SuperPower Inc.

The REBCO wire-maker quietly enabling the compact-fusion magnet race

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ABSTRACT

SuperPower Inc. manufactures second-generation high-temperature superconducting (2G-HTS) wire, a rare-earth barium copper oxide (REBCO) conductor that carries large currents with effectively no resistance at cryogenic temperatures. The company is a wholly owned New York subsidiary of Japan's Furukawa Electric, and its product is best understood as an enabling material rather than a finished device: thin coated-conductor tape that lets engineers build magnets at field strengths copper and low-temperature superconductors cannot reach. That capability has found a timely application in compact fusion, where high-field magnets shrink the reactor needed to confine plasma. SuperPower's most visible relationship is with Tokamak Energy, which it agreed in January 2023 to supply with HTS tape. The implications are threefold: SuperPower sits upstream of a fusion supply chain still forming, its parent's deepening commitment signals strategic intent, and its differentiation rests on manufacturing know-how in a field growing more crowded.

Keywords: REBCO; high-temperature superconductors; 2G-HTS; compact fusion; Tokamak Energy; Furukawa Electric; high-field magnets; coated conductors

Fact Box

- **Company:** SuperPower Inc.
- **Headquarters:** Glenville, New York, USA
- **Ownership:** Private (wholly owned subsidiary of Furukawa Electric Co., Ltd.)
- **CEO:** Hirotsugu (Harry) Nagata (appointed 2024)

1. Snapshot

SuperPower Inc. (superpower-inc.com) manufactures second-generation high-temperature superconducting (2G-HTS) wire from a facility in Glenville, New York. The company was formed in March 2000 out of the HTS group of Intermagnetics General Corporation (IGC), later sat under Philips, and became a wholly owned subsidiary of Japan's Furukawa Electric Co., Ltd. in February 2012. Manufacturing was historically at 450 Duane Avenue in Schenectady; in 2020 the company relocated to a larger facility in the Schenectady County Airport Business Park in Glenville. Hirotsugu (Harry) Nagata was appointed President, CEO and COO in 2024; his background is not independently detailed in public sources beyond the appointment. As a private subsidiary, the diligence gaps are material and up front: revenue, headcount, customer count, achieved annual output, and cost position are not reliably disclosed, and secondary revenue estimates conflict by nearly an order of magnitude.

One orientation note. This is not the consumer health app "Superpower" (superpower.com) that raised venture funding, nor any unrelated landscaping or excavation business sharing the name.

2. Thesis: Why This Company, Why Now

The bet is that high-temperature superconducting wire becomes a strategic bottleneck material as compact fusion moves from physics to engineering, and that SuperPower is one of the few firms with the manufacturing maturity to supply it. What changed is the magnet. REBCO tape generates magnetic fields far stronger than the low-temperature superconductors used in machines like ITER, and field strength is what lets fusion designers shrink the tokamak. A smaller, higher-field machine is a cheaper, faster machine, which is the entire premise of the privately funded compact-fusion wave.

That makes SuperPower an AI-adjacent-style picks-and-shovels play, but for fusion rather than compute: demand is driven less by SuperPower's own products than by how fast its customers raise capital and build prototypes. The reachable market today is narrow, measured in kilometers of tape sold to a handful of fusion and high-field-magnet programs, not the broad grid-modernization market the wider HTS pitch has long invoked.

3. The Core Idea in Plain English

SuperPower makes a flat metallic tape, only microns of active material thick, in which a REBCO ceramic layer carries electric current with effectively no resistance once cooled to cryogenic temperatures. Wind enough of that tape into a coil and you get a magnet far more powerful than copper can produce without melting.

The analogy: REBCO tape is to ordinary copper wire what a fiber-optic cable is to a copper telephone line. It moves far more of what matters through a far smaller cross-section, but it demands a specific operating environment and is much harder to manufacture. Old world, electromagnets were bound by how much current copper could carry before overheating, or required liquid-helium cooling for low-temperature superconductors. New world, the binding constraint becomes how much superconducting tape you can manufacture and how well you engineer the cryogenics around it.

4. The Technical Space

The category is coated conductors: depositing a superconducting ceramic onto a flexible metal substrate so it can be wound into practical devices. The hard problem is that REBCO is a brittle, crystallographically fussy oxide. To carry high current, its crystal grains must be aligned almost perfectly, and that alignment has to be reproduced continuously over hundreds of meters of moving tape, layer by layer, without defects that would choke the current path.

Standard approaches build a multilayer stack: a strengthening substrate, buffer layers that template the crystal orientation, the REBCO layer itself laid down by vapor-deposition techniques, and a stabilizing cap of silver and copper. The two dominant texturing routes across the industry are IBAD (ion-beam-assisted deposition) and RABiTS (rolling-assisted biaxially textured substrates).

What "good" looks like comes down to four dimensions. First, critical current, how much the tape carries before going resistive, especially in high magnetic field and at the operating temperature. Second, piece length and yield, since splices and dropouts kill magnet performance. Third, cost per kiloamp-meter, the real currency of fusion economics. Fourth, mechanical and thermal robustness under the stresses a high-field magnet imposes. The gap between lab demonstrations and reproducible, catalogable product is exactly where manufacturing yield and quality control decide winners.

