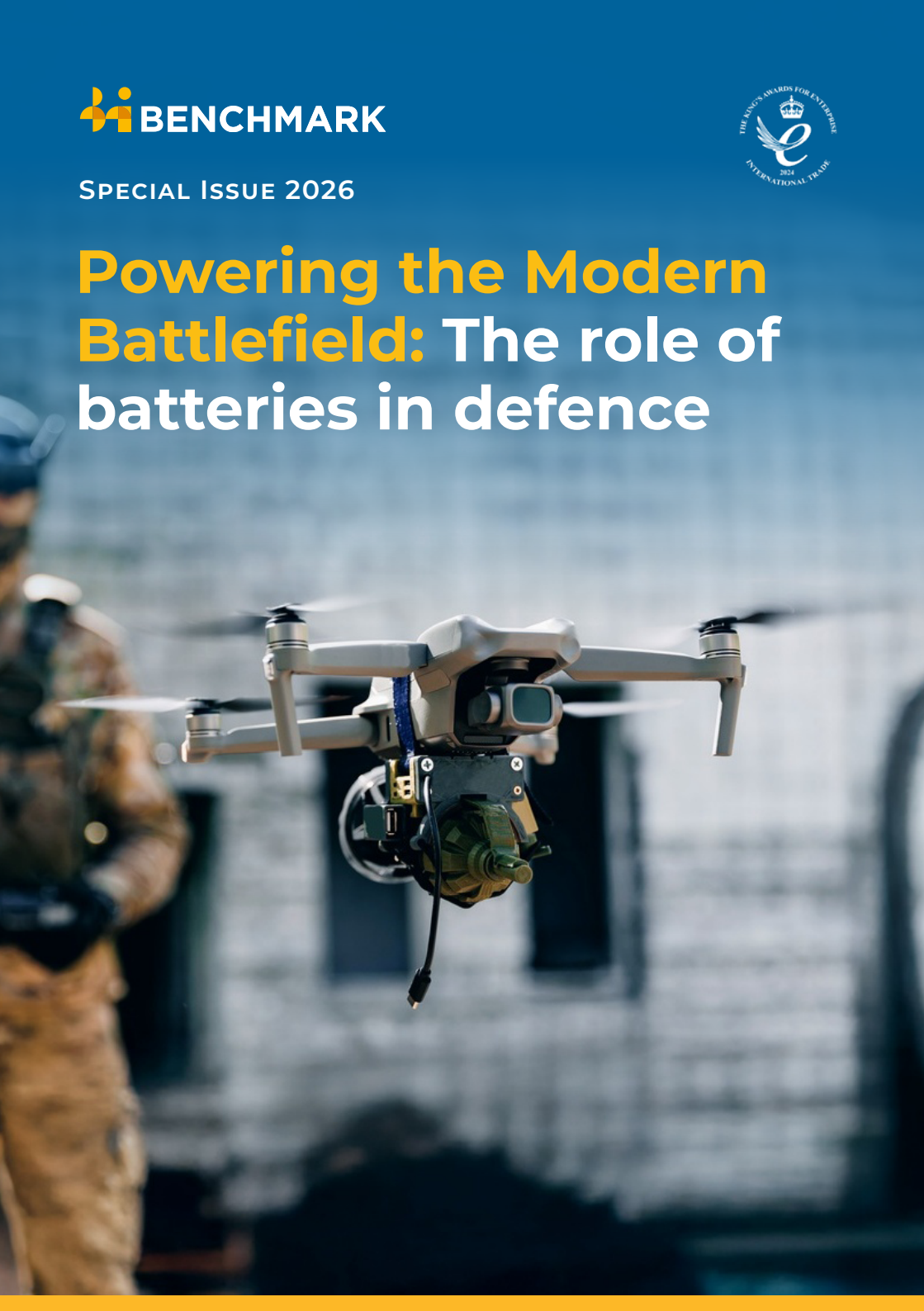
BENCHMARK

Special Issue 2026

# Powering the Modern Battlefield: The role of batteries in defence

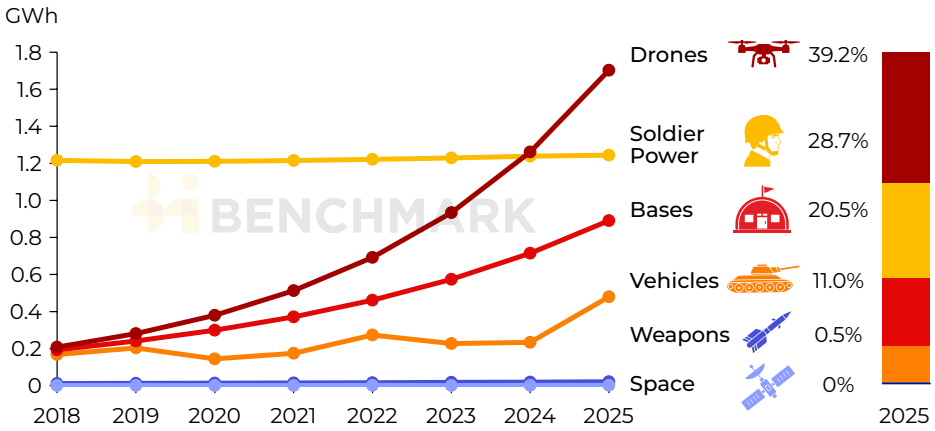


# Contents

# Introduction

The international order is increasingly marked by heightened instability, with, amongst others, Russia's ongoing invasion of Ukraine and a regional conflict in the Middle East involving the US, Israel, and Iran. In this context of uncertainty, governments are increasingly prioritising defence readiness and industrial competitiveness as core pillars of national security.

**Overview of defence battery demand drivers and GWh demand by demand applications 2018 – 2025**




*Source: Benchmark NRMM Forecast*

Modern warfare is also undergoing a profound transformation. Since the outbreak of the war in Ukraine in 2022, drones have evolved from support systems into primary battlefield assets. They are being deployed at scale, increasingly treated as expendable systems akin to ammunition. Ukrainian military sources attribute roughly 60–70% of Russian battlefield casualties to First-person-view (FPV) drones. This shift is redefining military advantage. Success depends not only on technological innovation, but also on the ability to manufacture drones in large volumes, iterate rapidly, and maintain resilient supply chains under pressure. At the centre of this are two essential components: batteries, which determine range, endurance, and payload; and rare earth permanent magnets (REPMs) in electric motors, which determine flight performance and reliability. Both depend on critical mineral supply chains in which China holds a dominant global position, especially for anode active material (AAM), rare earth element (REE) and REPM production. Furthermore, China has the world's largest and most vertically integrated drone industry, combining dominant manufacturing capacity with the deepest component supply chain and the largest deployed fleet. Its position has also been reinforced by explicit national policy support under its 15th Five-Year Plan. As a result, modern drone warfare, including in Ukraine, remains deeply reliant on Chinese-origin inputs across upstream critical mineral, battery and magnet production.



| | |
|---|---|
| **Soldier Power** | Radio, GPS and headsets, night vision shot detection and IR lasers |
| **Vehicles** | Armoured vehicles, fighter jets and submarines |
