

WHITE PAPER

ELECTRICITY AS WARFIGHTING IMPERATIVE

The Unowned Problem Defining the Next Fight

Prepared for:

U.S. Army Senior Leaders

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1. Purpose

This paper addresses a structural gap in how the United States Army conceptualizes, manages, and sustains electrical energy on the modern battlefield. The problem it describes exceeds any single functional community. It requires Army-level governance, ownership, and funding.

The central argument is direct: electricity has become the most critical enabling commodity in ground combat. Without it, the Army cannot sense, shoot, communicate, compute, or defend. Every modernization priority the Army has identified depends on the generation, storage, distribution, and efficient use of electrical power. Yet no single organization owns this problem. No general officer steering committee is scoping it. No funded program of record addresses it at scale. And the industrial base required to deliver the battery systems the Army will need does not exist in a form that can meet military requirements at military-relevant timelines.

This paper is not an advocacy document for electrification, green energy, or battery-electric vehicles. It is a risk assessment. The risk is that the Army enters its next major conflict structurally dependent on electrical energy it cannot generate, store, distribute, or sustain at the tactical edge.

2. The Structural Shift: Electricity as the Decisive Commodity

For most of the Army's modern history, liquid fuel defined operational reach. Fuel convoys were the center of gravity for sustainment operations. Formations measured endurance in gallons. The logistics architecture, from theater to tactical, was built around the movement and distribution of JP8.

That era is not over, but it is no longer sufficient to describe how combat capability is sustained. Fuel still underwrites operational reach. Ammunition still decides close combat. Mobility still matters. But the systems that now define overmatch do not run on fuel. They run on electrons. Electricity does not replace these other commodities. It defines the ceiling on what modern systems built around them can actually do.

Consider what a brigade combat team depends on today and will depend on increasingly in the near term: integrated sensor suites across manned and unmanned platforms, electronic warfare systems for spectrum dominance, counter-UAS systems operating persistently across the formation, tactical networking and high-bandwidth command and control, onboard computing and AI-enabled decision support, unmanned aerial and ground systems requiring continuous recharge, and directed energy weapons demanding high-voltage pulse power.

None of these systems consume JP8 directly. All of them consume electricity. The demand is not incremental. It is structural and accelerating. A platoon's battery burden has grown from roughly 48 pounds during Desert Storm to over 1,200 pounds today, and that figure does not include the sUAS, counter-UAS, and autonomous systems now being pushed to the tactical edge. As GM Defense's vice president for integrated vehicles told Defense News in January 2025, the amount of equipment now requiring energy is, in his word, 'unreal.' A platform without surplus

electrical generation capacity is already obsolete in design logic. A formation that cannot generate and distribute electricity at the point of need is a formation that cannot fight the way the Army intends to fight. In warfighter terms, electricity is what enables the force to see, sense, strike, and survive. Remove it, and every one of those functions degrades or fails.

Without electricity, we are fighting the way we did in Vietnam. That is not hyperbole. Remove electrical power from the modern formation and you remove the sensors, the networks, the autonomy, the electronic warfare, and the precision. What remains is mass, direct fire, and analog communications.

3. From Commodity to Combat Enabler: The Ammunition Analogy

The Army currently treats electricity the way it treats other sustainment commodities. It is generated, stored, and distributed through logistics channels. At the theater and operational level, that framing is reasonable.

But it breaks down at the tactical edge.

Consider ammunition. Ammunition is a Class V supply item managed through a logistics pipeline. Rounds are manufactured, stored, transported, and distributed through a well-understood sustainment architecture. That is its logistics identity. But the moment a round is chambered and fired, ammunition stops being a logistics function. It becomes a warfighting function. Nobody describes a trigger pull as a supply chain event.

Electricity is following the same trajectory. At the point of need, once electrical energy reaches the platform or the dismounted system, it is no longer a sustainment input. It is a warfighting enabler as fundamental as the ammunition in the breach. Without it, nothing fires, nothing senses, nothing communicates, nothing computes, nothing defends. The formation goes dark.

This distinction matters because how the Army classifies a capability determines who owns it, who funds it, who develops doctrine for it, and who trains the force to use it. If electricity remains categorized solely as a logistics commodity, it will be resourced and managed as a logistics commodity. The scale of investment, the urgency of doctrinal development, and the institutional priority will reflect that classification. It will not reflect the operational reality that electricity is now the enabling condition for every warfighting function above the individual rifleman.

The 25th Infantry Division quantified this reality in a 2023 tactical power storage analysis. An infantry soldier equipped with a PRC-163 radio, end-user device, and conformable wearable battery consumes 315 to 465 watt-hours during a 24-hour operational period, before accounting for night vision, weapon sights, or sUAS. A 15-soldier platoon consumes roughly 5,000 to 7,000 Wh per day. An infantry company needs 14,000 to 21,000 Wh to sustain a 24-hour operation. The current solution is to run two 2kW internal combustion generators continuously and to carry more batteries. The 25th ID concluded that at JPMRC, energy capacity was the limiting

factor for operational endurance. That is not a sustainment observation. It is a warfighting constraint.

