# VSC SYSTEMS

Highest energy in a Supercapacitor. Leading power density. One system.
With Multi-Scale Graphene Inside

# THE TEAM — INVENTORS + OPERATORS WHO HAVE SCALED

We invented the HyperCaP$^{+}$ electrode. We've scaled before

Anirban Das, Ph.D
**CEO**
*Tesla, Apple*

Phillip Aitchison, Ph.D
**CTO**
*CAP-XX, Ionic Industries*

Mainak Majumdar, Ph.D
**CSO – Advisor**
*Monash Univ*

Petar Jovanović Ph.D
**Head, Materials Dev**
*Monash Univ*

**Deep expertise:**
Supercapacitors, battery, nanomaterials, system integration, scaling from lab to fab.

# THE SHIFT IS ALREADY HAPPENING

NEWS | COMPUTING

**Will Supercapacitors Come to AI's Rescue?** ›

Power bursts in large AI workloads can threaten to overwhelm the grid

BY DINA GENKINA | 06 MAY 2025 | 3 MIN READ |

Dina Genkina is the computing and hardware editor at IEEE Spectrum

Supercapacitors are no longer optional.
They are becoming **core infrastructure.**

AI infrastructure and defense systems are forcing a **new standard in energy storage.**

AI rack power trends:

8 kW → 80 kW → 600 kW+

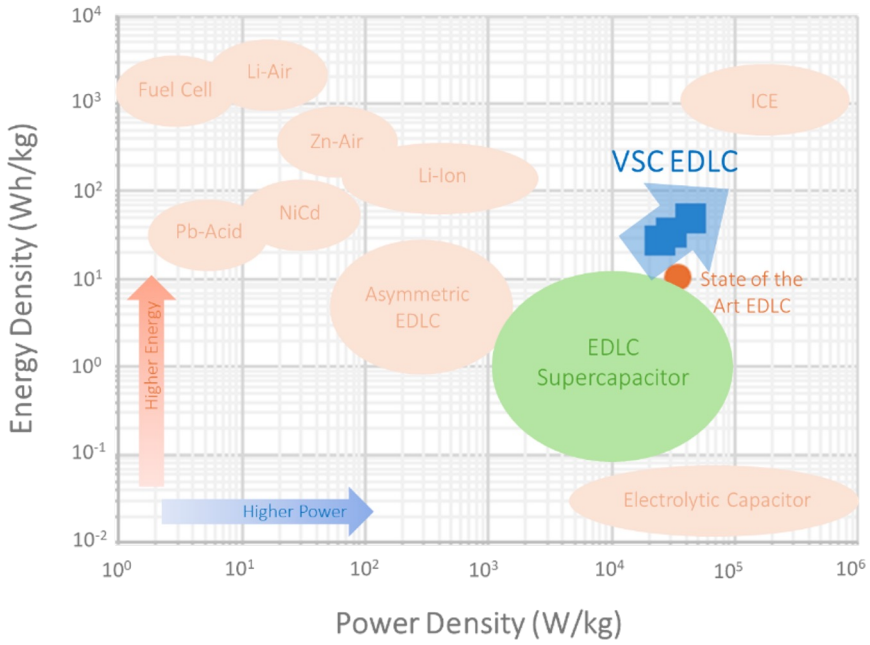
- Millisecond response + high-cycle durability now mandatory
- Lithium-ion alone cannot meet these requirements

Rack power architecture is evolving:

*BBU + HVDC + Supercapacitors*

*https://www.nb.com/en/global/insights/the-800-volt-gorilla-inside-ai-data-centers*

# THE PROBLEM - A BROKEN TRADEOFF




| | Batteries | Supercapacitors |
|---|---|---|
| Energy Density | High | Low |
| Power Density | Low | High |
| Cycle Life | Limited | Extreme |

Today's systems compensate by:

- Oversizing batteries
- Adding separate supercapacitor banks

**Result:** Higher cost. More complexity. Wasted space.

# OUR SOLUTION - COLLAPSE THE TRADEOFF

We build supercapacitor systems powered by proprietary HyperCaP⁺ electrodes.
A new class of material activated once during initial operation to unlock interlayer storage.

| | HyperCaP⁺ | Traditional Supercaps | Hybrid Supercaps |
|---|---|---|---|
| Energy Density | 50 Wh/L | < 10 Wh/L | 20 Wh/L |
| Power Density | 70 kW/L | 10-20 kW/L | 15 kW/L |
| Cycle Life | >100,000 cycles* | 500,000+ | 500,000+ |

* Proven performance in non-optimised prototype cells

- Highest energy density ever demonstrated in a supercapacitor
- Leading power density among energy-dense storage systems
- **Result** : One system. All three attributes.

