



**ENERGY &
MANUFACTURING®**
— in Appalachia —

Energy Supply Chain Overviews Webinar Series

Sept 11	AI Data Centers: Power & Electrical Infrastructure
Sept 25	Natural Gas: Upstream
Oct 2	AI Data Center: Advanced Cooling
Oct 16	Natural Gas: RNG from Anerobic Digesters
Nov 6	Geothermal
Nov 20	AI Data Centers: Steel Infrastructure

www.wemakeithere.org/energy/

Coming Soon

Natural Gas: Midstream Merchant Solar Hydrogen: SMR Electric Grid Components



Energy Industry Overview – Battery Storage



Alliance for
Manufacturing
and Technology

Acknowledgement

- ARC ARISE
- Tom Reed, Catalyst Connection
- Matt Henderson, Henderson Consulting
- John Cerveney, NY-BEST
- Akash Saraf, Customized Energy Solutions

Agenda

- What is Battery and Energy storage (BESS)
- The Rise of BESS
- Market Overview, Growth & Drivers
- Challenges & Opportunities
- Emerging Technologies
- Developers, Manufacturers & Associations
- Q&A

About AMT

- Private, not-for-profit established in 1988.
- Part of the Manufacturing Extension Partnership (MEP) Program.
- Experienced professionals who deliver business solutions to small to mid-sized Southern Tier Manufacturers.
 - Offer end-to-end business and technical consulting and training services to help organizations.
 - Connect to resources available at the local, regional, and national levels.
 - Provide economic impact to the community and region