4. The Mobility Imperative: Static Power Means Death

Ukraine has demonstrated with brutal clarity that static positions are increasingly untenable on the modern battlefield. Open-source reporting from two years of high-intensity combat shows persistent ISR from unmanned systems, loitering munitions, and precision strike collapsing the survivability window for elements that remain stationary. The lesson is not new, but the technology enforcing it is unforgiving and proliferating.

This has direct implications for how the Army generates and distributes electrical power. Generators are static assets. They have acoustic and thermal signatures. They tether formations to fixed positions. They create targetable nodes. In a contested environment with adversary sensor saturation, running a generator is broadcasting your location. As C5ISR Center engineers described in a 2021 National Defense article, the Army relies primarily on 'spot generation,' meaning a single generator or generators running in parallel to service a load, with a second generator consuming fuel in 'spinning reserve' providing no benefit except redundancy. These systems are typically oversized to handle peak demand, running continuously at a fraction of capacity, wasting fuel and generating unnecessary thermal and acoustic signatures.

The Army's own Mobile and Survivable Command Post (MASCP) project explicitly identified 'self-sustainable and dispersed power sources' as a critical enabling technology. As the Army explores breaking large command posts into smaller, dispersed, more survivable nodes, each node requires independent power. The traditional solution of towing generators behind each element multiplies exactly the signature problem the dispersal concept is trying to solve.

The force that can generate, store, and distribute electricity while mobile holds a decisive asymmetric advantage. This is not a logistics achievement. It is a combat capability. It means hybrid vehicle architectures that generate power on the move. It means onboard energy storage that enables silent watch with reduced thermal and acoustic signatures. It means low-acoustic-signature drive modes for tactical maneuver. It means exportable power available from any platform in the formation, not just dedicated generator sets at fixed locations.

A hybrid tactical vehicle is not a green initiative. It is a mobile power plant that extends range, reduces the fuel logistics tail, enables signature management, and provides exportable energy to the formation. Early prototypes in this space, such as the Plasan North America ATeMM with 47 kWh or more of stored energy per axle, demonstrated that a single platform could provide propulsion energy and mission energy simultaneously. Link two platforms and you double stored energy available to the formation. That is not a sustainment improvement. That is a combat multiplier. The Army's emerging interest in a Medium Modular Equipment Transport (MMET) reflects this logic: a flexible platform that can carry payload, export power, and extend formation endurance without adding another crewed vehicle to the convoy.

The side that can store, generate on the move, and distribute electricity at the tactical edge will have a decisive advantage. The side that cannot will be tethered to static positions, dependent on targetable generator sets, and unable to sustain the systems that define modern combat power.

5. Hybrid Architecture Matters: Not All Hybrids Are Equal

The term hybrid is used loosely across Army modernization discussions, but it encompasses fundamentally different architectures with different operational, logistical, and industrial implications. Requirements owners and end users must understand these distinctions before making fielding decisions, because the choice of hybrid architecture directly determines fuel consumption, exportable power capacity, maintenance complexity, supply chain requirements, and tactical employment.

There are three primary hybrid architectures relevant to military ground vehicles.

Parallel Hybrid. In a parallel hybrid, both the internal combustion engine (ICE) and one or more electric motors can drive the wheels simultaneously or independently. The electric motor supplements the engine during high-demand conditions such as acceleration or grade climbing, and can provide limited electric-only drive at low speeds. The architecture retains a conventional drivetrain (transmission, driveshaft, axles) with an electric motor added in parallel. Parallel hybrids offer modest fuel savings and limited silent drive capability. However, they provide relatively limited exportable power because the battery and motor system is sized to supplement propulsion, not to serve as a power plant. The mechanical complexity of maintaining both a full conventional drivetrain and an electric drive system creates sustainment considerations.

Plug-In Hybrid Electric Vehicle (PHEV). A PHEV is typically a parallel hybrid with a larger battery pack that can be charged from an external source. It extends electric-only range compared to a standard parallel hybrid. In a military context, this means longer silent watch and silent drive windows. However, it also means a larger, heavier battery system that must be charged, maintained, and eventually replaced. The plug-in requirement introduces a dependency on charging infrastructure or vehicle-to-vehicle power transfer that does not exist in the current logistics architecture.

Series Hybrid. In a series hybrid, the internal combustion engine does not mechanically drive the wheels at all. Instead, the engine drives a generator that produces electricity. That electricity either charges the onboard battery pack or powers electric drive motors at each axle. All propulsion is electric. The engine is a generator, not a drivetrain component. This architecture eliminates the conventional transmission, transfer case, and driveshafts. It offers the highest exportable power potential because the entire powertrain is electrical by design. The engine can run at its optimal RPM for maximum fuel efficiency regardless of vehicle speed. It enables full silent drive on battery alone, extended silent watch, and the ability to export high-voltage power to the formation. The series architecture eliminates conventional mechanical drivetrain maintenance but introduces different sustainment complexity: power electronics, inverters, high-voltage cooling systems, electric motor servicing, and battery management system

diagnostics. The maintenance burden is not necessarily lighter. It is fundamentally different, requiring new skill sets, tools, and training across the sustainment enterprise.