| **Bases** | Backup and forward deployed power, and solar + storage |
| **Drones** | Unmanned aerial, underwater & surface vehicles, and tactical robots |
| **Weapons** | Missile systems from MANPADS to Ballistic and Cruise. |
| **Space** | Cubesats, Low Earth Orbit and Geostationary Orbit |

These chokepoints create a structural vulnerability, meaning that any supply disruption would have immediate battlefield consequences. At the same time, the US and Europe face a significant challenge in reducing reliance on Chinese supply chains without undermining their ability to scale production.

Against this background, Benchmark assesses that battery demand from defence applications reached 4.3GWh globally in 2025. Drones are now the largest single driver, accounting for approximately 1.7GWh, just under 40% of the total, up from around 15% in 2020 following the surge that began with Russia's full-scale invasion of Ukraine in 2022. Batteries are also deployed across soldier power, ground vehicles, submarines and next-generation fighter jets, base power and storage, weapons and space applications. This Defence Special Issue examines the geopolitical and policy trends reshaping these supply chains and the essential role of batteries in drones and other defence applications.

> **"Drones are now the largest single driver, accounting for approximately 1.7GWh..."**



# Policy and geopolitical trends

To increase the development of defence capabilities, the North Atlantic Treaty Organisation (NATO) agreed in 2025 to raise defence spending to a total of 5% of GDP annually by 2035, with 3.5% of GDP for core elements such as equipment, personnel, and operations, and 1.5% of GDP for critical infrastructure, civil preparedness, and the defence industrial base. NATO members have also individually allocated more money to defence, like Germany, whose 2026 defence budget is approximately €108bn. Alongside increased defence spending, NATO places industrial capacity alongside military readiness, with a need for faster procurement, increased production volumes, and greater supply security and diversification.

Critical raw materials (CRMs) are deemed vital to defence industrial manufacturing, as well as NATO's technological edge and operational readiness. Therefore, NATO published a list of 12 CRMs it determined as being essential for defence.