Introductions

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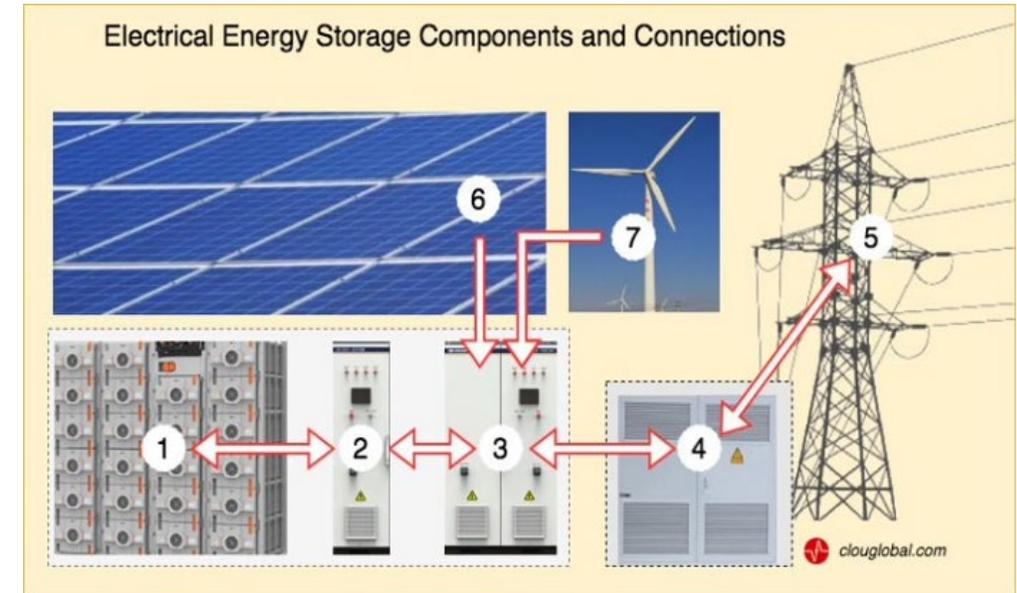
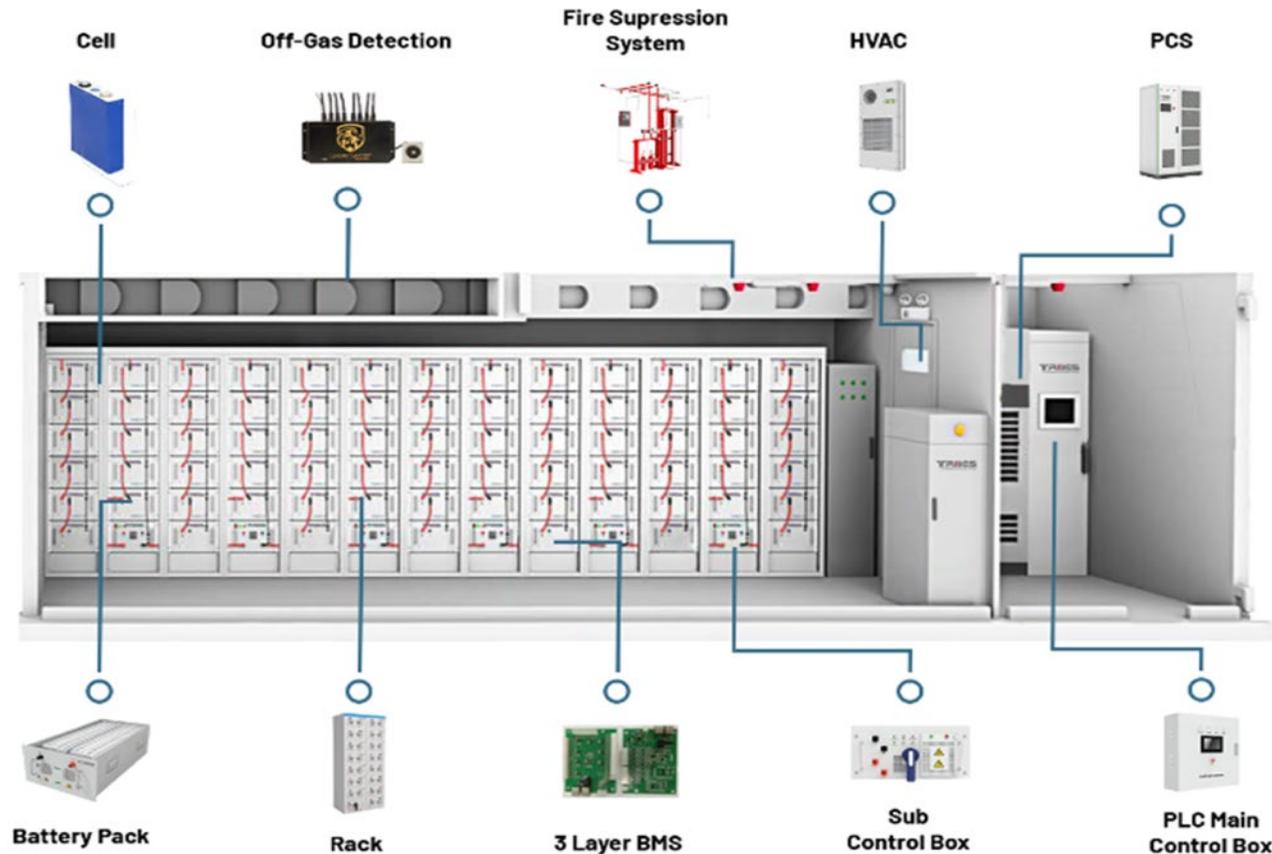
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What is Battery and Energy storage (BESS)



