ROW ENERGY

WHITE PAPER

Electrostatic Long-Duration Energy Storage (ELDES)

Powered by WEST Supercapacitor Technology

INTRODUCTION

Utah's rapidly expanding energy needs—Hyperscale Data Centers, IPP's, Microgrids & Municipal Resilience, Telecom, Towers & Federal Sites, Industrial growth, Municipal resilience, and EV charging corridors—expose significant limitations in today's lithium-ion (LFP/NMC) storage. These include:

+ Fire and thermal-runaway risk
+ Rapid degradation from day one
+ Limited cycling (≈1 cycle/day)
+ Short lifespan (5–7 years)
+ Heavy HVAC dependence
+ Poor extreme-temperature performance
+ Toxic mining and weak recyclability
+ Foreign supply chain exposure

WEST's graphene-based supercapacitor architecture provides a fundamentally different storage method:

+ Non-chemical, non-flammable energy storage
+ Zero heat generation under load
+ 500,000 cycles with no degradation
+ 4+ cycles/day
+ 99.1% round-trip efficiency
+ 100% usable capacity

WEST's is a true **Electrostatic Long-Duration Energy Storage (ELDES)** platform. ROW Energy integrates and manufactures this technology in Utah.

TECHNOLOGY OVERVIEW

Electrostatic Supercapacitor Architecture

WEST's modules operate electrostatically rather than chemically. Key characteristics include:

+ Graphene-based supercapacitors
+ GaN-based active balancing
+ DC-DC discharge smoothing
+ Ultra-low leakage (<1% after 90 days)
+ No electrolyte, no off gassing, no combustion risk

This eliminates all chemical and thermal failure modes found in lithium systems.

Extreme Temperature Operation

WEST modules maintain full performance from:

+ –40°F to +149°F

Lithium suffers permanent damage below ~23°F and above ~113°F and requires HVAC to remain within safe ranges.
WEST thermal resilience eliminates parasitic HVAC loads and prevents derating.

ROW's U.S. Assembly, Racking, and UL Commissioning

ROW performs all of these in Utah:

+ Module assembly
+ Racking and bus architecture
+ Factory testing
+ Integration
+ UL 810A / UL 9540 certification workflows

This provides a secure, domestic supply chain for utilities, hyperscalers, and government agencies.

Containerized Energy Storage

ROW Energy containers are:

+ Non-flammable
+ Stackable and modular
+ 80% biodegradable
+ Zero HVAC
+ Zero oversizing required

This simplifies permitting, reduces space, and lowers O&M.

ROW ENERGY VS. LITHIUM (TECHNICAL COMPARISON)

Lithium-ion / LFP	ROW Energy Supercapacitors
5–6 year lifespan	25–30 year lifespan
~6,000 cycles	500,000 cycles
≈1 cycle/day	4+ cycles/day
80–90% efficiency	97–99.1% efficiency
Fire risk; thermal runaway	No heat, no fire risk
Requires HVAC	No HVAC, no temperature derating
30–50% oversizing required	No oversizing
~70–80% usable capacity	100% usable capacity

PRIMARY DEPLOYMENT CATEGORIES

Hyperscale Data Centers

Requirements: zero downtime, ultra-fast failover, fire-safe storage, low PUE.

ROW Energy advantages:

+ Nanosecond UPS response
+ No thermal runaway
+ Full output from –40°F to +149°F
+ No HVAC load
+ 25–30 year service life

Independent Power Producers (IPPs)

Needs: multi-cycle operation, grid services, long-term revenue certainty.

ROW Energy provides:

+ 4+ cycles/day without degradation
+ Synthetic inertia, frequency regulation, black-start
+ 99.1% efficiency

Microgrids & Municipal Resilience

Ideal for:

+ Hospitals
+ Tribal communities
+ Rural towns
+ Airports and ports
+ Critical infrastructure

ROW Energy offers multi-decade stability with no HVAC or fire suppression requirements.

Telecom, Towers & Federal Sites

Technical strengths include:

+ Nanosecond responsiveness
+ High-altitude reliability
+ 500,000 cycles with zero degradation

Ultra-Fast EV Charging

Lithium is limited by high C-rate degradation, cold-weather derating, and transformer constraints.

ROW Energy enables:

+ 10-minute recharge buffering
+ Multiple cycles per day
+ Transformer demand reduction

TWENTY-YEAR ECONOMIC MODEL (50 MW)

Three architectures are evaluated over a 20-year period:

1. Pure Lithium-Ion (LFP)
2. Pure ROW Energy Supercapacitors
3. Hybrid (10% Supercaps + 90% Lithium)

Pure Lithium (50 MW)

+ Initial installation
+ Full rebuilds at years 5, 10, and 15

20-year total
$50,000,000

Pure ROW Energy Supercapacitors (50 MW)

+ One installation
+ Zero rebuilds

20-year total
$35,000,000

Hybrid (10% Supercaps / 90% Lithium)

