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CRITICAL MINERALS OUTLOOK · TUNGSTEN

TUNGSTEN

Critical Minerals Outlook Tungsten Volume 2.

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Demand & Applications (2026-2030). End-use demand by sector, substitution risk, recycling and emerging applications, and three illustrative 2026-2030 demand scenarios cross-checked against Volume 1's supply-side synthesis.

End-Use Demand | Substitution & Recycling | Demand Scenarios | Supply Cross-Check

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LANGUAGE & CONVENTIONS

British English, SI units. Tonnage figures are stated on a contained-tungsten-metal basis (t W) unless explicitly marked otherwise. The approximately 130,000 t estimate of 2025 world demand (China Tungsten Online, a forecast) is the exception: its unit basis is concentrate mass per the source, grade not stated (65% WO_3 assumed), and is flagged wherever it is used. The bases are **not interchangeable without conversion**; this volume does not net them against each other (an indicative bridge is given in Volume 3, Chapter 4), and every figure states its basis explicitly.

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- EXECUTIVE SUMMARY

Tungsten's demand structure is, on the evidence available at this cut-off, less cleanly documented than for most commodities in KEYSTONE.'s coverage, and that sourcing limitation is itself a finding worth stating up front: **no official (T1) statistical agency publishes a current global sectoral breakdown of tungsten end-use.** The US Geological Survey's *Mineral Commodity Summaries 2026* reports only a United States-specific split (cemented carbide ≈60% of US consumption), and every global percentage breakdown used in this volume is therefore drawn from the International Tungsten Industry Association (ITIA, a sectoral association, T3) or from named commercial consultancies (T3). That said, the convergence across independent sources is real: cemented carbide/hardmetal products are confirmed, independently, as the single largest global end-use category, in a 60-67% range depending on source and geography (ITIA's 2021 "first-use material" cut puts it at 65%; Fortune Business Insights at 60-65%; an EU-specific SCRREEN figure at 67%). Mill products, alloy and tool steels and superalloys follow at 8-14% depending on source, a range that overlaps the next two categories: tungsten metal products - a bundled category spanning heavy alloys/military, electrical-electronic components and, increasingly, photovoltaic tungsten wire - sit around 11-12%, and chemicals/catalysts around 9-11%.

World tungsten demand in 2025 is estimated at approximately 130,000 tonnes (China Tungsten Online, a commercial website, commentary of 19 August 2025, a forecast, T3; +6% year-on-year; unit basis: concentrate mass per the source, grade not stated (65% WO_3 assumed)) - a figure that is **not directly comparable** to the companion Volume 1's contained-metal mine-production figure of 85,000 tonnes, owing to a unit-basis uncertainty that recurs throughout this volume and is never silently reconciled. Beneath the long-run 3.4% CAGR (2007-2021, ITIA), the growth pattern is visibly bifurcated: the mature cemented-carbide base tracks industrial-production and mining-capex cycles in the low single digits, while a small set of newer sub-segments are growing far faster - photovoltaic tungsten diamond-wire-saw wire (+198% year-on-year, 2024-2025, a China Tungsten Online forecast that could not be verified), China's power-battery tungsten consumption (+22% year-on-year) and China-specific cutting-tool and aerospace tooling (+15-20%, China Tungsten Online, April 2025, T3; base period not stated) - and it is this second group, not the mature base, that is the more plausible marginal driver of the 2025-2026 price surge.