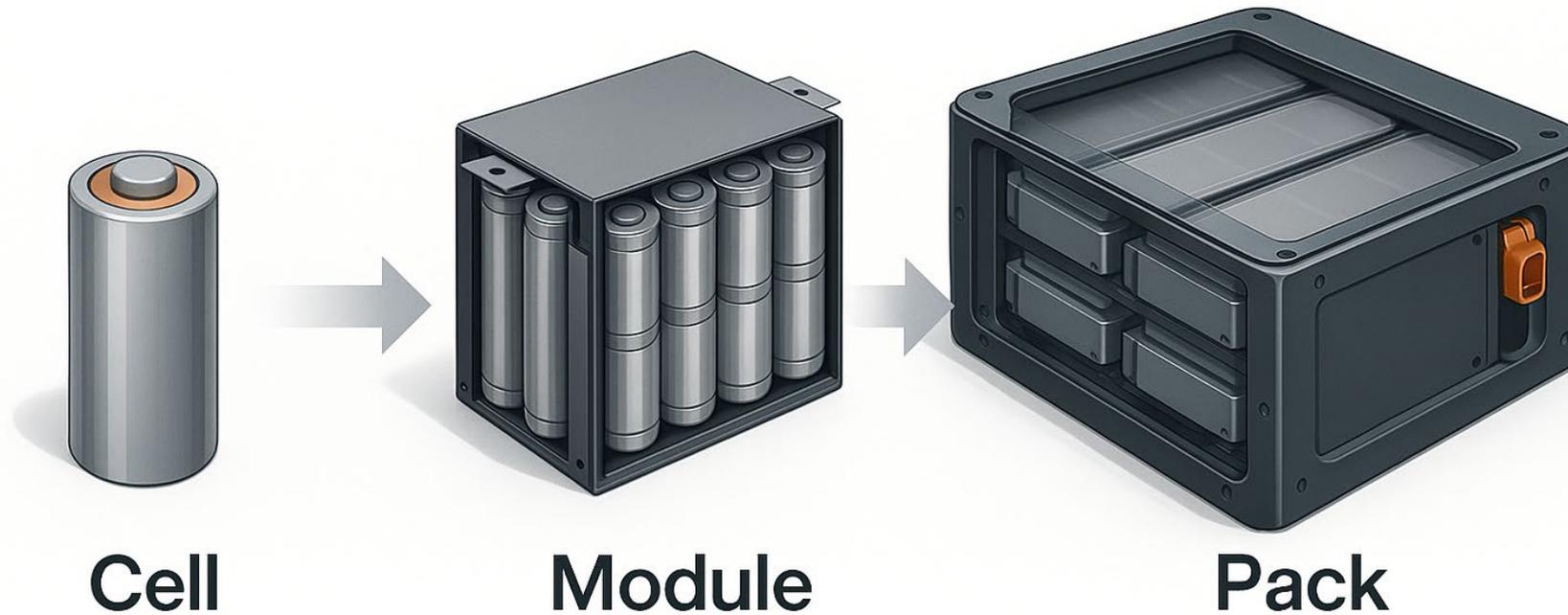
May 13, 2019 - Utility scale lithium ion Battery Energy Storage System (BESS) installation at Ft. Carson. NREL provided an independent review of Ft. Carson's proposed battery energy storage system through funding from the U.S. Department of Energy's Federal Energy Management Program (FEMP). Using our REopt energy optimization and modeling software, NREL verified the batteries' potential economic savings and helped Fort Carson characterize technology risk. (Photo by Dennis Schroeder / NREL)

What is Battery and Energy storage (BESS)