# THE BREAKTHROUGH - ACTIVATED MULTI-SCALE GRAPHENE (AMG)

nature communications

Article

https://doi.org/10.1038/s41467-025-63485-0

**Operando interlayer expansion of multiscale curved graphene for volumetrically-efficient supercapacitors**

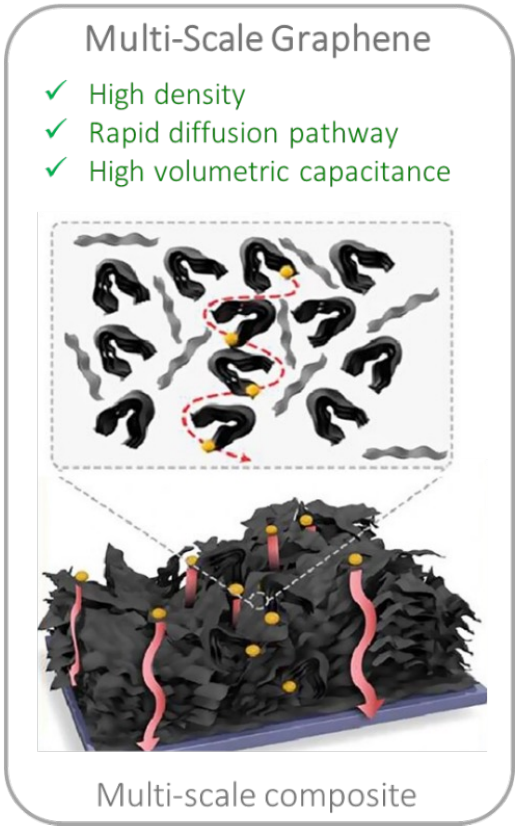
Received: 10 January 2025

Accepted: 18 August 2025

Petar Jovanović [1,2], Meysam Sharifzadeh Mirshekarloo [2,3], Phillip Aitchison [2,3], Mahdokht Shaibani [2,4] & Mainak Majumder [1,2]

What we invented:

- A proprietary multiscale graphene architecture with operando interlayer activation
- High packing density + dynamic ion accessibility
- Electrochemically activated internal surfaces
- Turbostratic crystallites prevent restacking after activation



# WHY THIS WINS

## We're not just building a better supercapacitor

We're creating a **new category**: HyperCaP+ electrodes that deliver leading power density with unprecedented energy density.

| Incumbents (Skeleton, CAP-XX, Eaton) | HyperCaP+ |
|---|---|
| Static porosity | One time activation |
| Fixed architecture | Permanent ion pathways after activation |
| Tradeoff between density and accessibility | No tradeoff |
| Energy density < 10 Wh/L | 50 Wh/L - highest in supercaps |
| Power density 10 - 20 kW/L | 70 kW/L - class leading |

IP Moat - Three Layers, Competitors cannot replicate:

- Materials design
- Manufacturing Process
- Operando activation

# HYPERCAP+ ELECTRODE: MANUFACTURING READINESS AND SCALABILITY

**Current Status:**

- TRL-6: Prototype-ready systems
- Validated in pouch cells
- Process: Two-step rapid thermal synthesis  scalable, low-temperature (700°C)
- Cost: Comparable to activated carbon

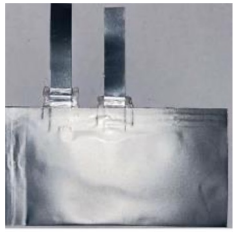
**Key Advantages:**

- Low-temp Process: avoids ultra-high-temperature graphitization (2000°C+)
- Feedstock flexibility: graphite oxide (commercially available)
- Equipment standard: existing industrial furnaces, no custom tooling

**Manufacturing Footprint:**

- Australia (R&D): Core material synthesis, process optimization
- US (Applications Lab): System integration, module assembly
- Partnerships: Toll manufacturing partners identified