The choice among these architectures is not academic. A parallel hybrid offers incremental improvement. A series hybrid offers a fundamentally different capability: the vehicle becomes a mobile power plant. For a force that needs exportable electricity, silent operation, extended range, and reduced fuel logistics, the architecture decision is a warfighting decision with direct sustainment consequences.

This paper does not advocate for a specific architecture. But it argues that the Army cannot make informed hybrid architecture decisions without understanding how each option affects fuel demand, battery requirements, maintenance posture, training, exportable power, and the broader Battlefield Circulation of Electricity. Requirements owners, sustainment functional chiefs, and CPE Combat Logistics must be part of those decisions from the outset, not informed after the fact.

6. The Voltage Architecture Problem

Beyond the operational concept, there is a technical reality the Army has not fully confronted: the voltage architecture gap.

Today's tactical batteries, such as those produced by SAFT and Brentronics, are predominantly low-voltage systems operating at 24VDC. These are designed for soldier-portable equipment, vehicle auxiliary power, and tactical electronics. They are proven, fielded, and understood.

But the emerging demand is for high-voltage power. Electric drive motors for hybrid propulsion, directed energy weapons, high-power electronic warfare systems, and exportable power for formation-level distribution all require voltage well above 100VDC. To reach those levels with existing tactical cells, you must place battery modules in series. That is not a simple wiring exercise. It introduces cascading complexity in battery management systems, thermal management, safety certification, fault isolation, and cable architecture.

Lower voltage means larger conductors to carry equivalent power. Larger conductors mean more weight, more volume, and more thermal load. Even for systems that can operate at lower voltage, the cable weight penalty is significant at scale across a formation. The Army does not currently have a coherent architectural standard for managing the transition from low-voltage tactical power to high-voltage platform power. Individual programs are making independent decisions, creating a fragmented landscape that will compound integration and sustainment challenges.

7. The Industrial Base Does Not Exist

This is perhaps the most consequential section of this paper, because it addresses a structural constraint that no amount of doctrinal innovation or organizational reform can bypass: the United States does not currently possess the industrial base required to deliver military-grade battery systems at the scale and specification the Army will need.

7.1 Cell Manufacturers Will Not Customize for DoD

The major lithium-ion cell manufacturers, including Panasonic, Samsung SDI, LG Energy Solution, and SK On, operate gigafactories producing hundreds of millions of cells per year. Their entire capital structure, process engineering, quality systems, and supply chains are optimized for automotive and consumer electronics formats. Global EV battery cell production exceeded 800 GWh in 2024 and is projected to surpass 2,000 GWh by 2030.

DoD battery requirements represent a rounding error against that volume. Specialty defense-focused cell producers exist, including SAFT and EnerSys, but they operate at scales orders of magnitude below automotive gigafactories. Asking a major cell manufacturer to produce a military-specification cell variant at DoD quantities is economically irrational. The production economics do not support it. No cell manufacturer will retool a gigafactory line for thousands of cells when the same line produces millions for automotive OEMs. This is not a criticism of industry. It is a recognition of market structure.

7.2 Safety and Ruggedization Must Happen at the Pack Level

The practical implication is that DoD must accept commercial cells as COTS inputs and engineer military compliance at the module, pack, and battery management system (BMS) level. This is where shock and vibration tolerance, ballistic protection, wide-temperature-range operation, abuse tolerance, field serviceability, and safety certification under standards such as NAVSEA S9310-AQ-SAF-010 must be addressed.

The BMS becomes the critical safety and performance layer: cell balancing, thermal runaway detection and mitigation, fault isolation, state-of-charge management, and voltage regulation all reside there. This is not minor integration work. It is a distinct engineering discipline that produces a fundamentally different product than a commercial EV battery pack.

7.3 Cost Reality

Commercial EV battery packs are trending toward \$100 to \$130 per kilowatt-hour at the pack level. Based on current low-volume ruggedized pack integration for military applications, realistic pricing for mil-grade packs ranges between \$500 and \$1,000 per kilowatt-hour. Higher-volume production could push the lower end down over time; extremely rugged or specialty packs could exceed the upper bound.

That is a four-to-eight-times premium over commercial pricing. The cells themselves may represent \$100/kWh of input cost. The remaining \$400 to \$900 per kWh is engineering, certification, low-volume manufacturing overhead, and sustainment support. This cost structure is real and unavoidable given military requirements and production volumes. Any program that benchmarks military battery costs against commercial EV pricing is building its cost estimate on a false foundation.

7.4 Why Industry Will Not Solve This Alone

The Army CTO has acknowledged the need for industry investment in battery technology for defense applications. That recognition is important. But industry will not invest at the scale required without conditions that do not currently exist.

First, there is no funded program of record for battlefield energy storage at scale. There is no RFP. No funded line item. Industry responds to funded demand, not concept papers. Second, even with a demand signal, industry will not invest unless that signal comes with credible pricing that reflects actual cost. If DoD signals demand at \$150/kWh, no company will build a mil-spec pack line. The economics require DoD to accept and budget for \$500 to \$1,000/kWh pricing. Third, the companies that could perform this pack integration work (SAFT, Brentronics, EnerSys, and a small number of other specialty producers) need sustained volume commitments, not one-off prototype contracts. These firms exist but lack the scale DoD will require. The collapse of Xerotech, a company specifically attempting to build ruggedized battery systems for defense and industrial applications, illustrates the difficulty of sustaining a defense-focused pack integrator without stable demand signal and realistic pricing. The market structure alone cannot build and sustain the supplier base DoD needs.

