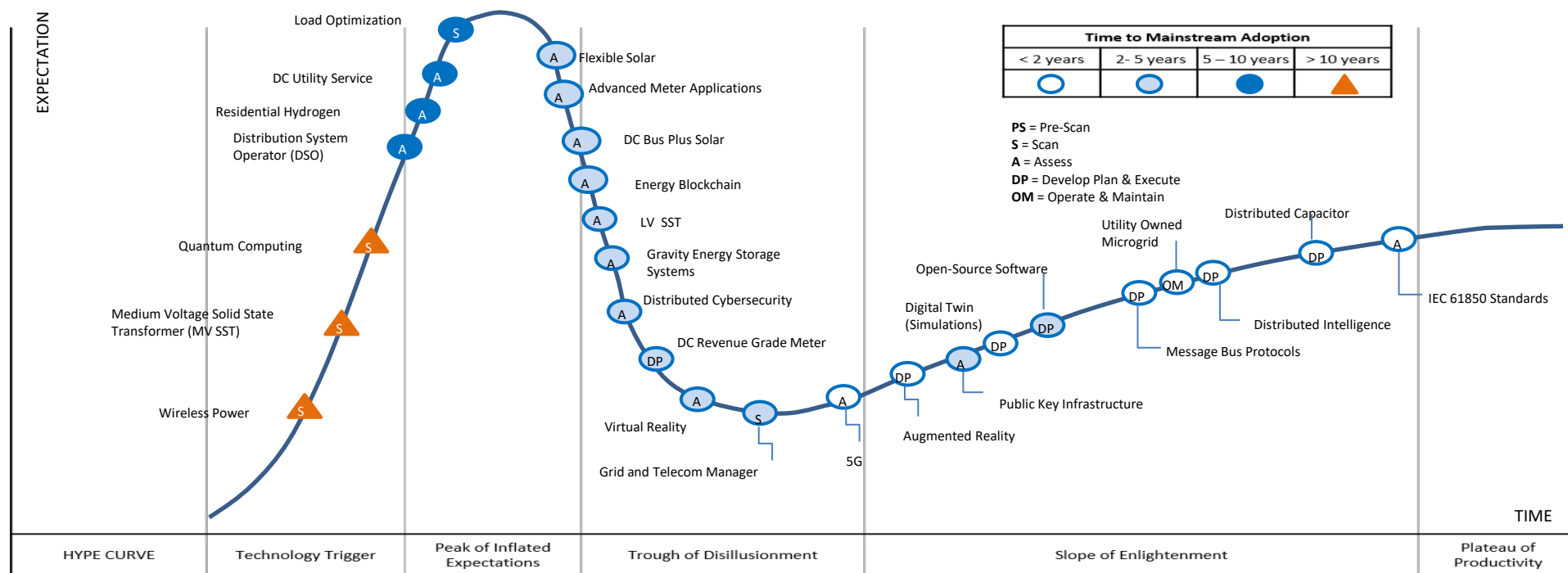
But that is not the only important advantage to this nascent technology, says **Tom Fenimore**, Duke's director of Smart Grid Emerging Technology and Operations. The flow battery uses a non-toxic chemical storage that produces less heat and thus eliminates a fire risk present in lithium-ion battery technology.

"It is inherently safe, offers the potential for long duration and can be manufactured at a very large scale for grid use," Fenimore says.