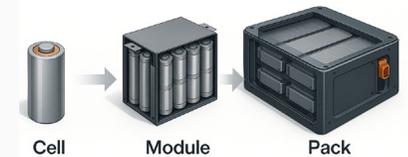
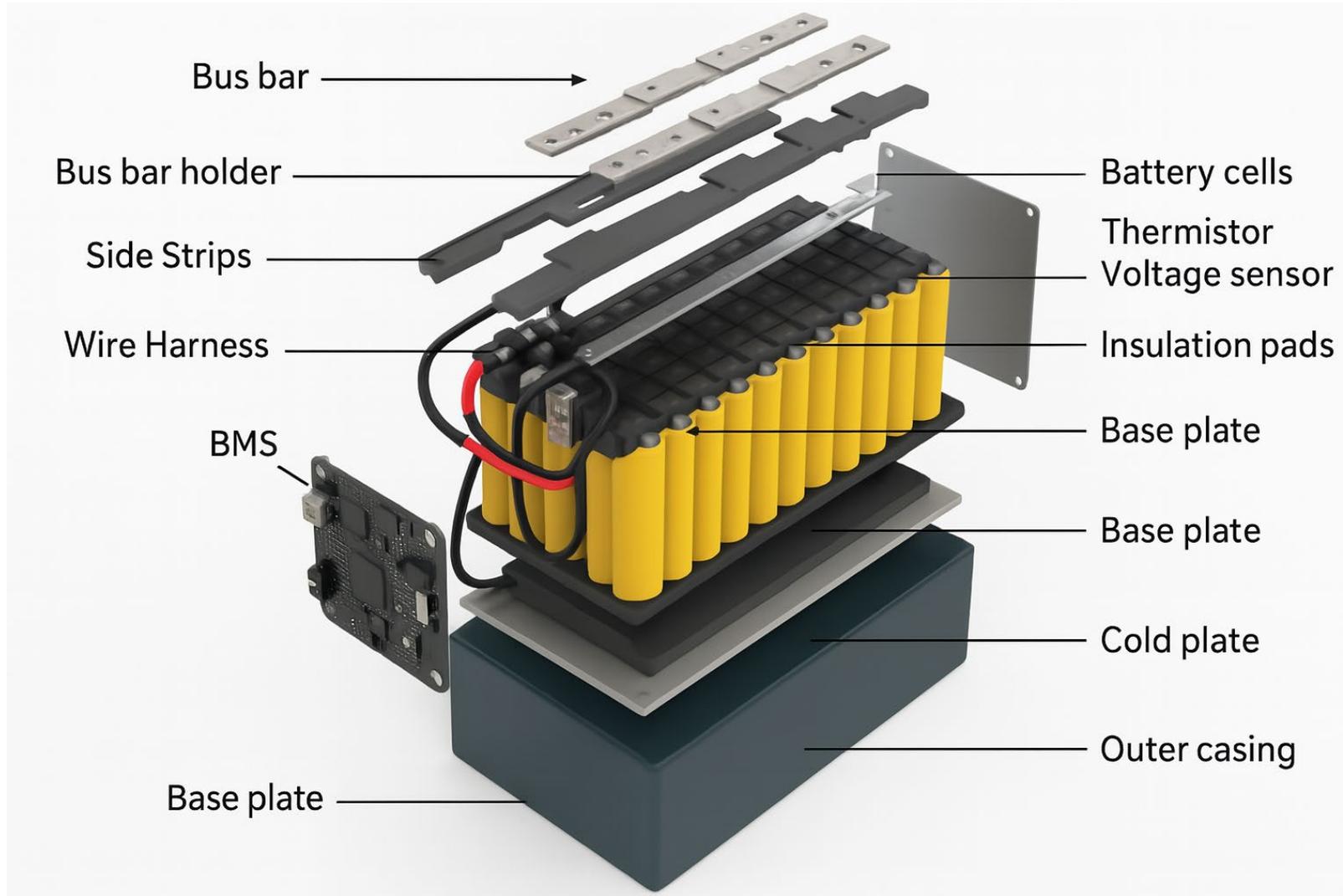


1. Battery Racks/Stacks
2. Battery Management System (BMS)
3. Power Conversion System (PCS)
4. Transformer
5. Power Grid
6. Solar Power Plants
7. Wind Turbines

What is Battery and Energy storage (BESS)



What is Battery and Energy storage (BESS)



Introduction – The Rise of BESS

Role in Modern Energy Infrastructure

Battery Energy Storage Systems (BESS) are essential to modern energy infrastructure, enabling the integration of renewable energy sources, supporting grid modernization, and advancing decarbonization policies.

This technology is rapidly becoming a cornerstone of 21st-century energy systems worldwide.

Support for Renewable Energy

As intermittent renewables like solar and wind become more prevalent, BESS provides critical grid stability.

It also enables energy shifting and offers backup power capabilities.

Advancing Decarbonization

BESS plays a pivotal role in advancing decarbonization policies.

Its adoption supports the transition to cleaner and more sustainable energy systems.