There is a counterpoint worth noting. Venture-backed startups are beginning to enter the tactical power space, bringing commercial power electronics, high-voltage architecture, and software-defined energy management from the automotive and eVTOL sectors into defense applications. Some have moved from concept to fielded systems supporting Army units within months, not years. This is a positive signal: private capital recognizes battlefield power as a real and growing market. But it also highlights the fragility. These are small companies, typically pre-scale, dependent on sustained DoD demand to survive beyond early funding rounds. Without institutional commitment from the Army, they face the same market structure problem that has historically killed defense-focused energy companies. Venture capital will fund innovation. It will not fund patience. If the Army does not convert early adoption into sustained programs, these companies will pivot to commercial markets or fail.

7.5 NDAA Sourcing Restrictions Compound the Problem

FY24 NDAA Section 154 established an October 2027 prohibition on DoD procurement of batteries produced by six named Chinese entities, including CATL, BYD, Envision, EVE, Gotion, and Hithium. A battery is considered produced by a covered entity if that entity assembled the final product or provided a majority of the components.

FY26 NDAA Section 842 broadened the restriction significantly, prohibiting DoD from procuring advanced batteries, including cells and key components, that are owned by, sourced from, refined in, or produced by any foreign entity of concern. The restriction is phased: new acquisition programs by January 2028, standard batteries by January 2029, and existing programs by January 2031. This is no longer a named-entity list. It is a categorical prohibition that reaches upstream into the battery supply chain based on foreign ownership and processing, not just final assembly location.

The legislative trajectory is accelerating. During the FY25 NDAA process, both the House and Senate versions included provisions that would have required DoD to procure batteries sourced, refined, and produced in the U.S. or allied countries (Canada, UK, Australia, New Zealand, South Korea, Japan), starting at 10% in 2026 and scaling to 95% by 2029, effectively capping non-allied content at 5%. That percentage mandate did not survive conference and was replaced by a battery strategy requirement (Section 883) with no sourcing teeth. But Congress returned the following year with the harder FY26 Section 842 entity-based prohibition. The direction is clear: restrictions are tightening year over year. The Army needs to plan against where this legislation is going, not where it is today.

These provisions are strategically sound. Chinese dominance in lithium processing, graphite refining, and cell production represents a genuine national security vulnerability. However, the legislation creates prohibition without corresponding industrial capacity. There is no funded pathway to scale allied or domestic cell production to fill the gap. The eligible supplier base shrinks while compliance costs rise. Combined with mil-spec certification requirements and low DoD volumes, the result is a thinner, more fragile, and more expensive industrial base for military batteries. The Army cannot surge combat power if it cannot surge battery production. And right now, it cannot.

8. The Ownership Void

The preceding sections describe a problem that is simultaneously operational, technical, industrial, and institutional. The Army's dependence on battlefield electricity is growing exponentially. The systems that generate, store, and distribute that electricity are not organized under any single proponent. The industrial base to deliver those systems does not exist at required scale. And the cost structure is not reflected in any current budget line.

Who owns this problem?

Today, the honest answer is: nobody. Or more precisely, everybody owns a piece and nobody owns the whole.

DEVCOM and GVSC work vehicle power and energy. C5ISR addresses power for sensors and networks. Under the new PAE/CPE acquisition structure, PAE Maneuver Ground manages platform power requirements for combat and soldier systems. PAE Agile Sustainment and Ammunition, through CPE Combat Logistics (the former PEO CS&CSS), manages tactical wheeled vehicles, power generation systems, and force sustainment equipment. T2COM and its subordinate Futures and Concepts Command (FCC) explore future concepts and force design. CASCOM owns sustainment doctrine and distribution. The Quartermaster School addresses classes of supply. The Transportation School addresses movement and distribution.

But no single organization has been tasked, funded, or empowered to address battlefield electricity as an integrated, Army-level problem spanning generation, storage, distribution, efficient use, industrial base development, supply chain security, safety certification, and doctrine.

This is not for lack of trying. The Army has attempted to address battlefield energy management before and failed. Army Futures Command and the broader Army Staff spent approximately five years convening the Army Battery Management Working Group, holding weekly meetings, briefing successive general officers through rotation cycles, and producing recommendations. Those recommendations were sound. They addressed battery standardization, centralized procurement, demand signaling, and management architecture. They went unresourced. The working group moved at the pace of a glacier, and at the end of that process the Army still had no plan to manage this problem. The failure was not analytical. It was institutional: no single leader with sufficient authority directed action, and the working group structure lacked the command authority to force resource decisions.

Organizational mechanisms to address portions of this challenge already exist but have been marginalized. The Joint Standardization Authorities and Joint Standardization Boards that PM E2S2 has longstanding responsibility for are codified in DoD and Army policy under DoDI 4120.11. They manage programs supporting all power requirements from Engineer (Prime Power), Sustainment (Mobile Electric Power), and Maneuver (Small Unit Power). These authorities can and should be empowered to address battery standardization and power interface management without the need for new policy or regulatory changes. However, the PAE reorganization has marginalized that office. The realignment of portfolios sent a clear signal that programs of importance were pulled out and given to other PAEs with more agility. What remains is an office told to keep buying generators at a time when the Army's own leaders are saying generators are part of the problem.