This working list covers the principal raw materials required for batteries, electric motors, permanent magnets, semiconductors, aerospace alloys, armour, and other defence systems. A compelling illustration of this is drone manufacturing, which depends on graphite, lithium, cobalt, and manganese for its batteries, and REEs are required for high-performance REPMs to make the motors. Notably, nickel, central to the high-nickel chemistries that

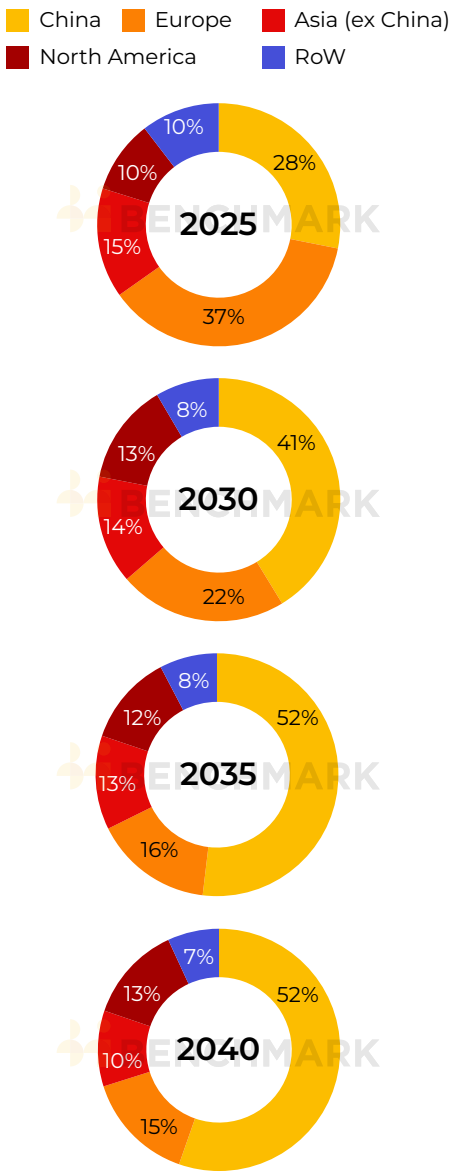
**NATO Defence Critical Raw Materials**

| | | | | | |
|---|---|---|---|---|---|
| 13 Al Aluminium | 4 Be Beryllium | 27 Co Cobalt | 31 Ga Gallium | 32 Ge Germanium | 6 C Graphite |
| 3 Li Lithium | 25 Mn Manganese | 78 Pt Platinum | 74 W Tungsten | 22 Ti Titanium | REEs Rare Earth Elements |

dominate military drone demand, does not appear on NATO's list. The EU's Action Plan on Drone and Counter-Drone Security calls for the "massification" of drone and counter-drone production, through raw material supply security policy, including research into substitutes and stockpiling where necessary. NATO has recently established a CRM initiative at its Ankara 2026 summit under which participating allies will jointly acquire, store, transport, and manage stockpiles of materials considered essential to defence production to provide a buffer against short-term disruption.

Drones and counter-drone systems are seen as a defence industrial priority, and NATO's Drone Edge initiative is expected to direct more than $40bn over five years towards drone and counter-drone capabilities. The programme also includes a commitment to train five times more drone operators by the end of 2027 and the creation of a dedicated counter-drone marketplace. The marketplace is intended to give allies access to NATO-tested and interoperable systems and to accelerate procurement of technologies that have already demonstrated their value on the battlefield. The initiative reflects lessons from the ongoing war in Ukraine, where

**Defence battery demand by region**




*Source: Benchmark NRMM Forecast*



relatively low-cost systems have been deployed at scale and rapidly adapted in response to battlefield conditions (see more below). To deepen its industrial cooperation with Ukraine, the EU has secured a drone partnership with Ukraine, seeking to combine Ukrainian battlefield experience with European manufacturing capacity. Meanwhile, a dedicated Drone Alliance connects European companies with Ukrainian defence innovation. The stated objective is to move from ad hoc procurement towards joint production and a more integrated European market for drones and counter-drone systems.

However, raw material supply dependency and weaponisation remain a strategic concern, as these can be translated into not only commercial but also military pressure. China has leveraged its dominance across several stages of the battery and magnet supply chains through its dual-use export controls, including the October 2025 synthetic graphite, battery, REE and magnet equipment and technology export controls that have been suspended until 10 November 2026. Additionally, in October 2024, China's Ministry of Foreign Affairs sanctioned three US defence suppliers, drone makers Skydio and Edge Autonomy and shipbuilder Huntington Ingalls Industries, in retaliation for US military assistance to Taiwan. The measures froze the companies' assets in China and barred all Chinese entities from transacting with them, cutting off Skydio's battery supplier and forcing the company to ration customers to one battery per drone. Skydio's only Taiwanese customer at the time was the civilian National Fire Agency.

