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ENERGY STORAGE FIELD VALIDATION

How ES Field Validation Supports U.S. Large Load Growth & the Broader Electric Grid

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PROJECT OVERVIEW



- Goal: ES demonstration projects are strategic instruments for validating performance, de-risking investment, building market confidence, and informing necessary Codes, Standards, and Regulations (CSRs).
- Current Practice: Non-National Lab led demonstration projects are often performed in a silo with little to no information flowing to the broader ES community. National Lab led demonstration projects provide unprecedented access to the life-cycle operational and performance characteristics and many other project lessons learned.
- Why SNL: SNL's long leadership and experience in ES Demonstration Projects, complementary technical R&D depth with cost competitive materials, power electronics, analytics, and reliability makes SNL a leader in achieving DOE OE's goals.
- Innovation: National Lab ES demonstration projects test, validate, and attempt to bridge the "second valley of death" where technologies are too mature for basic research funding but too unproven for private capital.
- Demonstration projects have been instrumental in proving ES is a key enabler of enhancing grid stability, improving the efficiency of all generation assets, and improving the overall flexibility of our Nations electric power system.
- Vertical/Investment Area:
 - Grid Integration and Field Validation
- Alignment/Supports strategic pathway: ES demonstration projects supports an energy policy that enables the goals of Stabilizing and Optimizing grid services and Growing grid capacity utilizing all forms of reliable, dispatchable American energy that also includes job creation in on-shored manufacturing of ES materials, components and systems.

FROM LOAD GROWTH TO COMMERCIALIZED CAPACITY

Why DOE OE relies on national-lab field validation to turn nameplate capacity into firm, dispatchable grid capacity



THE PRESSURE

Load growing faster than the grid can absorb

AI data centers: 4.4% of U.S. electricity in 2023 → 6.7–12% by 2028 (DOE).
Hyperscale campuses now arrive as 500 MW–1 GW single-point loads.

RESPONSE

THE TOOL

Storage can scale to meet this demand

\$70/kWh stationary pack price (BNEF 2025, ↓45% YoY). 24 GW utility-scale BESS planned for 2026 (EIA, record). 500+ GWh through 2031 (ACP/SEIA).

THE VALIDATION GAP, who closes it?

WHAT OEMS PUBLISH

Lab-bench specifications

Single-cell, controlled climate, idealized duty cycles. Warranty assumptions, not field behavior.

WHAT NATIONAL LABS DELIVER

Independent field validation

Neutral, validation testing on a diverse set of technologies and system deployments by or with the National Labs & industry partnerships.

WHAT THE MARKET NEEDS

Codes, bankability, and markets

Interconnection studies, Codes and Standards (UL 9540A, NFPA 855), insurance, 20-yr PPAs: all need field-validated data.

MAP TO OE STRATEGIC PATHWAYS

01 STABILIZE

Driver: New ramp & fault profiles from AI campuses, other load growth, disaster scenarios.

Validation delivers: Fault ride-through, black-start, grid-forming behavior under real duty cycles, field validated so utilities can count storage as firm capacity.

02 OPTIMIZE

Driver: 44 GW existing fleet must do more including frequency, voltage, capacity, ancillary stacking.

Validation delivers: Field-measured round-trip efficiency, degradation curves, and controls performance that can unlock revenue stacking and longer warranted life.

03 GROW

Driver: 500+ GWh needed by 2031 with much of it for AI loads.

Validation delivers: De-risks next-gen chemistries (sodium-ion, metal-air, flow, thermal, mechanical, super caps) from TRL 6→8. This is the lab-to-grid step commercial capital won't fund alone.

National-lab field validation turns nameplate capacity into bankable, dispatchable capacity which is the linchpin between OE strategy and the grid utilities operate.



Where the Load Is Landing and Where Storage Needs to Lead



HOME > NEWS > THE MISSION CRITICAL POWER CHANNEL

Oracle to deploy up to 2.45GW of Bloom fuel cells at New Mexico data center

https://projectjupitertogether.com/?gad_source=1&gad_campaignid=23911232041&gclid=EAlaIqobChMI--vD7tqMIQMv9BGtBh2G7jRNEAAYASAAEgImW_D_BwE

Energy Storage is the cornerstone for grid-limited large loads but only field validated systems will actually supply these needs.

C&I ENERGY STORAGE: THE GRID WORKHORSE

Utility-scale, large-load BESS alone can't solve all grid problems.



UTILITY-SCALE BESS

100+ MW · substation-connected · wholesale market participation

- Bulk energy arbitrage and capacity
- Frequency regulation, spinning reserve
- Intermittent firming at the ISO/RTO level
- Multi-year siting, interconnect, & permitting
- Sited where land is cheap (utility owned), convenient for the utility but not where local load lives

C&I-SCALE BESS

100 kW–50 MW · distribution & behind-the-meter · aggregated VPPs

- Voltage support & feeder power-flow control
- Peak shaving, demand response, ancillary services
- Microgrid islanding & black-start for critical loads
- Grid resilience
- Affordability
- Solves problems where the load lives

C&I STORAGE

01

Stabilize

Voltage support, fast frequency response, and grid-forming capability at the distribution level where bulk BESS can't reach.

Feeder voltage regulation · Microgrid islanding · Backup for hospitals, water, comms

02

Optimize

Time-of-use arbitrage and demand-charge management let C&I sites shift load off-peak, deferring T&D upgrades and squeezing more out of existing feeders.

Peak shaving · Demand-charge reduction · T&D upgrade deferral

03

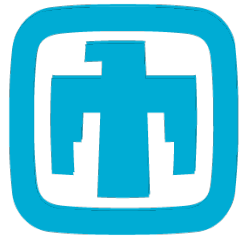
Grow

C&I deployments scale where transmission can't by hosting new industrial loads, charging depots, and data-center on-ramps before the bulk grid catches up.

Industrial onsite · Data-center on-ramp during interconnect wait · Charging depots

Field validation of energy storage operating at the distribution edge is how OE and the National Labs work translates into impacts that reach the American customer.

FIELD VALIDATION IN ACTION



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- 📱🔋 Energy storage enables resilience & affordability with rural electric co-ops
- 📱🔋 Innovative energy storage technologies
- 📱🔋 Supercapacitor testing & evaluation
- 📱🔋 Energy storage Codes & Standards updates



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