There is no General Officer Steering Committee with two- and three-star champions driving toward a coherent understanding of the scale and complexity of this challenge. There is no cross-functional governance structure equivalent to what the Army stood up for other transformational priorities. The problem is being addressed in fragments, program by program, without an integrating framework.

The problem is not a lack of recognition. The evidence that battlefield electricity is a growing crisis is extensive and well-documented in open sources. The reporting trail in this paper's bibliography spans five years, but the underlying problem is far older. At the August 2025 Army/Navy/USMC Battery Industry Day, the Pentagon's Senior Battery Advisor presented a 1994 Joint Battery Industry Sector Study that identified the same core failure: the lack of communication between military organizations and battery suppliers concerning procurement plans and requirements. That study recommended the government improve demand signaling to allow suppliers to plan effectively. Thirty-one years later, the same recommendation appeared in the 2023 DoD Lithium Battery Strategy. Veterans of the tactical power generation industry report encountering the same ownership void two decades ago when selling generators to the Army. The problem is not new. It is cyclical. Each generation of leaders rediscovers it, documents it, and rotates before solving it. The difference between 1994 and today is consequence. Then, the failure produced inefficiency. Now, it produces a formation that cannot fight.

In October 2021, National Defense reported on the Army's investment in hybrid power microgrids, documenting the C5ISR Center's efforts to develop tactical microgrid standards and

the 82nd Airborne's testing of hybrid power systems at Fort Bragg. The article documented the fundamental inefficiency of the Army's spot-generation approach and the need for intelligent power management.

In April 2022, Defense News published a detailed report titled 'Power struggle: How the US Army is tackling the logistics of battlefield electricity,' documenting the proliferation of power demands at every echelon, the battery standardization challenge, the absence of a tactical recharging concept, and the lack of an Army operational energy strategy. Army Secretary Wormuth acknowledged that the sustainment piece is 'often under attended to.' The article noted the Army had not conceived of integrating different power capabilities into a coherent package because of the way it writes requirements. A month later, AUSA published 'Power Hungry: Feeding Growing Requirements for Energy on the Battlefield,' noting that the Army was using approximately 20 times more energy per soldier than in World War II while reducing the number of soldiers by a roughly equivalent amount. Officers at the Army Futures Command's Futures and Concepts Center stated that everything, including hybrid, electric, and nuclear, was 'on the table,' but acknowledged there was no single solution. In July 2022, National Defense reported on the Mobile and Survivable Command Post project, which explicitly identified dispersed power sources as a critical technology gap for survivable operations.

In January and February 2025, 3rd Brigade, 10th Mountain Division conducted Combined Resolve 25-1 at Hohenfels, Germany, as part of Transforming in Contact. The CSA, General Randy George, visited the exercise and told Defense One that the Army learned lessons about battery technology and cold weather challenges, noting direct impacts on drone operations. He also highlighted GM Defense's NGTV-H prototype, telling reporters it could power the brigade command and control node for two days on a single charge. The JLTV Project Manager noted soldiers were particularly enthusiastic about export power capabilities not present in current fielded vehicles. These observations from the Army's most senior uniformed leader confirm the operational relevance of the problem. But observations from a field exercise, no matter how senior the observer, do not by themselves produce programs of record, funding lines, or organizational ownership.

In August 2025, the Center for Army Lessons Learned published a full handbook titled 'Best Practices on Operationalizing Battlefield Energy,' documenting both 2nd Mobile Brigade Combat Team, 25th Infantry Division's experience at JPMRC and 2/101 MBCT's experience at Lethal Eagle 24.1. The CALL publication reported that 15 and 30 kW generators at Lethal Eagle routinely operated at less than 10% capacity, wasting fuel and generating unnecessary signatures. At JPMRC, insertion teams operated for 56 to 96 hours on a single energy storage module without generators. Battalion TOCs reduced generator run-time to six hours per day by pairing generators with modular battery systems. The authors proposed a structured distribution framework of Power Supply Points and Power Supply Transfer Points, modeled on ammunition and water distribution. Their conclusion was unambiguous: battlefield energy must be treated as its own class of supply, forecasted and synchronized with the same rigor as fuel, water, and ammunition. An Army institutional publication arrived at the same conclusion independently. It generated no institutional response.

That same month, Defense One reported that the Pentagon is developing a department-wide battery strategy for release in 2026, updating a 2023 lithium-ion battery strategy. The Pentagon's senior battery advisor stated that batteries are important for enabling capabilities like drones, communications, and many other things needed to fight and win. Congress mandated this strategy in the FY25 NDAA. But a strategy document, however well-intentioned, is not organizational ownership, and it is not a funded program of record.