**1 kg/day**
0-12 months



Pouch Cell Testing

**10 kg/day**
13-24 months


Commercial Cells

**> 100 Kg/day**
25-36 months


CESS Systems
(CESS / BBU / UPS/ BESS)

# USE CASE #1 - HYPERCAP+ CESS FOR AI DATA CENTRES

Load smoothing for 40% greater FLOPS, reduced energy consumption

## The Problem:

- Poor on-rack efficiency to manage demand surges and heat generation
- High capital cost for cabling, cooling, UPS

## Our Solution:

- On-rack capacitive energy storage system (CESS) with μs response time
- Load smoothing for 40% reduction in energy consumption, reduced heat, increased FLOPS (no throttling)
- High capacity CESS to replace BBU as option
- No hazardous Li-batteries

## New Power Architecture Paradigm:

- 600 kW racks at 800 V (up from 8 kW, 48V)
- Searching for energy efficiency
- On-Rack CESS / BBU for reduced capex
- On-rack CESS for 40% improved energy efficiency

### AI Data Centers - Beachhead Market

- 11,000 data centres in 2026, 14% CAGR to 2030
- 100 GW power, 1000 TWh/yr energy in 2030
- $3 Trillion investment 2026 to 2030

**HyperCaP+ CESS System**
Drop-in BBU replacement / augmentation
40% improved efficiency, less heat, more FLOPS

# USE CASE #2 - HYPERCAP+ BBU / UPS REPLACEMENT

Safe, reliable power replacement for BBU / UPS

### The Problem:

- Unreliable grid power and fluctuating renewable off-grid systems
- Grid power quality (harmonics, frequency control)
- BBU lithium-ion safety concerns, short life, low efficiency

### Our Solution:

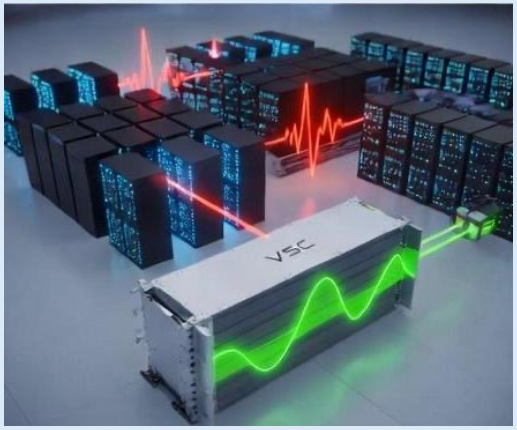
- High capacity, high power CESS to replace on-rack BBU and off-rack BBU cabinets
- No hazardous Li-batteries

### Improved Power Architecture:

- Decentralised power backup
- On-rack CESS as BBU replacement for power ‘glitches’ (1 to 30s)
- On-site large capacity CESS for power quality & grid support
- On-site BESS / UPS for 4-8 hrs backup

### Data Center Power Quality - Expansion Market

- Rapid expansion of data centers
- Lagging, aging grid, regular power outages.
- 15% of US energy consumption in 2030




**HyperCaP+ BBU Replacement**
On-Rack / Off-Rack / Containerised
Safer and 60% smaller than BBU

# USE CASE #3 - HYPERCAP+ DEFENSE HIGH PULSE POWER

Unparalleled power and energy in a compact system

## The Problem:

- Extremely high power pulses for energy weapons (lasers, rail guns)
- State of the art EDLC have low energy density (too bulky)
- Lithium-ion batteries have insufficient power (high resistance)

## Our Solution:

- SWaP optimised HyperCaP+ with industry-best resistance (0.1 mOhm)
- 5x energy density of leading EDLCs (50 Wh/L vs 10 Wh/L)
- 6x power of hybrid supercapacitors (90 kW/L vs 15 kW/L)

## Enabling Technology:

- Directed energy weapons, UAV, radar systems, robotics
- High pulse power
- Reliability over cost

### Extreme Pulse Power - Parallel Market

- Micro (μs) and millisecond (ms) pulses
- Enabling for next generation energy weapons

**HyperCaP+ Pulse Power**
Copmpact, ruggedised, SWaP optimized
75% smaller than EDLC, 10x power of hybrids

# USE CASE #4 - HYPERCAP+ RENEWABLE GRID POWER QUALITY

## On and Off-Grid Stabilisation

### The Problem:

- Unreliable grid power and fluctuating renewable off-grid systems
- Grid power quality (harmonics, frequency control)
- Lithium-ion safety concerns, short life, low efficiency