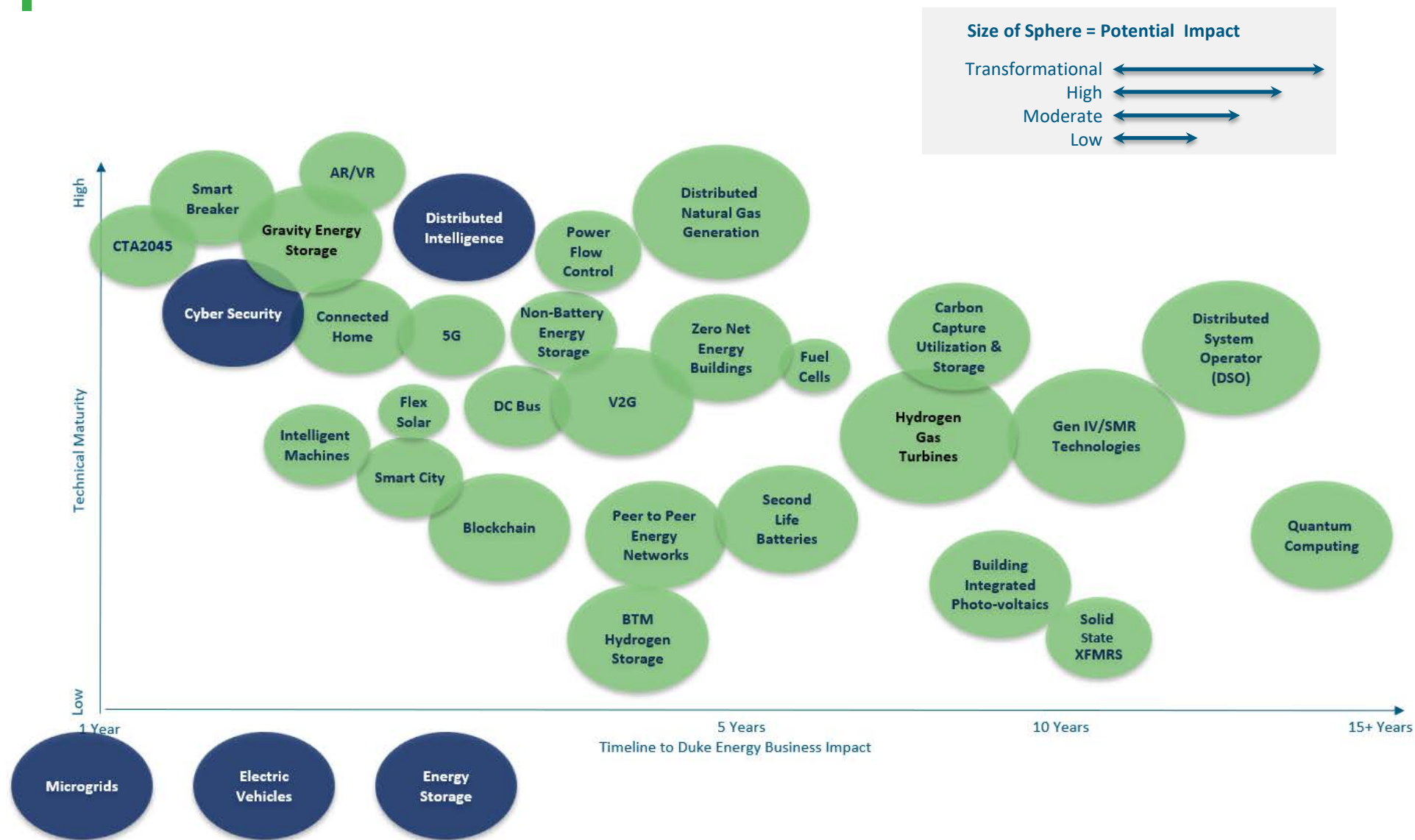
The battery is expected to have a 20-year lifespan with no degradation and is recyclable.



