

The Electrification Imperative

Transforming the U.S. Military for the Battlefield of Tomorrow





The Electrification Imperative: Transforming the U.S. Military for the Battlefield of Tomorrow

Executive Summary

The electrification of the U.S. military is no longer a distant ambition; it is a present necessity. Modern warfare increasingly depends on electrically powered systems, making electricity as critical to combat operations as fuel and ammunition. Yet, the Department of Defense (DoD) has not fully leveraged electrification as a strategic advantage. Instead, it has been framed primarily as an environmental initiative rather than an operational imperative. This misalignment risks compromising U.S. military superiority in future conflicts.

To maintain combat effectiveness, the DoD must treat electrification as a **warfighting necessity**, not a climate policy. Electrified tactical platforms extend operational reach, enhance survivability, and reduce logistical vulnerabilities. Additionally, the economic landscape presents a major challenge—while the U.S. is investing heavily in battery **cell** manufacturing, there are no viable, profitable businesses producing **low-volume, high-mix** battery packs for the military and off-highway sector. Without addressing this gap, the U.S. risks supply chain dependencies that will cripple future operations.

The Strategic Need for Electrification

Electrification offers clear advantages for modern combat:

- **Extended Operational Reach & Mobility:** Even mild hybrid tactical vehicles eclipse legacy systems in power, mobility, and range—enabling combat forces to move further, faster, and fight harder in all conditions. Hybrid-electric platforms reduce fuel consumption, allowing units to operate longer without resupply while enhancing battlefield maneuverability.
- **Stealth and Survivability:** Electric platforms produce lower thermal and acoustic signatures, making them harder to detect and target.
- **Power for Lethal & Defensive Systems:** Electrified tactical vehicles can provide robust electrical power for networked weapons, counter-UAS (CUAS) capabilities, directed-energy weapons (DE), and electronic warfare (EW) systems while on the move in an increasingly mobile battlefield. Legacy systems require static power generation and force tactical formations to establish vulnerable fixed positions in order to operate these advanced weapon systems.
- **Logistical Efficiency:** Reduced fuel dependency decreases reliance on vulnerable supply convoys, a long-standing Achilles' heel of military operations.

Despite these benefits, electrification **remains underdeveloped** within the U.S. military. The ability to generate, store, and distribute electricity effectively on the battlefield has not kept pace



with technological advancements. Future conflicts will require forces to operate in contested logistics environments where traditional fuel supply chains are unreliable.

As electrification transforms the battlefield, it is also essential to acknowledge and prepare for its limitations. Electrified systems and platforms must be hardened to withstand the challenges of modern combat. The battlefield is inherently hostile, and adversaries will exploit vulnerabilities in energy storage and distribution systems. This calls for a broader energy strategy that not only advances electrification but also explores alternatives to ensure operational continuity when electrified systems are compromised. While this concept merits further exploration, it underscores the need for a dual approach: embracing electrification while mitigating its inherent risks.

The Misalignment in Strategy: From Climate Policy to Combat Necessity

The U.S. Army's *Army Climate Strategy* has emphasized electrification as a way to reduce emissions rather than enhance lethality. While reducing emissions is a secondary benefit, it should not be the primary justification. Electrification should be positioned as a **national security priority** to maintain battlefield dominance against near-peer adversaries like China, who are already advancing hybrid-electric military platforms.

China controls the majority of global lithium-ion battery production and critical mineral processing. The People's Liberation Army (PLA) is integrating hybrid-electric platforms, advanced energy storage, and distributed energy solutions, providing them with a tactical and strategic edge. If the U.S. does not accelerate its electrification efforts, it risks being technologically and operationally outmaneuvered.

The Industrial Base Challenge: The Low-Volume, High-Mix Problem

A critical gap in the U.S. supply chain is the **lack of companies specializing in low-volume, high-mix battery pack production** for defense and off-highway applications. While billions are being invested in battery **cell** manufacturing, this does not translate into viable military-grade battery **packs** that meet the diverse needs of ground forces and specialized equipment.

Key concerns include:

- **Diversity of Applications:** Military and off-highway vehicles require a range of battery sizes, voltages, and chemistries. Unlike commercial EVs, a one-size-fits-all approach does not work.



- **Lack of Domestic Production:** The absence of a sustainable business model for low-volume, high-mix battery packs increases dependence on foreign suppliers, exposing the U.S. to strategic vulnerabilities.
- **Financial Barriers:** Unlike mass-market EV production, the defense sector lacks the scale to attract private investment, making government intervention or incentives necessary.

Without addressing this gap, the U.S. risks having access to raw battery materials but no means to produce mission-ready power systems for military applications.

Overcoming Battlefield Energy Challenges

Electrification introduces new logistical considerations that must be addressed to ensure combat effectiveness:

- **Energy Storage & Generation:** Unlike fuel, electricity cannot be stockpiled in large volumes without massive infrastructure investments. Deployable microgrids and battlefield energy storage solutions must be prioritized.
- **Recharge vs. Refuel:** While refueling takes minutes, recharging can take hours unless rapid-charging or battery-swap solutions are developed.
- **Predicting Demand:** Military logistics officers excel at forecasting fuel consumption but lack the tools and doctrine to accurately plan electricity requirements for future battlefields.

To meet these challenges, the DoD must **invest in infrastructure** that enables seamless electricity logistics, just as it has done with fuel distribution for over a century.

Policy and Industry Recommendations

To make electrification a battlefield advantage, the U.S. must take the following actions:

1. **Reframe Electrification as a Warfighting Imperative:** Shift the justification from climate policy to combat effectiveness, survivability, and operational reach.
2. **Develop a Comprehensive Roadmap:** The DoD must outline clear electrification milestones across all services, incorporating hybrid-electric and fully electric systems.
3. **Invest in Low-Volume, High-Mix Battery Pack Production:** Government funding and private-sector incentives are necessary to build a sustainable domestic supply base.
4. **Enhance Energy Logistics Capabilities:** Develop forward-operating charging infrastructure, mobile energy distribution systems, and improved battlefield energy forecasting tools.

5. **Secure Critical Material Supply Chains:** Reduce reliance on China by incentivizing domestic mining, refining, and processing of lithium, cobalt, and other critical minerals.

Conclusion

The battlefield of tomorrow will not be won by those who simply have the most firepower—it will be won by those who can **outmaneuver, outlast, and overpower their adversaries through superior energy management**. Electrification presents a strategic opportunity to extend operational reach, enhance survivability, and reduce logistical vulnerabilities.

The time for action is now. If the U.S. military does not take decisive steps to lead in electrification, it risks falling behind adversaries who already recognize its transformative potential. This is not about adapting to technology; it is about ensuring **the very foundations of military readiness and national security**.

The choice is ours. The stakes could not be higher.