### Our Solution:

- Containerised high capacity, high power CESS to replace Li-ion
- No hazardous Li-batteries

### Decentralised Renewable Power Architecture:

- Multiple, decentralised power generators feeding grid (or large off-grid)
- Distributed large capacity CESS for power quality & grid support
- Large-scale BESS for overnight (4 - 12 hrs) energy storage

### Grid Power Quality - Expansion Market #2

- Renewable energy 25% growing to 50% in 2030
- Variable quality input needs rectification and smoothing

**HyperCaP+ Grid Support**
Containerised
Safer and 60% smaller than Li-ion batteries

# CESS WITH HYPERCAP+ : ADDRESSABLE MARKET

## Serviceable market at $1.23B+ today to grow 5x by 2030

| Use Case | TAM 2026 ($B) | TAM 2030 ($B) | SAM 2026 ($B) | SAM 2030 ($B) | Growth Drivers |
|---|---|---|---|---|---|
| 1. HyperCaP+ CESS for AI Data Centres (on-rack load smoothing, peak shaving, 40% efficiency gain | 1.4 | 5 | 0.28 | 1.4 | AI-specific energy storage. Volatile rack loads (8→600 kW). SAM = short-burst CESS/hybrid slice where HyperCaP+ replaces/augments BBU |
| 2. HyperCaP+ BBU / UPS replacement (on-rack/off-rack backup, power quality, safer 60% smaller) | 8.5 | 13 | 0.35 | 1.5 | Broader data center UPS + BBU market (deck's $13.6B 2030 benchmark). SAM = high-cycle, ms-response portion for Li-ion replacement. Overlap with UC1 exists in AI facilities |
| 3. HyperCaP+ Defense high pulse power (DEW, radar, railguns – SWaP-optimized pulses) | 7.5 | 15 | 0.25 | 1 | Directed Energy Weapons (DEW) + pulsed-power systems. SAM = high-power-density subsystems (5× energy, 6× power vs. EDLCs). US/DoD focus |
| 4. HyperCaP+ Renewable grid power quality (containerized smoothing, frequency control, renewable integration) | 18 | 39 | 0.35 | 2 | Grid-scale energy storage / power-quality segment of BESS. SAM = fast-response, short-duration slice (harmonics, voltage support) vs. long-duration Li-ion |
| Total | **35.4** | **72** | **1.23** | **5.9** | |

*a) https://finance.yahoo.com/sectors/energy/articles/ai-data-center-energy-storage-163200272.html?guccounter=1*
*b) https://www.prnewswire.com/news-releases/data-center-ups-market-worth-12-47-billion-by-2030--marketsandmarkets-302600838.html*
*c) https://www.mordorintelligence.com/industry-reports/directed-energy-weapons-market*
*d) https://www.researchandmarkets.com/reports/6231711/energy-storage-grid-system-market-report?srsltid=AfmBOorV4aqHgErV3_GeMss8Rb4hhkH-oQU0B9x2bof7I1lhLKegtFQ_*

# PRODUCT STRATEGY

## Systems, not Materials - Powered by HyperCaP⁺ Electrodes

We do not sell materials - we sell systems:

- Rack-level and module-level supercapacitor systems
- Drop-in for AI data centers and defense platforms
- Powered by proprietary HyperCaP⁺ electrodes inside

Why systems:

- Capture full system margin
- Solve complete customer problem
- Own the customer relationship
- Faster path to revenue

*We are launching with complete supercapacitor systems designed for AI data centers and defense platforms - Built on a NATO-compliant, vertically integrated supply chain that scales from pilot to production.*

Geographic Locations:

| Function | Location | Rationale |
|---|---|---|
| Systems Design & Applications | USA | Customer proximity, defense compliance, GTM execution |
| Materials & Process R&D | Australia | Supercap inventor team, cost-effective R&D |
| Supply Chain | NATO-based | Tariff-proof, defense-eligible, secure sourcing |

# WHY NOW - THE PERFECT STORM

## Seed Round: $3.5M (18 month runway)

| Allocation | Amount | Milestone |
|---|---|---|
| Scale Electrode Production (AUS) | $1.3M (37%) | Pilot Production Capacity achieved |
| Build System Prototypes (US) | $850K (24%) | Working Prototype Developed for customers |
| Secure Strategic Pilots | $750K (22%) | Customer validations, LOIs, system certifications |
| GTM & Business | $350K (10%) | Pipeline of qualified leads |
| IP + Ops | $250K (7%) | IP secured for systems, next gen materials |