Major Trends in Grid Technology



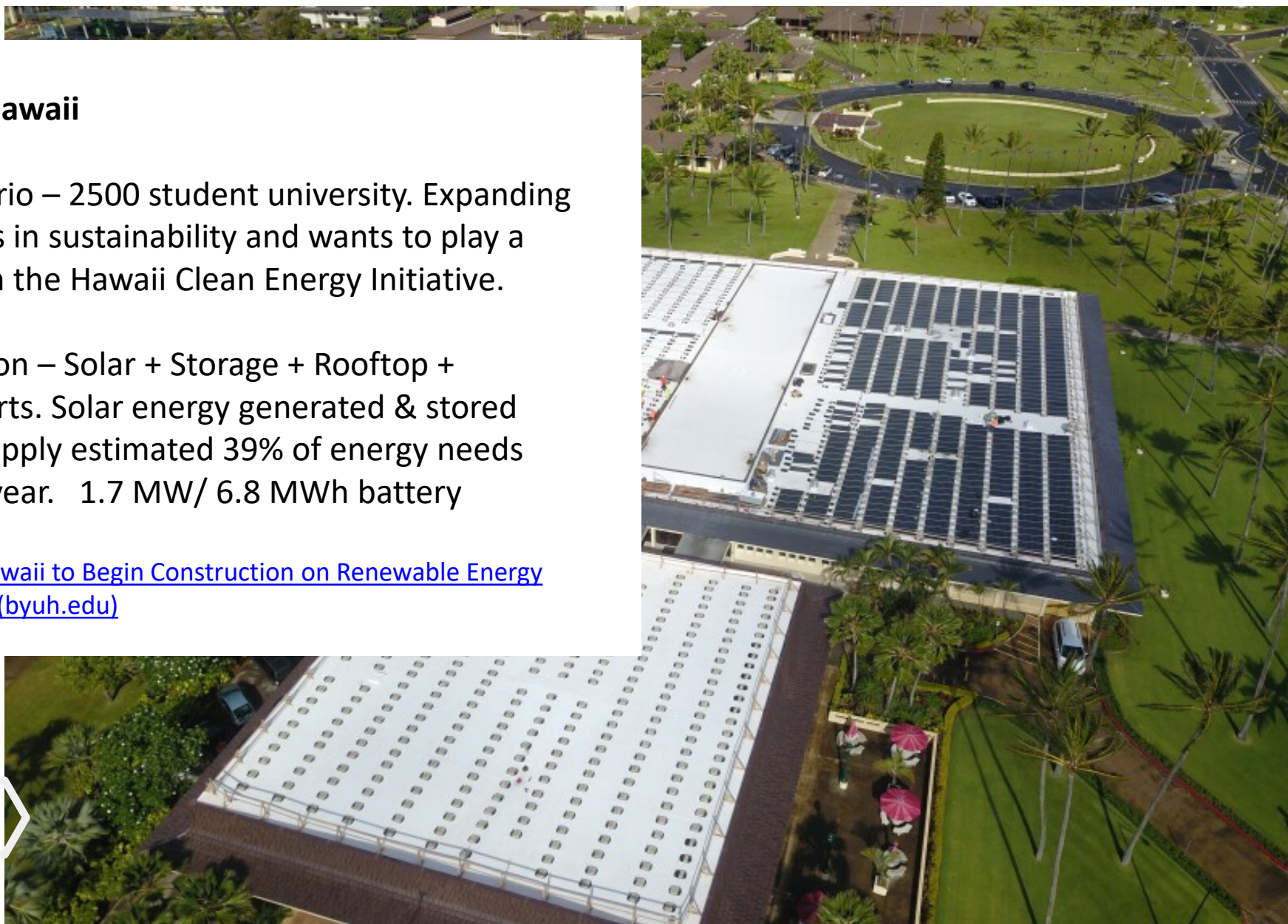
Grid Technology Trends



Battery Storage Deployment Success

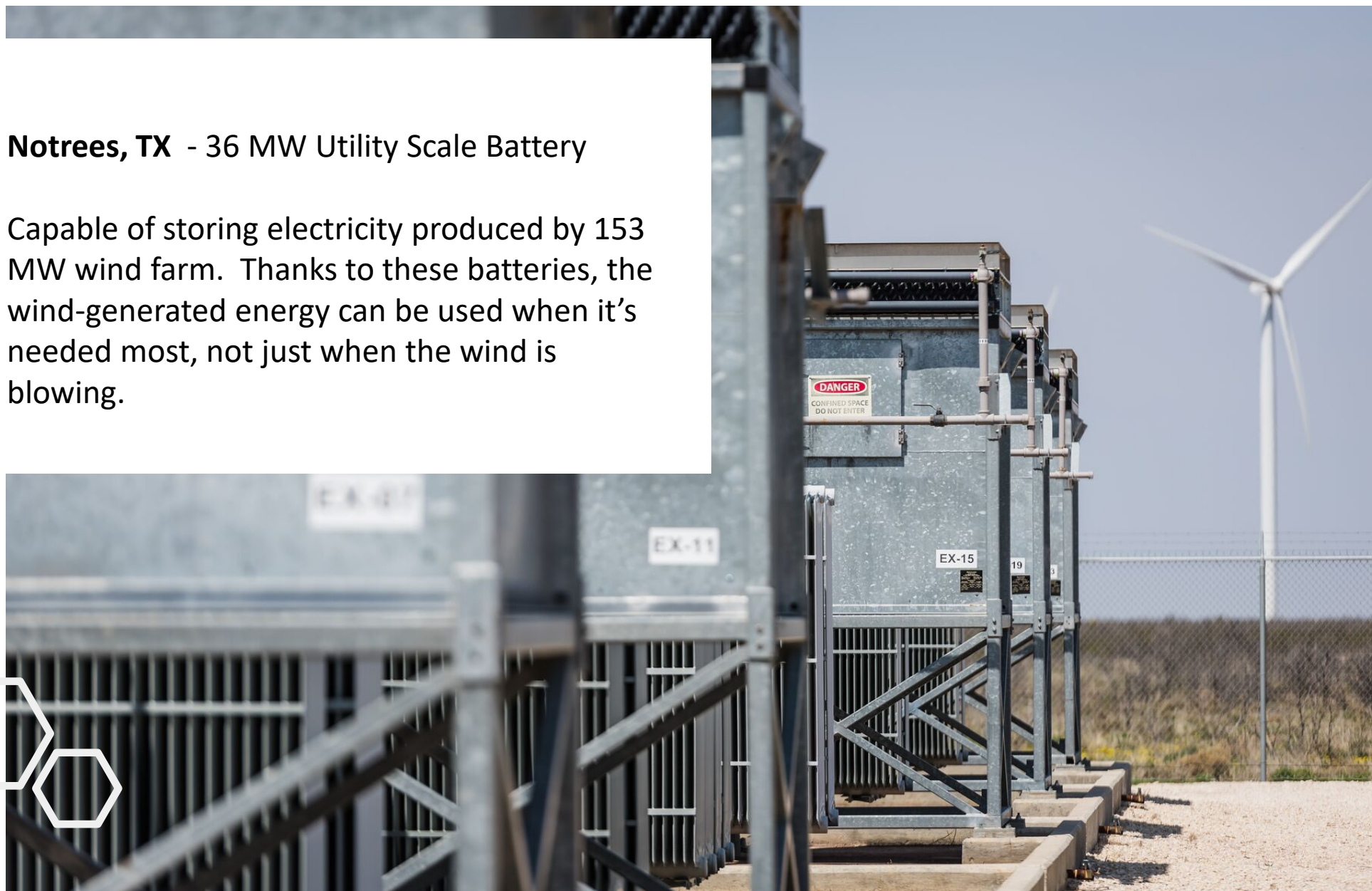
- **BYU Hawaii**
- Scenario – 2500 student university. Expanding efforts in sustainability and wants to play a part in the Hawaii Clean Energy Initiative.
- Solution – Solar + Storage + Rooftop + Carports. Solar energy generated & stored will supply estimated 39% of energy needs each year. 1.7 MW/ 6.8 MWh battery

[BYU–Hawaii to Begin Construction on Renewable Energy System \(byuh.edu\)](http://byuh.edu)