> **"Drones and counter-drone systems are seen as a defence industrial priority, and NATO's Drone Edge initiative is expected to direct more than $40bn over five years towards drone and counter-drone capabilities."**

Against this background, NATO allies, especially the US, have developed China-derisking and procurement policies to drive allied supply diversification and decrease China's involvement in dual-use battery supply chains. For instance, Section 154 of the US FY2024 National Defence Authorisation Act (NDAA) bars the Department of War (DoW) from procuring batteries produced by six named Chinese companies from 1 October 2027: CATL, BYD, Envision Energy, EVE Energy, Gotion High-Tech and Hithium. Section 842 of the FY2026 NDAA goes further, requiring the DoW to phase out advanced batteries whose functional cell components or technology are owned, sourced, refined or produced by a foreign entity of concern (FEOC), including China, applying to new acquisition programmes from 1 January 2028, standard batteries from 1 January 2029 and existing programmes from early 2031. Executive Order (EO) 14415 of 20 July 2026 tightened this further, making waivers for prohibited foreign material significantly harder to obtain from 1 January 2027 and directing new rules to trace components back to raw material origin. While the US has been narrowing its procurement waivers, drones were the first product category tested under the EU's €90bn Ukraine Support Loan to receive a derogation, permitting purchases with more than 35% of their value originating outside the EU, Ukraine and the EEA-EFTA states, in practice largely coming from China.

Ukraine's rapid adoption of drone technology has led to Europe currently being the largest driver of battery demand for defence applications. However, over the next decade Benchmark forecasts that China will grow to account for over half of defence battery demand by 2035 as it accelerates the deployment of drones in its military activities.



# Drones

Drones now account for the largest share of battery demand in military applications, owing to a surge following the start of the Russia-Ukraine conflict. That conflict changed how drones are viewed and used in warfare, with unprecedented deployment of FPV unmanned aerial vehicles (UAVs). Laden with explosives and flown into artillery, armour or strategic sites at high speed, FPV UAVs are also used for reconnaissance. The industry now outputs tens of thousands of drones daily.

FPV UAVs used in the Russia-Ukraine conflict have largely been drawn from the commercial drone market. Commercial drones are in principle built for photography, mapping, agriculture and delivery: cheap, mass-produced, standardised, made from civilian and largely Chinese components, iterated on consumer timescales of weeks. In contrast, military drones are purpose-built for contested environments: encrypted, frequency-agile, resistant to electronic warfare, ruggedised, sometimes carrying AI terminal guidance, but far more expensive, lower-volume, and historically slow to field. However, as the war in Ukraine has progressed, that distinction faded away, and commercial drones have become increasingly specialised for military use. But commercial drones still carry real liabilities: they are jammable, their navigation can be spoofed, and their firmware can be geofenced or remotely disabled. All of this resulted in a hybrid civil-military Ukrainian drone manufacturing model: the cheap commercial production model and rapid iteration, hardened with unjammable fibre-optic control, encrypted links, and domestically sourced components. Ukraine's genuine advantage was applying commercial mass-production economics to military drones.

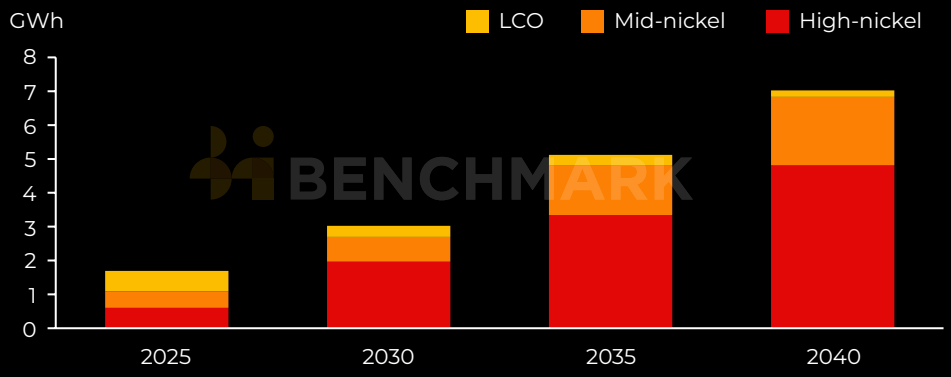
As part of China's "low-altitude economy", an emerging industry pillar of China's 15th Five-Year Plan, the country currently operates the world's largest and most vertically complete drone industry. While its industry is overwhelmingly commercial in emphasis, with an industrial ecosystem of motors, batteries, flight controllers and magnets, its commercial dominance and