In June 2025, the Army's Chief Technology Officer published an essay describing the Transforming in Contact methodology. In it, he confirmed that cold weather at Combined Resolve crushed batteries and communications during TiC rotations in Germany, and explicitly identified lighter power management solutions as one of the Army's critical needs. The CTO, the CSA, active-duty field grade officers, CALL, and OSD have now all publicly identified the same problem. The Army's draft Operational Energy Strategic Framework, prepared by ASA(IE&E), further establishes four lines of effort for operational energy and calls for Energy Key Performance Parameters in system development. The institutional recognition is broad and senior. The institutional response remains fragmented and unfunded.

In February 2026, Aviation Week reported that elements of the 82nd Airborne Division attempted to operate 42 drones simultaneously during a September 2025 exercise at Fort Irwin. They sustained four. The limiting factor was not drones, operators, or tactics. It was batteries and power generation. Flight time was 28 to 29 minutes per sortie with a 2.5-hour recharge cycle. The regiment arrived with 20 double-charging batteries, grossly insufficient for the planned operational tempo. Light infantry had no organic power generation. When generators arrived on logistics vehicles, they had reliability issues when repositioned. Despite operating at roughly 10% of planned capacity, those four drones identified targets for 44% of the regiment's mortar fires and 241 confirmed enemy casualties in eight days. The regiment commander, LTC Mat Scott of the 504th PIR, publicly documented battery limitations as the primary constraint. The Drone Dominance Program intends to field 340,000 small UAS by end of 2027. If a regiment cannot sustain 42 at Fort Irwin, nobody has worked the battery and power generation math backward from 340,000.

The reason these documented, validated, and publicly acknowledged problems remain unaddressed is structural, not intellectual. The Army's officer assignment system rotates leaders through key positions every 18 to 24 months. A project manager, a brigade commander, a division commander, or a CPE director sees the power problem, engages on it, develops initial understanding, and then moves to the next assignment. The incoming officer starts from scratch. There is no institutional memory mechanism that survives a change of command for a problem this cross-cutting. Individual officers carry the knowledge with them when they leave. Without a standing governance body, a funded program, and codified doctrine that outlasts any single officer's tenure, the problem resets with every rotation cycle. Recognition without institutional persistence produces nothing. The Army will continue to observe the problem, document the problem, discuss the problem at conferences, and fail to solve the problem until it establishes the organizational structure required to sustain attention, funding, and authority across multiple assignment cycles.

This is not a prediction. It is a pattern the Army has repeated before. The problem will eventually be addressed. The question is whether it is addressed through deliberate institutional action now, or through crisis-driven improvisation in the opening weeks of a conflict where the absence of battlefield electricity degrades every modernization investment the Army has made over the past decade.

9. Recommended Actions

The following actions are not prescriptive solutions. They are institutional steps necessary to move from recognition to execution. The Army has studied this problem long enough. Existing recommendations from the Army Battery Management Working Group, the CALL publication, the OSD Lithium Battery Strategy, and the ASA(IE&E) Operational Energy Strategic Framework provide sufficient analytical foundation. What is required now is decision and direction at the Secretary of the Army or Chief of Staff level. No single subordinate command, whether AFC, AMC, or ASA(ALT), can solve this alone. The problem is cross-cutting by nature and requires cross-cutting authority.

Direct Execution on Existing Recommendations. The Army Battery Management Working Group produced sound recommendations on standardization, centralized procurement, and demand signaling that were never resourced. The CALL publication proposed a distribution framework. The OSD battery strategy identified the demand signal gap. Rather than form another working group to study the problem for another year, senior Army leadership should direct execution on the recommendations that already exist, with a named general officer accountable for integration and a funded line to back it. This requires Secretary of the Army or CSA endorsement. Recognition without direction produces nothing. Direction without funding produces frustration. Both are required.

Conduct a Comprehensive Demand Assessment. The Army does not currently have a consolidated picture of electrical energy demand at the formation level, current or projected. Every modernization program that adds sensors, autonomy, networking, or electronic warfare increases electrical demand. That demand must be aggregated across programs and mapped to formation-level requirements for generation, storage, and distribution capacity. The 82nd Airborne's experience at Fort Irwin, where a regiment could not sustain 42 drones because nobody modeled the battery and power generation requirements, is evidence that this assessment has not been done.

Develop Doctrine for Battlefield Circulation of Electricity. The Army has well-developed doctrine for fuel distribution (Battlefield Circulation of Petroleum). No equivalent exists for electricity. Developing a Battlefield Circulation of Electricity (BCoE) framework should be a CASCOM-led initiative, defining how electrical energy is generated, stored, distributed, managed, and prioritized from theater to tactical edge. CASCOM is the natural institutional home for this effort: the Chief of Transportation and the Chief of Quartermaster own the doctrine, training, and organizational structures most directly aligned with the storage, distribution, and management of battlefield commodities. Electricity is the next battlefield commodity. Notably, the Center for Army Lessons Learned published a framework in August 2025 proposing Power Supply Points and Power Supply Transfer Points as echeloned

distribution nodes for battlefield energy, modeled on ammunition and water distribution geometry. This convergent thinking from an institutional Army source reinforces the doctrinal direction. Critically, battlefield power management is not simply about how much energy a formation carries. It is about how intelligently that energy is controlled and distributed to the systems that need it, when they need it. BCoE doctrine must address prioritization, load management, and command and control of electrical energy as a managed resource, not just a commodity to be trucked forward.