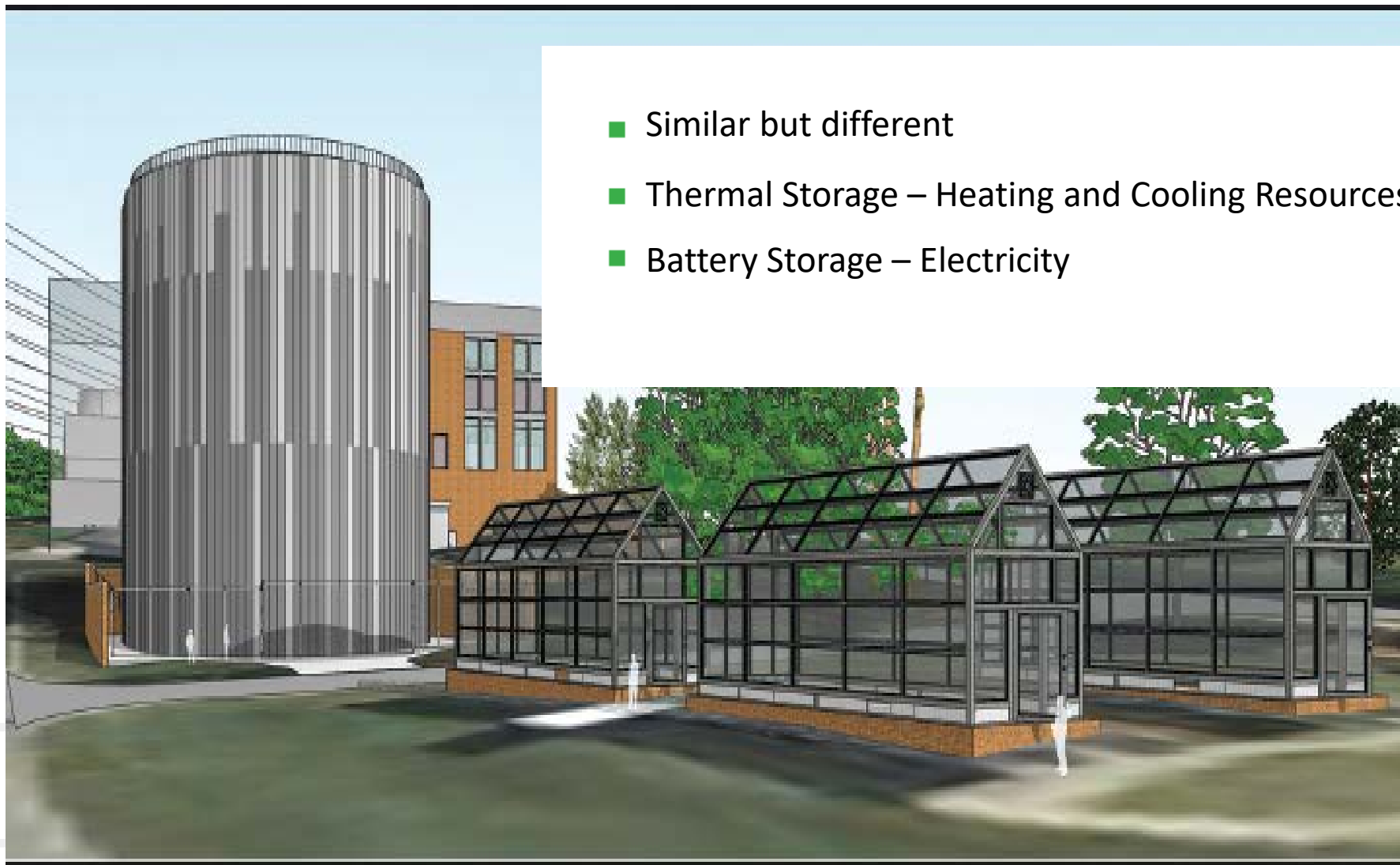


Battery Storage Deployment Success

- **Notrees, TX** - 36 MW Utility Scale Battery
- Capable of storing electricity produced by 153 MW wind farm. Thanks to these batteries, the wind-generated energy can be used when it's needed most, not just when the wind is blowing.



Battery Storage or Thermal Storage



Battery Benefits Beyond Thermal Storage

Benefits/Considerations

- Multiple Dispatch Modes
 - Heating
 - Cooling
 - Motor Loads
 - Energy Arbitrage
 - Resiliency
- Space Considerations
 - Parking Decks
 - Ground Mount
- Maintenance
 - Contracts Available
 - Cooling (check efficiency)

Challenges

- Initial Cost
- Electrical Infrastructure
- Financial Success dependent on market rates