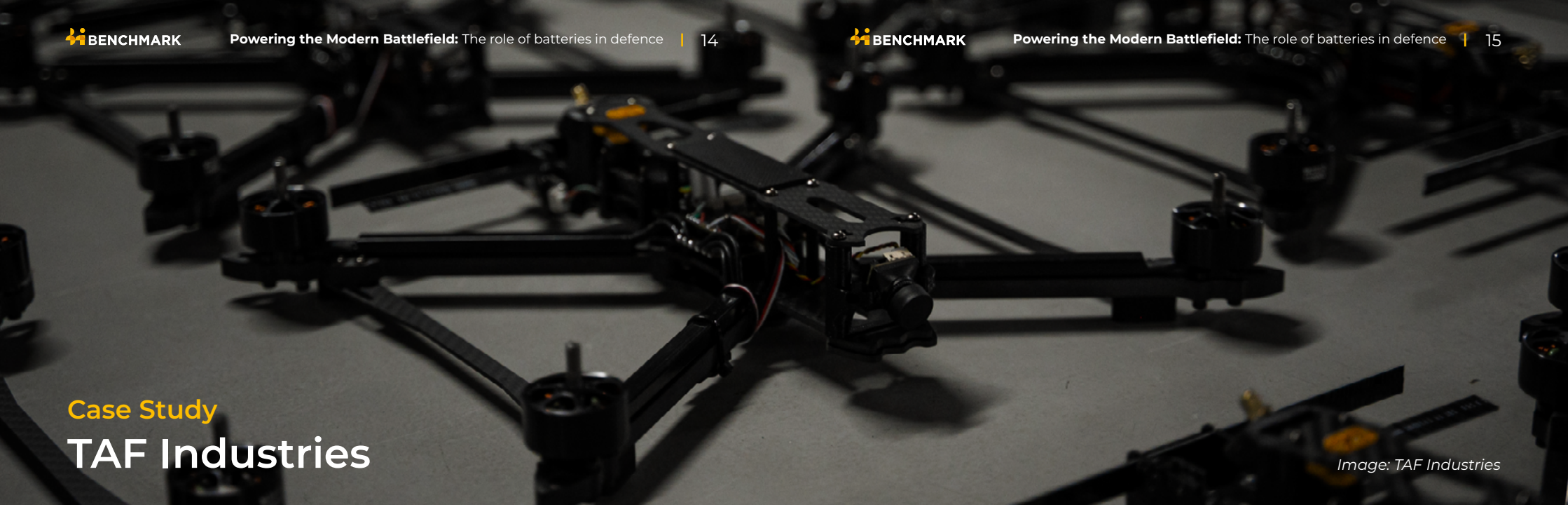
component flows are precisely what make China a military power in drones. In contrast, Ukraine runs an almost entirely military drone sector built from nothing since 2022, with an estimated 6 to 7 million FPV drones a year. Ukraine has also reportedly largely localised the battery assembly part of the drone supply chain to assuage geopolitical concerns. For 2026, Russia is reportedly aiming to produce 7.3 million FPV UAVs and its drone industry is also overwhelmingly military.

However, this production estimation originates as a Ukrainian intelligence assessment and independent estimates imply materially lower delivered volumes. The US is the outlier with an annual production number of 100,000 units, which is approximately less than a week of Ukrainian output and is from a base that remains largely commercial and is only now pivoting to military scale through the US Drone Dominance programme.

**Defence drone battery demand, GWh, annual**




*Source: Benchmark NRMM Forecast*



Case Study

# TAF Industries

*Image: TAF Industries*

TAF Industries, previously TAF Drones, was founded in 2022 by Oleksandr Yakovenko to develop drones and associated technologies for the Ukrainian military. It now offers over 30 products and states production in excess of 80,000 drones each month, which it says could rise to 150,000 if funding allowed. TAF Industries' flagship product is its Kolibri FPV UAV. Its standard version is available in four sizes, with the largest variant, equipped with a ~0.66kWh battery pack and able to carry a five-kilogram warhead for up to 15 minutes. The smallest drone has a capacity of 0.18kWh and can carry a 1.5kg warhead. In September 2025, TAF Industries released fibre optic variants of its Kolibri FPV UAVs. These drones cannot be jammed by radio interference, unlike their standard radio counterparts. This comes with the trade-off of reduced range, shorter flight times, lighter payload capacities, and a lower maximum altitude due to the physical fibre optic line. The largest fibre optic Kolibri FPV UAV has a ~0.89kWh battery and can carry a three-kilogram warhead.