Market Overview & Growth

Installed BESS Capacity

26 GWh

Global installed BESS capacity exceeds 200 GWh as of 2024, and China is leading

Estimated market size

USD 10-16 billion

Includes Utility Scale Battery systems (primarily Lithium-ion), residential and commercial storage (Tesla Powerwall, etc.), installation, integration, and maintenance activities

Expected market growth compound annual growth rate (CAGR)

32%

Emerging Markets / Targets

New York **6 MW**

New Jersey **2 MW**

Connecticut **1 MW**

Leading States

California ~**11.7 GW**

Texas ~**7.5 GW**

Arizona ~**2.1 GW**

Nevada ~**1.1 GW**

New York ~**0.2 GW**



Key Market Drivers

- Government Policies
 - Federal and state climate goals mandate clean energy and storage deployment (e.g., California's SB100, New York's CLCPA).
- High Energy Demand
 - Growing electricity consumption from data centers (4.4% in 2023, projected up to 12% by 2028).
 - Utilities deploy BESS for grid support, congestion relief, demand charge management, and resilience.
- Environmental Goals
 - Corporations like Amazon, Google, Microsoft use BESS to meet Scope 2 and 3 emissions targets.
 - Puerto Rico integrates BESS with solar for hurricane resilience.
- Technological Advancements
 - Declining lithium-ion battery costs and improved performance expand BESS applications.

Technological Advancements in BESS

- Decline in Lithium-ion Battery Costs

- Lithium-ion battery pack prices dropped to \$139/kWh in 2023, down 14% from 2022.
- Sub-\$100/kWh expected to accelerate adoption.

- AI Enhancements in Battery Management

- AI algorithms extend battery lifespan, optimize efficiency, and reduce operational costs.
- These advancements are pivotal for modern energy storage systems.

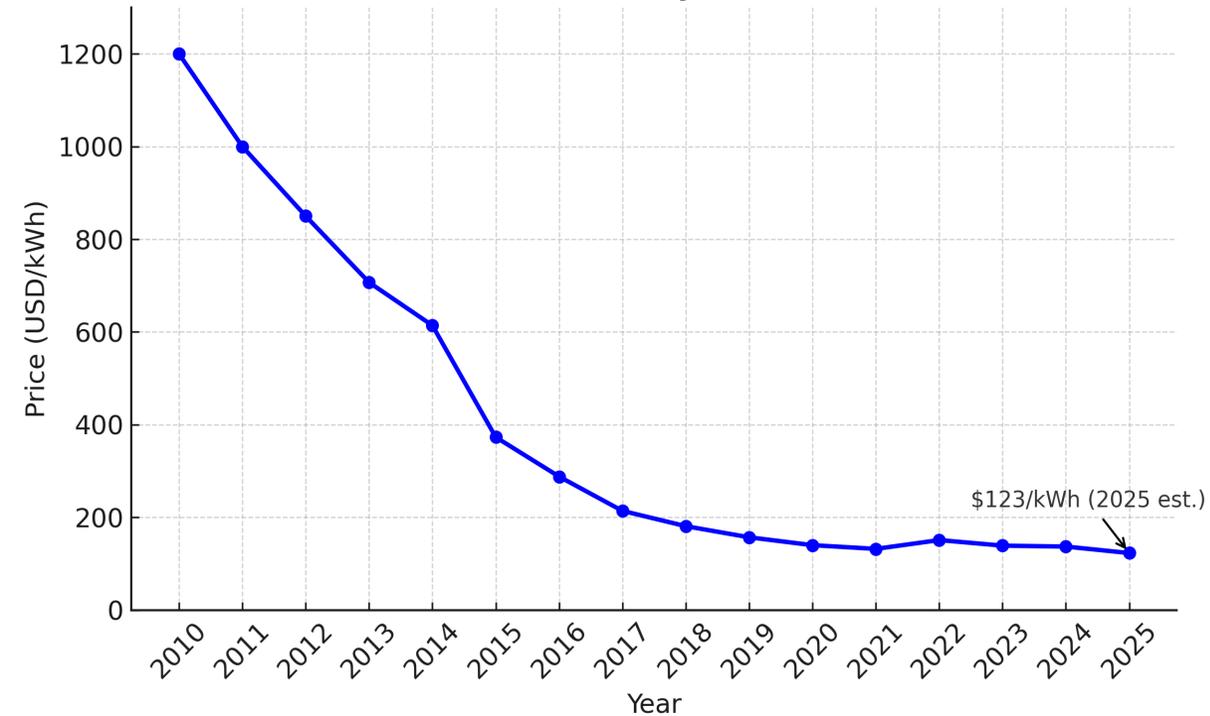
- Repurposing Second-life EV Batteries

- Second-life EV batteries are increasingly repurposed for stationary storage.
- This is especially prevalent in low-duty applications.