Confront the Industrial Base Gap with Realistic Pricing and Sustained Demand

Signal. The Army must accept that military-grade battery packs will cost \$500 to \$1,000 per kilowatt-hour and budget accordingly. It must issue sustained demand signals, not prototype contracts, to enable pack integrators to invest in facilities, workforce, and certification. Without this, no domestic industrial base will materialize.

Adopt a Centralized Battery Procurement Model. The Army proved with generators that centralizing procurement through a dedicated program office creates demand signal stability and better buying power. Programs do not pay for the standard generators they need to function; generators are furnished through centralized management. The same model is directly transferable to batteries. Structuring battery-intensive programs around 'batteries not included' cost structures, with separate budget lines managed through a centralized battery program office, will incentivize industry to build around standard batteries and focus internal R&D on core technology rather than custom battery development. This is not a new concept. It is an existing, validated acquisition mechanism that nobody has applied to the battery problem.

Empower Existing Standardization Authorities. The Joint Standardization Boards under PM E2S2, codified in DoDI 4120.11, already have authority to manage power standards across Engineer, Sustainment, and Maneuver portfolios. If power systems are not managed from at least a standards and interface perspective by a central office, the fractured capability development and materiel development structure will continue solving the same problems from different angles with incompatible technology. Companies building standards-compliant modular energy storage systems have demonstrated that a single product can integrate across platforms from Abrams to ISV to MRZR using batteries standardized under MIL-STD 3078. The standards path works when someone actually uses it. PM E2S2 should be resourced and directed to execute this mission, not marginalized.

Establish a Voltage Architecture Standard. Individual programs are currently making independent power architecture decisions. The Army needs a common reference architecture for tactical and platform power that spans low-voltage soldier systems through high-voltage vehicle and formation-level export power. This should be a DEVCOM-GVSC led effort with CASCOM and CPE Combat Logistics input on sustainment and distribution implications.

Clarify Policy Language on Electrification. Recent Army Transformation Initiative guidance using the term 'electrification' has been interpreted by subordinate organizations and industry as a blanket prohibition on all electric-related architectures, including hybrid systems, anti-idle, exportable power, and energy storage. This interpretation is freezing investment and R&D in systems the Army will need. The distinction between battery-electric vehicles and hybrid

power systems must be made explicit at the policy level. The Army CTO has acknowledged this distinction. It must be formalized.

10. Selected Bibliography: A Problem Documented but Unresolved

The following sources document the Army's battlefield electricity challenge as reported by defense journalists, active-duty officers, Army institutional publications, OSD staff, and senior Army leaders over a five-year period. They are listed chronologically. Collectively, they demonstrate that the problem described in this paper has been independently identified, validated operationally, and publicly discussed at every level from platoon to Pentagon. None of these publications, individually or collectively, produced a funded program of record, organizational ownership, or codified doctrine for battlefield electricity management. The bibliography is itself evidence of the gap between recognition and institutional action.

1. Tadjdeh, Yasmin. "Army Investing in Hybrid Power Microgrids." *National Defense Magazine*, 5 October 2021. Documented C5ISR Center hybrid power system development, spot generation inefficiency, and tactical microgrid standards work with the 82nd Airborne Division.
2. Judson, Jen. "Power Struggle: How the US Army is Tackling the Logistics of Battlefield Electricity." *Defense News*, 12 April 2022. Comprehensive reporting on power demand proliferation, battery standardization challenges, absence of operational energy strategy, and Army Secretary Wormuth's acknowledgment that sustainment is 'often under attended to.'
3. Maze, Rick. "Power Hungry: Feeding Growing Requirements for Energy on the Battlefield." *AUSA*, 31 May 2022. Reported the Army uses approximately 20 times more energy per soldier than in WWII. Quoted AFC Futures and Concepts Center officers acknowledging all energy options are 'on the table' with no single solution identified. Referenced the National Academies of Sciences 2021 report concluding battery-electric combat vehicles are not technically feasible by 2035.
4. Luckenbaugh, Josh. "Army Aiming to Demo New Mobile Command Post by 2026." *National Defense Magazine*, 21 July 2022. Documented MASCP project identifying self-sustainable and dispersed power sources as critical enabling technology for survivable, mobile command posts.
5. GVSC. "Vehicle Power Networks to Provide More Combat Lethality." *Army.mil*, 21 July 2022. Documented STAMP microgrid demonstration showing vehicle-networked power export up to 100 kW at 600 VDC. GVSC Powertrain Electrification Branch Chief stated legacy tactical power systems 'decrease combat system availability, create a vulnerable static posture, lack energy storage, lack consumption awareness, and impose challenging logistical requirements.'
6. Hinds, MAJ Jason. "25ID Tactical Power Storage Use Cases." *25th Infantry Division / Lightning Labs*, 4 May 2023. UNCLASSIFIED briefing quantifying soldier, platoon, and company electrical energy consumption requirements for IBCT operations in the Indo-Pacific. Identified energy capacity as the limiting factor for operational endurance at JPMRC.
7. Judson, Jen. "Army Tries Out Next-Gen Hybrid Tactical Vehicle Prototype in Germany." *Defense News*, 22 January 2025. Reported platoon battery burden increase from 48 lbs in Desert Storm to 1,200 lbs today. Documented 3/10 MTN testing of GM Defense NGTV-H hybrid prototype at Combined Resolve 25-1.