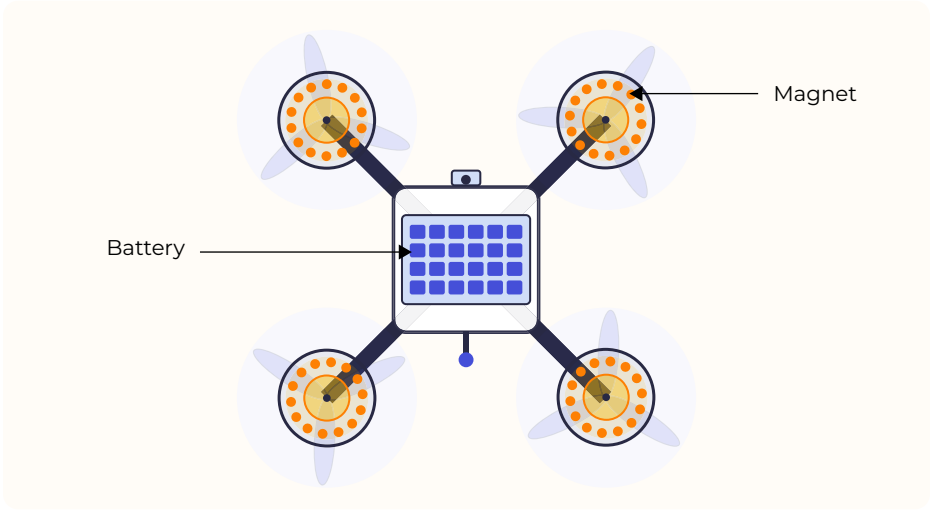
The Kolibri 10 drone carries a published 20,000mAh 6S4P pack of 24 cells of a total energy of roughly 444Wh. The configuration implies cylindrical lithium-ion cells of a class typically rated at 250–270Wh/kg of energy density at cell level, pairing a nickel-rich NCM cathode with a graphite anode. This energy density level sits right under China's suspended October 2025 export control, which starts to bite at a ≥300Wh/kg energy density level. Its four brushless motors are built to the 12N14P configuration standard for this size class, implying some 56 sintered NdFeB magnets per airframe, typically in high-coercivity grades containing a few per cent of dysprosium or terbium. TAF does not publish its cell or motor supplier, so these are estimates rather than manufacturer figures. Scaled against TAF's stated output of some 80,000 drones a month, one product line from one Ukrainian manufacturer implies demand on the order of twenty million cells, fifty million magnets and around 400MWh of cell capacity a year.

> **"The Kolibri 10 drone carries a published 20,000mAh 6S4P pack of 24 cells of a total energy of roughly 444Wh."**

TAF is expanding beyond its 20+ domestic production sites and has been securing deals across Europe. In February 2026, it signed an MoU with German firm Wingcopter at the Munich Security Conference to establish a joint venture producing its reconnaissance UAVs in Germany. In April 2026, it signed further MoUs with THYRA GmbH for serial production of Kolibri i10 interceptors in Germany and with Finland's Summa Defence. All three sit under the "Build with Ukraine" programme. In July 2026, TAF became one of 18 founding members of the previously mentioned EU–Ukraine Drone Alliance.

## Inside the TAF Kolibri 10" Advance

The battery and magnet content of a combat-proven attack drone




## TAF states output of ~80,000 drones a month, roughly 960,000/year

Multiplied across one year of production

**~960k**
Drones per year

**~20M***
Lithium ion cells

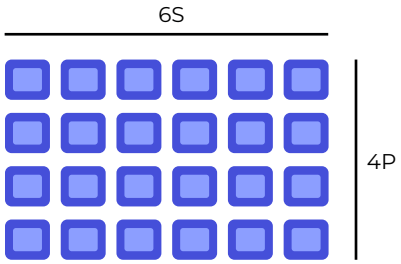
**~50M***
Rare-earth magnets

**~400MWh**
Annual cell demand



## The Battery

One 6S4P pack: 24 cylindrical cells, 20,000mAh




**Cell Chemistry: What's inside each cell**

Cathode: Nickel-rich NCM*
*Lithium, Nickel, Manganese, Cobalt*

Anode: Graphite
*Natural and Synthetic, ~90% China-processed*

**Stored Energy: How much it holds**

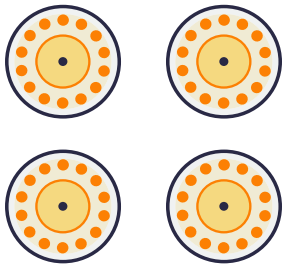
**~444Wh**
The whole pack: 22.2V × 20Ah

**Energy Density: Energy per kilogram**

**250-270Wh/kg***
per cell; ≈200–230 at pack level — so ≈ 2kg

## The Magnets

Four motors × 14 magnets in each bell



**4**
Brushless motors

**14**
NdFeB magnets each

**~56**
Magnets per drone

**Dy/Tb**
Heat-resistant grades

Battery configuration (20,000mAh 6S4P) is TAF Industries' published specification for the Kolibri 10" Advance; the 24-cell count is arithmetic from that designation.

*Engineering estimate, not disclosed by TAF. Cell format, cathode chemistry and energy densities are typical of 21700-class cylindrical Li-ion in this application, not measured on this pack.