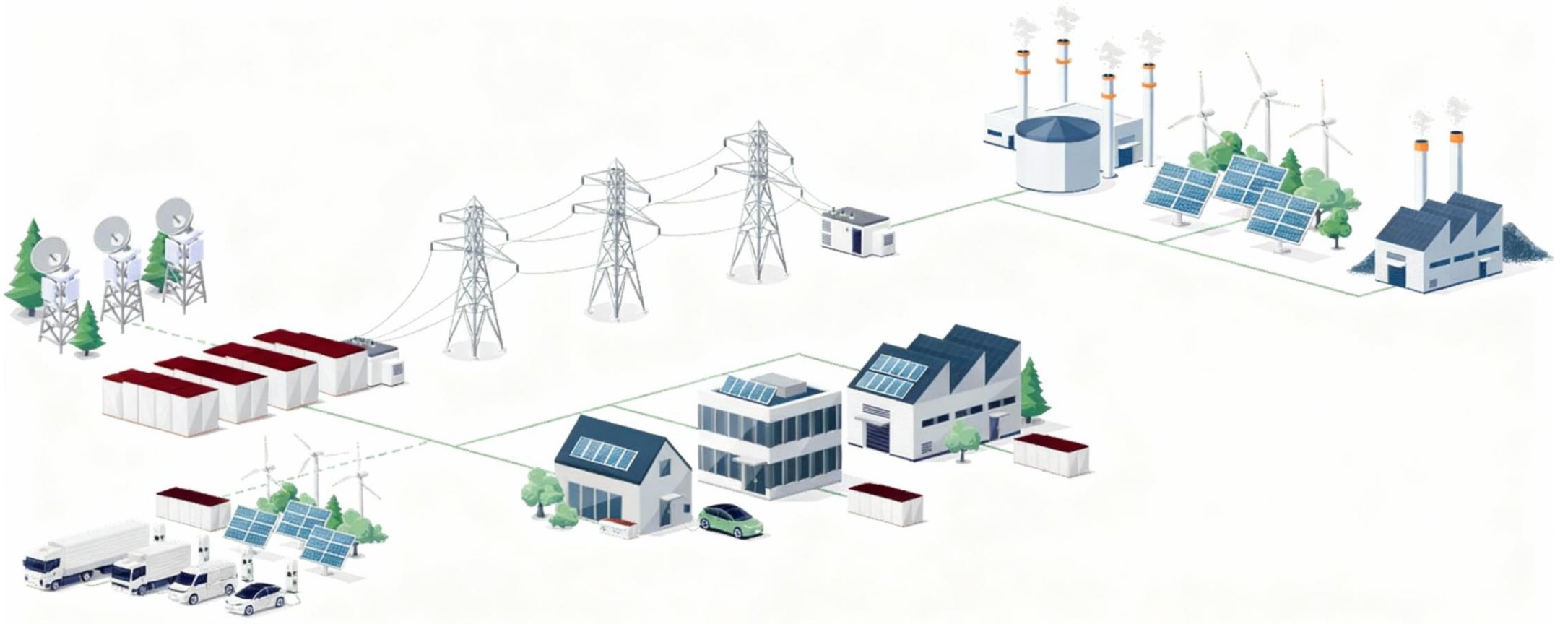
In a hybrid system, ROW Energy supercapacitors sit on the DC bus ahead of the lithium pack, absorbing high-stress events such as surges, transients, high C-rate demands, and fast charging pulses. ROW Energy generates no heat, allowing the lithium to operate only in a gentle, low-temperature, slow-cycling regime. This directly reduces electrolyte breakdown, SEI layer growth, and internal resistance—the main drivers of lithium degradation.

Hybrid systems also protect lithium from harmful temperatures. ROW Energy performs fully from –40°F to +149°F, shielding lithium from the sub-23°F and above-113°F zones where permanent damage accelerates. ROW Energy absorbs micro cycles and peak bursts, preventing over-cycling and eliminating the 30–50% oversizing that lithium systems require.

Key hybrid benefits:

+ Reduces lithium heat stress
+ Eliminates high C-rate cycling
+ Reduces full and partial cycles by 40–60%
+ Extends lithium life from ~5 to ~10 years
+ Removes oversizing requirements
+ Improves system-level efficiency
+ Reduces HVAC and parasitic load

20-year total
$25,500,000



SUMMARY TABLE (20-YEAR TOTALS)

Architecture	Total Cost	Notes
Pure Lithium	$50.0M	Full rebuilds every 5 years
Pure Supercaps	$35.0M	No rebuilds
Hybrid (10%/90%)	$25.5M	Lithium replaced once at year 10

WHY ROW + WEST LEADS THE U.S. STORAGE MARKET

+ U.S.-based assembly, racking, and UL commissioning
+ Non-chemical, non-flammable architecture
+ 25–30 year service life
+ Zero degradation
+ Operates from –40°F to +149°F
+ 4+ daily cycles
+ Nanosecond-level response
+ Lower 20-year cost than lithium
+ Eliminates oversizing and augmentation
+ Ideal for hyperscalers, IPPs, microgrids, telecom, and EV charging