- **AI infrastructure exploding:** 8 kW → 600 kW+ racks; backup systems must evolve
- **Supercaps becoming standard:** "BBU + HVDC + Supercaps" for GB300/Rubin
- **Defense modernization accelerating:** High pulse power demand across platforms
- **Our IP is defensible**: Three layers; competitors cannot replicate
- **Science validated:** Nature Communications
- **Team has scaled before:** Tesla, Apple, CAP-XX - from lab to fab
- **TRL-6:** Patents pending, pilot-ready, cost parity
- **Highest energy in a supercap:** 50 Wh/L, 5 x traditional supercaps
- **Leading power density:** 70 kW/L, best-in-class for energy-dense systems

# CLOSING

## Partner with us as we make it happen

We invented the **HyperCap⁺ electrode**.
We deliver the highest energy in a supercapacitor with leading power density.
We're building the systems AI data centers and defense need.
Now.

- **Highest energy density ever demonstrated in a supercapacitor**: 50 Wh/L
- **Leading power density**: 70 kW/L
- **Proprietary primed electrode: C**ompetitors cannot replicate
- **Advanced Technology:** TRL 6
- **Complete supercapacitor systems: F**or the fastest-growing market in energy storage
- **$6B SAM** (AIDC + Defense) by 2030, 5X growth in next 4 years
- **Validated technology:** Nature Communications
- **Optimal structure:** US holding + Australia R&D
- **World-class team:** Inventors + operators who have scaled before
- **Clear exit:** Acquisition by AI infra provider, defense prime, or energy leader

# APPENDICES

# TAM - AI DATA CENTER  POWER PROTECTION MARKET

Total Addressable Market (UPS + BBU): $18 B by 2030

Why This Market Is Accelerating:

| Driver | Impact |
|---|---|
| AI Rack Power | 8 kW → 80kW → 600kW+ |
| Standard Architecture | "BBU + HVDC + Supercapacitors" for GB300/Rubin |
| Lithium-ion BBU Adoption | 40% of data center backup (55% at hyperscale) |
| Supercapacitor Advantages | Microsecond (μs) response, 100,000+ cycles, no thermal runaway |
| 800V HVDC Deployment | Planned by 2027 |

Our Advantage:

- Highest energy density in a supercap
  - 50 Wh/L → More backup power in less space
- Leading power density
  - 70 kW/L → Instant response when needed
- Cost parity
  - Comparable to activated carbon

# COMPETITIVE POSITION

## 3x Higher Volumetric Energy & Power than EDLC, 7x Higher Power than Hybrid

| | | VSC Can (D60) | | Skeleton Can (D60)[a] | | Mushashi Hybrid Prismatic[b] | | VSC Prismatic (A5) |
|---|---|---|---|---|---|---|---|---|
| Capacitance | *F* | 8800 | | 3400 | | 4100 | | 3400 |
| ESR | *mΩ* | 0.24 | | 0.17 | | 1.0 | | 0.1 |
| Voltage | *V* | 3.0 | | 3.0 | | 3.8 | | 3.0 |
| Length | *mm* | 138 | | 138 | | 150.2 | | 215 |
| Width | *mm* | 60 | | 60 | | 93.2 | | 156 |
| Thickness | *mm* | 60 | | 60 | | 15.8 | | 7.4 |
| Volume | *L* | 0.39 | | 0.39 | | 0.22 | | 0.25 |
| Weight | *kg* | 0.76 | | 0.51 | | 0.32 | | 0.43 |
| Energy | *Wh/L* | 28.2 | *VS* | 10.9 | *VS* | 26.0 | | 17.0 |
| | *Wh/kg* | 14.5 | | 8.3 | | 17.0 | | 9.9 |
| Power | *kW/L* | 24.0 | | 33.9 | | 13.0 | *VS* | 90.0 |
| | *kW/kg* | 12.3 | | 26.0 | | 9.0 | | 52.3 |

High Energy Devices

High Power Device

*a) www.skeletontech.com - Estonia, Germany, Finland*
*b) https://musashienergysolutions.com/products/#cells - Japan, USA*