Magnet count assumes the 12N14P pole configuration standard for 5"–10" quadcopter motors. Annual figures assume 80,000 units/month across a mixed 7"/8"/10"/13" range. · 3 August 2026.

# Other military battery applications

Next to drones, systems carried and operated by soldiers represent the second biggest source of battery demand across military applications, with more than 1.2GWh of battery demand in 2025. These include handheld radios, global positioning system (GPS) units, weapon sights, and night-vision goggles, among other equipment. The increasing electrification and digitalisation of infantry forces are driving growth in this specialised segment of military energy storage. Demand is supported by the size of the global military workforce and regular equipment-replacement cycles, although individual battery packs are generally small. Traditionally, each piece of equipment has used its own dedicated battery. More recently, wearable battery systems have been developed that can be integrated into clothing or ballistic vests and used as a central power source for multiple devices. As standard equipment evolves, the energy requirement per soldier is likely to increase. However, total battery demand in this segment will remain constrained by the weight and volume that personnel can carry, as well as by the changing role of military personnel away from direct front-line activity.

Beyond drones and soldier-worn equipment, military battery demand is more limited in volume but highly diverse. Applications include military bases, vehicles (including armoured vehicles), fighter jets and submarines, several weapon systems, and space assets. These segments have more targeted requirements, creating opportunities for cell manufacturers that can supply specialised products rather than compete solely on volume.

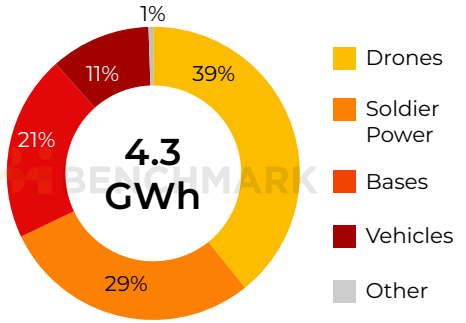
Military bases are increasingly deploying battery energy storage systems (BESS) across sites and equipment installations. Applications include backup power for critical systems, power supply at forward operating bases (FOBs), and the development of microgrids. BESS can improve resilience to grid outages and provide a more stable power supply for essential operations.



Generators and lead-acid batteries have historically dominated power provision at military bases. Lithium-ion batteries are gaining market share, particularly in backup power and FOB applications, because of their lower operating costs, longer service life, and reliability. Lithium-ion and other advanced chemistries can also provide performance advantages in longer-duration and co-located applications, where space utilisation and system efficiency are important. A wider range of technologies may be used for high-power applications, including radar and weapons systems, where power density, response time, and operating conditions can impose more demanding requirements than those found in commercial energy storage.

Military installations are expected to become the second-largest source of battery demand after drones within the next few years. Although the technology requirements of many base applications overlap with those of the commercial energy storage market, procurement remains security critical. This makes military BESS an important niche within the defence battery supply chain, particularly as lithium iron phosphate (LFP) becomes the dominant chemistry in global BESS deployments.

**Overview of different defence battery demand drivers, 2025**




*Source: Benchmark NRMM Forecast*

The security implications of battery sourcing have already become apparent. In 2024, an 11MWh BESS installed by Duke Energy at Camp Lejeune in North Carolina was reportedly decommissioned and replaced with a system supplied by a US-based or allied-country manufacturer after concerns about its use of CATL cells and systems. The case illustrates how restrictions on foreign suppliers can affect not only future military procurement, but also existing installations.