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- EXECUTIVE SUMMARY

Substitution risk, assessed sector by sector, is rated Low across the great majority of tungsten demand. The dominant cemented-carbide segment sits at the centre of a decades-old competitive equilibrium - ceramics, cermets, polycrystalline diamond and cubic boron nitride each occupy adjacent niches but are individually disqualified from general substitution by specific technical weaknesses (brittleness, thermal limits, chemical incompatibility with steel) - and no quantified market-share shift away from carbide as a result of the 2025-2026 price shock was found, although SMM (13 July 2026) reports some substitution in low- and mid-range applications. Two segments carry a Medium rating, for different reasons. Semiconductor-grade tungsten is the one substitution trend identified as reported commercial in NAND (specialist press; not company-confirmed): molybdenum is reported by specialist press (The Elec, 2 July 2024) as introduced in Samsung's ninth-generation V-NAND, whose mass production Samsung announced on 23 April 2024, and reportedly targeted for mass production at SK hynix by the end of 2026 (industry-press report, not confirmed by the company), with DRAM and logic adoption expected but not confirmed - but this niche is a small fraction of total tungsten tonnage (for scale, trade-press tungsten hexafluoride output of 8,000-9,000 tonnes per year is equivalent to roughly 4,900-5,600 tonnes of contained tungsten on a KEYSTONE. stoichiometric conversion, an indicative T3 proxy rather than a sector consumption statistic, against tens of thousands of tonnes for hardmetals), so its aggregate demand impact is judged Low even as it remains the clearest early-warning indicator of accelerating substitution elsewhere. Photovoltaic tungsten wire's risk is cost- and margin-driven rather than technology-driven: no rival core-wire material has been identified, but, according to China Tungsten Online commentary (T3, unverified), China's "anti-involution" production-discipline campaign in the solar-wafer industry has "temporarily restrained" further wire-penetration growth, meaning the 40-50%-per-year industry forecast reported by Argus should be read as an upper bound, not a base case. Recycling offers only partial relief: a blended ~35% input rate masks a sharp structural split between an industrial/buy-back segment already near its practical ceiling (>95% recovery) and a dissipative segment (wear parts, small tools, ammunition, wire) where recovery is structurally limited by how the metal is consumed or dispersed in use, not by processing technology (the approximately 30% figure is the ITIA all-product end-of-life average, so recovery in this segment is below that level; the ITIA material reviewed gives no segment-specific rate).

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- EXECUTIVE SUMMARY

This volume constructs three explicitly **illustrative KEYSTONE. scenarios** - never forecasts - for 2026-2030 aggregate demand, extrapolating qualitatively from the bifurcated growth pattern above rather than from a disaggregated sourced forecast, since none is adopted here.

ILLUSTRATIVE 2030 CONSTRUCTIONS

Three scenarios for world tungsten demand in 2030.

- **Base (illustrative KEYSTONE. scenario):** roughly 3-3.6% per year, reaching approximately 150,000-155,000 tonnes (same unit basis as the 2025 starting point) by 2030.
- **High (illustrative KEYSTONE. scenario):** roughly 6-8% per year, reaching approximately 175,000-190,000 tonnes, contingent mainly on broader hardmetal (carbide) growth and on a slower pace of substitution; photovoltaic wire, even if it reaches the Argus upper bound of about 8,000 tonnes per year by 2027, adds at most about 3,500 t W over its 2025 level of about 4,500 t W (about 6,800 t of concentrate at 65% WO_3, about 5% of the 130,000 t base), a minority of the spread between scenarios on the 2027 figure (about 17-34% of the High-Base gap and 11-17% of the High-Low gap; wire demand beyond 2027 is not quantified in the sources reviewed); the 15-20% growth reported for China's cutting-tool and aerospace tooling (China Tungsten Online, April 2025, no period stated) is not quantified in tonnes by any source reviewed.
- **Low (illustrative KEYSTONE. scenario):** roughly 0-1% per year, broadly flat at approximately 130,000-135,000 tonnes, reflecting either a broader-than-expected spread of semiconductor substitution or a mining-capex/industrial downturn compounding the photovoltaic-wire cost headwind. No scenario implies an outright contraction in tungsten demand over the period.