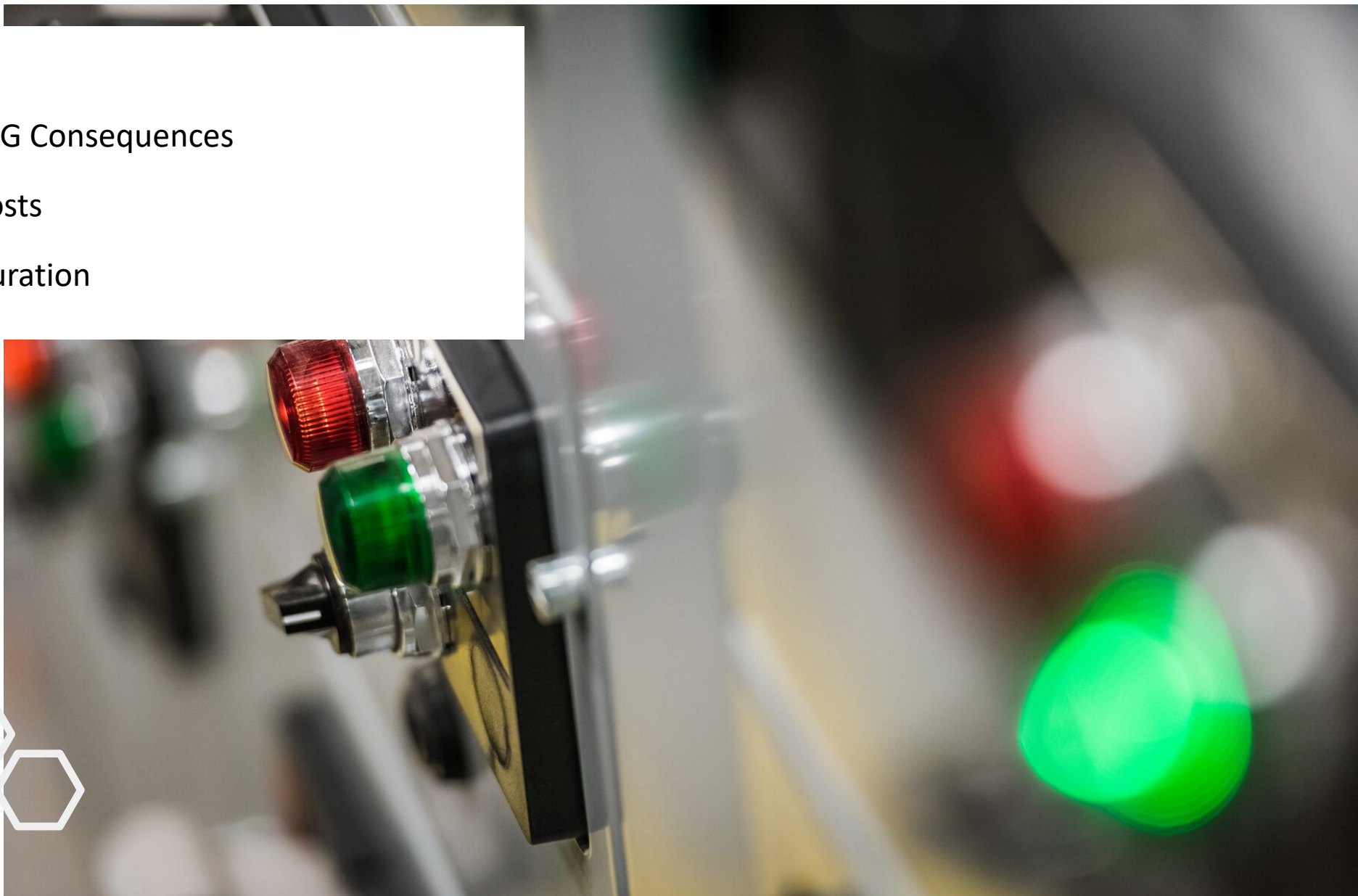
Influential Landscape

- Legislative
 - National
 - State
 - Regulators
 - Munis
- Market Trends (rates)
- ESG
 - Promoters
 - Road blockers



Battery Storage Tipping Points for Deployment

- ESG Consequences
- Costs
- Duration





Thank you!

Questions?

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Thank You for Attending!



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CampusEnergy2022

Feb.15-18 | Westin Boston Seaport District Hotel | Boston, MA

<https://www.districtenergy.org/campusenergy2022>

Registration Opens This Week!