# Conclusion

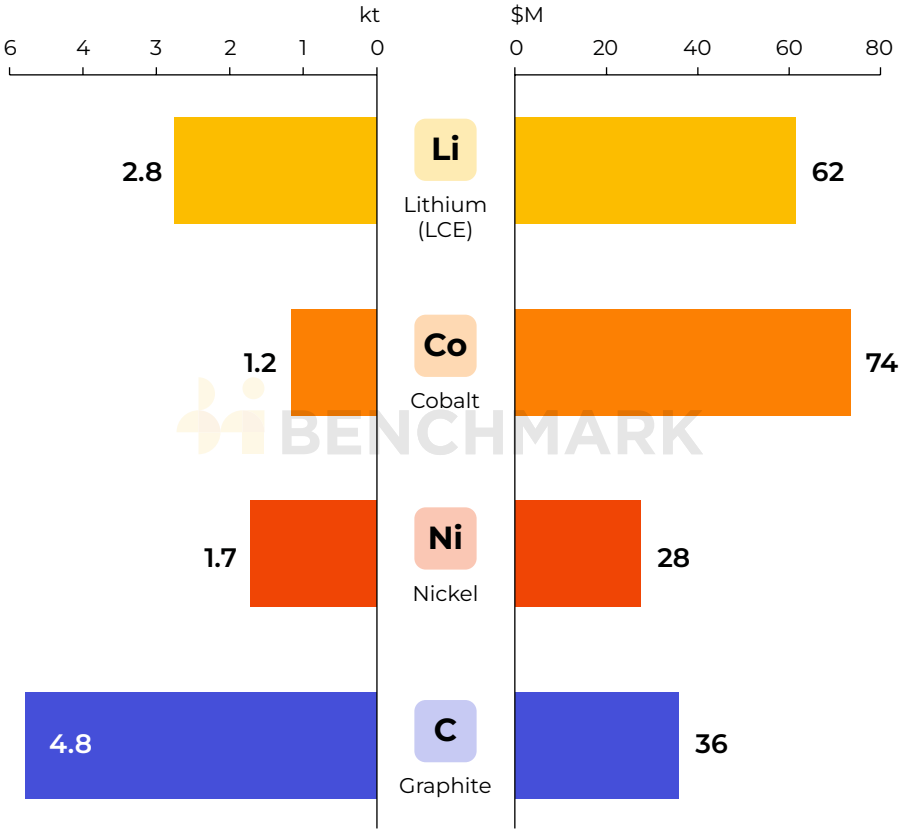
Defence battery demand is entering a period of structural growth and diversification. Global demand reached 4.3GWh in 2025, with drones accounting for approximately 1.7GWh and soldier-worn systems contributing more than 1.2GWh. Demand is also expanding across bases, vehicles, weapons, and space assets. Although drones will remain the principal growth driver, these applications require a broad range of battery formats and performance characteristics, creating opportunities for suppliers able to meet demanding requirements for energy density, reliability, safety, power output, and operation in contested environments.

In volume terms, however, the defence battery market remains small compared with the civilian market. Defence accounted for only 0.2% of global lithium-ion battery demand in 2025, and the approximately 10.5 kt of lithium, cobalt, nickel and graphite required for defence batteries is valued at about $200m, which is just a fraction of the whole market. Graphite-anode was the largest requirement by volume in 2025, at approximately 5kt, but accounted for only about $36m of total expenditure. Cobalt represented the smallest volume, at more than 1kt, but the highest value, at approximately $74m. Defence is therefore a price-taker in raw material and battery markets.

Despite the limited scale, these materials remain strategically important and a chokepoint, given the supply concentration vulnerable to disruption. Graphite, lithium, nickel, cobalt, and REEs underpin the batteries, REPMs and motors used in drones and other defence applications, while China remains the world's largest drone producer and holds dominant positions across several stages of critical mineral processing, battery manufacturing, and magnet production. Export controls and other restrictions have caused supply disruption, and future ones could cause operational and commercial disruption. The US, EU and other NATO allies have responded through increased defence spending, domestic and allied procurement requirements, stockpiling initiatives, supply chain mapping and support



**LiB Defence demand in 2026 by critical mineral, unit: kt (LHS) and $M (RHS)**




*Source: Benchmark Mineral Intelligence*

for drone and counter-drone production. Building resilient alternatives will take time and require more than replacing individual suppliers. It will also depend on sustained investment in mining, processing, cell and magnet manufacturing, system integration, supported by faster qualification and procurement. The future defence battery market will ultimately be determined not only by military demand, but by whether governments and industry can convert strategic supply chain priorities into commercially viable capacity.

COMING SOON

# Benchmark to cover ten new critical mineral markets.

## Ferro alloys, minor metals, defence materials.

| | | | | |
|---|---|---|---|---|
| 92 **U** Uranium | 74 **W** Tungsten | 22 **Ti** Titanium | 23 **V** Vanadium | 42 **Mo** Molybdenum |
| 31 **Ga** Gallium | 32 **Ge** Germanium | 14 **Si** Silicon Metal | 5 **B** Boron | 30 **Zn** Zinc |

“Allied defence budgets are rising at a pace not seen since the Cold War. NATO members have committed to 5% of GDP by 2035, and the industrial build-out that follows will be constrained less by budgets than by materials.

Batteries are one part of that picture. Drones, soldier power, silent watch and base energy resilience all draw on the lithium, cobalt, nickel and graphite supply chains Benchmark has priced and modelled for over a decade.

But the same rearmament cycle pulls hard on a wider set of critical minerals. From October, Benchmark covers them.”

**Michael Finch**
Product Director, Benchmark Mineral Intelligence



# About us

Benchmark Mineral Intelligence is the world’s largest and most credible platform for prices, IOSCO assured data, and market intelligence with 120 analysts dedicated to researching the full depth and breadth of energy transition supply chains.

Having acquired Rho Motion in 2024, our reporting and analysis now extends from mine to grid with coverage across lithium ion batteries, rare earth elements, battery demand and EV & Energy infrastructure.

Headquartered in London, UK, we have offices and teams strategically located globally.

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