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- EXECUTIVE SUMMARY

A qualitative cross-check against the companion Volume 1 (Supply & Mining) surfaces a tension flagged for further reconciliation rather than resolved here: Volume 1's own Base supply scenario finds that non-Chinese refining/midstream capacity persists as the binding constraint to 2030 (announced project capacities are stated in mixed units and no comparable aggregate is given) - the bottleneck remains essentially unresolved - against a demand side that, even on this volume's conservative Base case, continues to grow at roughly trend rate with only mixed evidence so far of a demand-side response to the 2025-2026 price shock (SMM reports destocking and some substitution, while company volume data are mixed). The 2025-2026 price surge itself (tungsten product prices up over 200% in 2025; Chinese domestic 65% wolframite concentrate reached RMB 1,050,000/t on 12 March 2026 (China Tungsten Online price report of 12 March 2026, T3) and European APT stood at US$2,900-3,200/mtu CIF Rotterdam on 2 July 2026 (SMM article of 3 July 2026, as reported in Volume 1, T2), and by 30 September 2026 the Chinese domestic 65% wolframite concentrate had closed at RMB 380,000/t (China Tungsten Online monthly review of 30 September 2026, T3), about 64% below its March peak (KEYSTONE. calculation)) is arguably the first real-world evidence that this tension is not merely theoretical.

For institutional and mining-metallurgy buyers, the practical reading is threefold: the cemented-carbide core is the most structurally defensible part of demand and the segment on which to build long-term offtake assumptions; semiconductor-grade tungsten and photovoltaic wire are the two segments carrying genuine, if differently sourced, technology and margin risk and merit close monitoring even though neither moves the aggregate materially on its own; and recycling should not be built into any 2026-2030 procurement case as a meaningful offset to primary-supply dependence.

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- STANDING DATA FLAGS

STANDING DATA FLAGS

Five sourced divergences and gaps, flagged once.

Unit basis: concentrate mass per the source, grade not stated (65% WO_3 assumed). The approximately 130,000-tonne 2025 demand estimate (China Tungsten Online, a commercial website, commentary of 19 August 2025, a forecast, T3) is described by the source as "calculated as tungsten concentrate", without stating the grade or the treatment of recycling. This volume reads it as concentrate mass at 65% WO_3, a KEYSTONE. assumption, equivalent to about 67,000 t of contained tungsten (factor 0.5154; primary basis). Two sensitivities are not supported by the source wording: 130,000 t read as WO_3 mass (about 103,000 t of contained tungsten) and 130,000 t read as contained tungsten including secondary supply. The estimate is therefore not reconciled in this volume with the contained-metal basis of Volume 1's approximately 85,000-tonne mine-production figure (USGS), and the two figures should not be netted against each other here. Volume 3 (Chapter 4) bridges the two series with an indicative conversion that takes the 65% WO_3 concentrate reading as reference and the other readings as sensitivities; the unit caveat of this volume applies to that bridge. The ITIA tonnage series cited in §1.3 (76,150 t in 2012; 104,500 t in 2018, via SCRREEN) carries no basis stated in the SCRREEN factsheet consulted and is not comparable with the concentrate-mass estimate above. The most recent available global sectoral end-use cut (ITIA, data-year 2021) is already several years stale relative to this volume's 30 September 2026 editorial cut-off, and no more recent T1 or association-grade global breakdown was located. A more recent commercial breakdown (data-year 2025) appeared in a draft market report published in August 2026 by S&P Global; its figures are not reproduced here. No source - including China Tungsten Online - publishes an official national sectoral percentage table for Chinese tungsten end-use; that site's sectoral colour is directional and qualitative, not a disclosed percentage breakdown. Available sources do not disaggregate "tungsten heavy alloys/military" from "electrical/electronic" within the combined approximately 11-12% "tungsten metal products" bucket. Regional consumption-share sources diverge and are presented side by side rather than reconciled (ITIA's 36% China share of end-use consumption, 2021, versus an earlier SCRREEN-cited claim that China "consumes half of the tungsten available worldwide" versus Fortune Business Insights' value-weighted 71.6% Asia-Pacific figure). Where a claim could not be tied to a primary document, the text names the secondary source and date that report it, or states that it is not quantified in the sources reviewed.

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