8. *Inside Defense*. "Army Chief Moves to Foil Biden-Era Electric Vehicle Test Plan." February/March 2025. Reported CSA General George stating the NGTV-H hybrid prototype could power a brigade command and control node for two days on a single charge. George redirected \$13.3M from electric ISV contract to hybrid ISVs that 'have already proven capable and effective in training.'
9. Myers, Meghann. "State of the Army 2025." *Defense One*, 18 April 2025. CSA General George discussed battery technology lessons learned in cold weather at Combined Resolve, noting direct impact on drone operations during Transforming in Contact.
10. McLachlan, MAJ Sean, and Todd Goodson. "Best Practices on Operationalizing Battlefield Energy: Power Generation, Storage, and Distribution in LSCO." *Center for Army Lessons Learned, Publication No. 25-1085*, August 2025. Approved for public release. Full CALL publication documenting 2/25 ID JPMRC and 2/101 MBCT Lethal Eagle rotations. Field-validated modular hybrid power systems. Proposed Power Supply Points and Power Supply Transfer Points as echeloned distribution framework for battlefield energy. Argued battlefield energy must be its own class of supply with the logistical priority of ammunition.
11. Williams, Lauren C. "Pentagon Readies New Battery Strategy Amid Growing Drone Demands." *Defense One*, August 2025. Pentagon developing department-wide battery strategy for 2026 release. Senior battery advisor stated batteries are important for enabling capabilities needed to 'fight and win.' Congress mandated the strategy in FY25 NDAA.
12. Miller, Dr. Alex. "The Army Is 'Transforming in Contact.' Here's How." *First Breakfast*, 20 June 2025. The Army CTO described TiC methodology, tranche buys, and flexible funding reforms. Noted that cold weather at Combined Resolve crushed batteries and communications during TiC rotations in Germany. Identified 'lighter power management solutions' as an explicit Army need alongside lower-cost sensors and smaller mission command systems.
13. Army Operational Energy Strategic Framework (2025 Draft). ASA(IE&E). Established four Lines of Effort for operational energy: Energy Optimization, Acquisitions, Supply Chains, and Awareness & Training. Called for Energy Key Performance Parameters (E-KPP) in system development, hybrid tactical vehicles by 2035, and battery form factor standardization. Governance assigned to ASA(IE&E) and ASA(ALT) with Army Staff leads at G-4 and G-3/5/7.
14. Trimble, Steve. "82nd Airborne Division Finds Limits of Drone Operations at Fort Irwin." *Aviation Week*, 26 February 2026. Documented 504th PIR attempt to operate 42 drones simultaneously, sustaining only four due to battery limitations and absence of organic power generation. Regiment commander publicly identified battery constraints as the primary limiting factor on drone capacity during NTC rotation.

Fourteen sources. Five years. The Army's most senior uniformed leader, the Army CTO, active-duty field grade officers, the Center for Army Lessons Learned, Pentagon officials, ASA(IE&E), defense journalists, and independent research bodies have all identified the same problem. The bibliography documents extensive recognition without commensurate institutional action. Recognition alone does not produce programs, funding, doctrine, or organizational ownership. Until it does, the problem persists.

11. Closing Assessment

The Army is building a force that depends on electrical energy for every function that distinguishes it from a Cold War-era formation. Sensors, networks, autonomy, electronic warfare, directed energy, and distributed computing all scale with kilowatts, not gallons.

The institution has not yet organized itself to meet this dependency. No single organization owns the problem. No governance structure is driving toward a solution. The industrial base cannot deliver what will be needed. And the cost structure is not reflected in current planning.

This is not a future problem. It is a current gap with a trajectory that makes it worse every year. Every new system the Army fields that consumes electrical power and every modernization program that increases electrical demand widens the gap between what the force needs and what the institution can deliver.

The Army has studied this problem for over thirty years. The recommendations exist. The evidence is overwhelming. What is missing is a decision by senior Army leadership to direct action, assign accountability, and fund execution. That decision requires Secretary of the Army or Chief of Staff authority. No subordinate command can solve a problem this cross-cutting without top-down direction.

The question is not whether the Army will need to address battlefield electricity at scale. It is whether the Army will address it deliberately, on its own terms, or reactively, under conditions not of its choosing.

About the Author

John Cavedo is a retired U.S. Army Colonel with 30 years of service, including 17 years in the Acquisition Corps. He served as the JLTV Project Manager during the Engineering and Manufacturing Development phase (2012-2015) and subsequently as President and CEO of Plasan North America & Plasan Carbon Composites (2018-2024), where he led the two companies through the tumultuous COVID period, with full P&L responsibility. He is the founder and principal of 360 Enterprises LLC, a defense advisory firm supporting over 15 companies across the defense industrial base, from venture-backed startups to Fortune 500 defense primes. His advocacy for battlefield electricity management, including the Battlefield Circulation of Electricity (BCoE) framework, reflects direct experience spanning tactical operations, acquisition leadership, and industrial base engagement.

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