Next I&I Webinar

***Redundant and Resilient Control System
Design for District Energy Facilities***

Sponsored by Thermo Systems

Wednesday, November 17 at 1:00pm EST

<https://bit.ly/ThermolandI>

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Contact Tanya Kozel at

tanya.idea@districtenergy.org

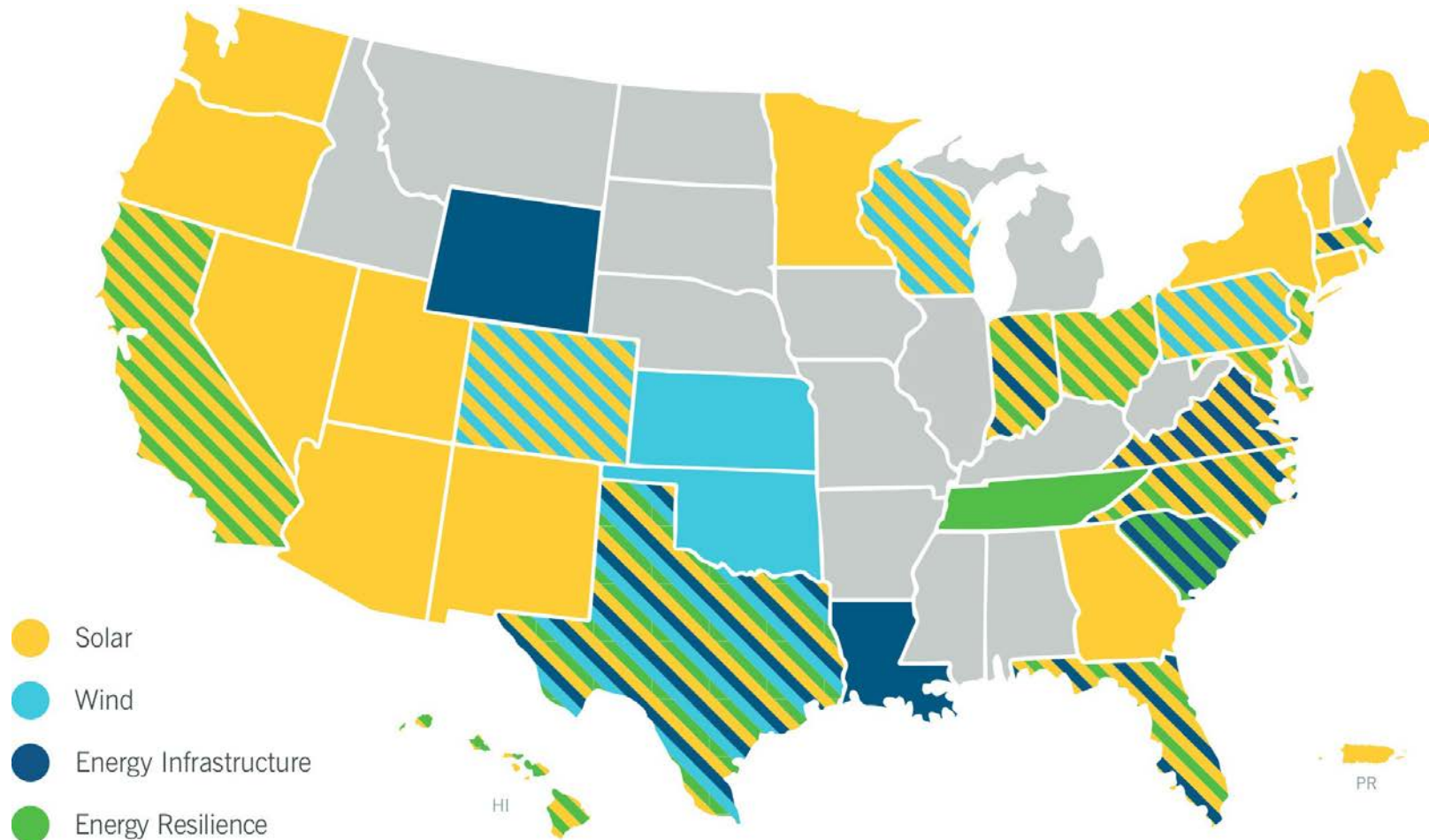
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Virtual Learning

Our Nationwide Sustainable Energy Solutions.



■ 5,100+ MW renewables owned and operated

■ 1,000+ renewable installations

■ 20+ years of experience

■ 800+ times equipment provided businesses with continuity