- Improved Safety and Grid Integration

- Enhanced safety features and grid-responsive controls improve reliability.
- These developments facilitate seamless integration into energy networks.

Decline in Lithium-ion Battery Pack Prices (2010-2025)



Challenges and Concerns

Challenge	Why It Matters
Regulatory Hurdles 	Delays deployment; increases costs and uncertainty.
Environmental Impacts 	Mining & disposal risks harm ecosystems.
Resource Constraints 	Reliance on few countries for key minerals.
Safety Risks 	Thermal runaway hazards require strong safety protocols.
Grid Integration 	Complex upgrades needed for smooth operation.

Supply Chain Opportunities for Manufacturers

NAICS Code	Component / Sub-assembly	Category
3321 – Stamping	Bus bars (stamped)	Modules, Packs
3323 – Architectural & Structural Metals Mfg.	Fabricated metal parts	Packs, Racks, Containers
3261 – Plastics Product Mfg.	Injection-molded plastics	Modules, Packs
3344 – Semiconductor & Other Electronic Component Mfg.	Circuit boards / PCBAs	Modules, Packs, BMS, PCS
3345 – Measuring & Control Instruments Mfg.	Sensors	Modules, Packs, Containers
3359 – Other Electrical Equipment & Component Mfg.	Electrical components & connectors	Modules, Packs, BMS, PCS
3353 – Electrical Equipment Mfg.	Cables & harnesses	Modules, Packs, Racks
3334 – HVAC & Commercial Refrigeration Equipment Mfg.	HVAC systems	Containers

Emerging Technologies



Lithium-ion
Mature, dominant
technology



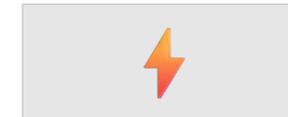
Flow batteries
Long cycle life



Sodium-ion
Low-cost, early
commercialization



Iron-air
Long-duration,
low-cost



Solid-state
High energy density

Technology	Benefit	Status
AI/Smart BMS	Performance, safety	Mainstreaming
Second-Life Batteries	Sustainability, lower cost	Early adoption
Vanadium/Iron Flow	Long duration, safe	Early commercial
Sodium-Ion	Low cost, safe	Emerging (pilots, pre-commercial)
Iron-Air	Very long duration, low cost	Pilots ++
Solid-State Li	High energy, safer	R&D / early pilots

Leading Developers, Manufacturers & Associations



Provides turnkey energy storage systems enhanced with AI-driven software for optimal performance.



Develops large-scale battery projects, including the Moss Landing facility, integrating renewable generation.



Major developer of utility-scale solar and storage projects across the U.S



U.S. trade association advancing battery technology and domestic supply chain through industry collaboration, training, and advocacy.



New York consortium supporting energy storage growth via networking, policy advocacy, and testing/commercialization resources.

In Case You Missed It!

- **Short Summary:**

- Battery Energy Storage Systems (BESS) are rapidly transforming modern energy infrastructure by enabling grid modernization, renewable integration, and decarbonization expansion.
- The market is experiencing explosive growth driven by increasing energy demand, technological innovation, and policy support, while facing challenges and opportunities in regulations, supply chains, and safety.

- **Key Highlights:**

- BESS is scaling fast – Global capacity over 200 GWh, U.S. growing at 32% CAGR.
- Costs keep falling – Lithium-ion packs heading toward \$120/kWh by 2025, unlocking more applications.
- Opportunities are real – U.S. manufacturers can tap into components, integration, and recycling markets.