5. How Their Technology Works (and What's Proprietary)

SuperPower produces REBCO coated-conductor tape, sitting at the materials layer of the stack, well upstream of the magnets, cables, and devices its customers build. The product carries current with effectively zero resistance at cryogenic operating points such as 77 K, 30 K, and 4.2 K. One honest caveat against the vendor framing: real conductors do not have literally zero resistance but a finite critical current, above which they revert to normal, resistive behavior. The engineering art is maximizing that critical current cheaply and reproducibly.

The proprietary value decomposes into three components.

› **Process recipe and texturing.** The specific buffer-stack chemistry, deposition parameters, and texturing route that yield high, uniform critical current over long lengths are closely held trade secrets refined over two decades of continuous production since the IGC days. This is genuine know-how, hard to copy from a paper.

› **Long-length manufacturing yield.** Turning a lab coupon into kilometers of consistent tape is the actual technical challenge in this field. Reel-to-reel uniformity and defect control are operational capabilities competitors cannot simply buy.

› **Parent integration.** Furukawa Electric brings wire-manufacturing scale, capital, and a downstream path into magnet assembly. This is not a physics moat, but it can turn tape into a system deliverable.

SuperPower wire has also featured in partner record demonstrations, including NHMFL magnets exceeding 40 Tesla and high-current cables exceeding 10,000 Amperes. These are specific project demonstrations under controlled conditions, not catalog product ratings, and the distinction matters.

The blunt read: little of this is patent-fortified in a way that stops a determined, well-funded rival. The physics and the IBAD/RABiTS deposition toolkit are public. What is hard to replicate is the accumulated process tuning and the throughput, and that is craft and time, not an unbreakable lock.

6. Business and Go-to-Market

The model is materials supply: SuperPower sells tape, by the meter and ultimately the kilometer, to organizations building magnets, cables, and research instruments. The motion is sales-led and relationship-driven, anchored to a small number of high-value technical partners rather than self-serve volume. Pricing is not publicly disclosed, but HTS tape is generally sold by the meter or kiloampere-meter, with price heavily dependent on tape width, critical-current specification, and volume commitment.

The flagship commercial signal is fusion. In January 2023, SuperPower and Furukawa signed an agreement to supply Tokamak Energy with HTS tape for its ST80-HTS prototype device, with "several hundred kilometres" cited as the expected, forward-looking volume; production later commenced with first batches delivered. That figure is an expectation, not a settled delivered total, and should be read as such. The relationship has since deepened: Furukawa entered an investment agreement with Tokamak Energy in December 2023, and in June 2025 Tokamak Energy and the Furukawa Electric Group agreed to establish a joint operational base in Japan to manufacture fusion magnet technology in support of the FAST (Fusion Advanced Superconducting Tokamak) program. That move into co-manufacturing is a qualitatively stickier structure than a tape-supply contract.

Beyond fusion, in July 2022 SuperPower was selected as an industry partner in a U.S. DOE INFUSE-funded project with the National High Magnetic Field Laboratory to improve REBCO conductor production. Worth precision: INFUSE funds the DOE lab, not SuperPower directly, so this is partner selection rather than a cash award to the company.

On unit economics, the candid position is that revenue is not reliably known. Secondary estimates diverge by nearly an order of magnitude, roughly $11 million versus roughly $90 million, neither audited, and cost per

kiloamp-meter, the metric fusion buyers actually care about, is not disclosed.

7. Competitive Landscape and Moats

SuperPower competes in a small but increasingly crowded field of REBCO and HTS conductor makers. At the 2012 acquisition it was described as one of only two commercial 2G-HTS producers; that scarcity has since eroded. The specific names of its current direct rivals are not verified in the available material, so the honest posture is to treat the rival as an archetype rather than name a competitor the evidence does not support.

Closest direct rival, the archetypal REBCO supplier. Against another commercial REBCO tape maker bidding on the same fusion magnets, SuperPower wins where customers value parent-backed industrialization, its long US production history as a second qualified source, and long-length uniformity that matches the magnet's envelope. It loses where a rival offers a lower cost per kiloamp-meter, higher critical current at the buyer's exact cryo-field point, shorter lead times, or has secured anchor offtake with a major fusion developer first, since these programs qualify conductors deeply and switch reluctantly. The one adjacent pressure the evidence does support is alternative conductors: at least one cost model argues low-loss Bi-2212 can beat REBCO for some fusion magnet uses.

Three moats are worth taking seriously, capped honestly.

› **Manufacturing know-how.** On top of the technical edge above, the durable advantage is reproducible long-length yield, which compounds with production volume and is slow for newcomers to match.

› **Qualification lock-in.** Once a fusion or high-field-magnet program designs around a specific tape's properties, requalifying a different supplier mid-program is costly and slow, creating real switching costs.

› **Accumulated application data.** Deliveries into fusion prototypes and partner record demonstrations generate operational data tied to specific tape vintages, which shortens qualification cycles on repeat buys.

The asserted-but-soft claim is brand leadership: "leading" status and REBCO as the cost-winning conductor are not settled. The platform risk is real, and it sits unusually close to home. A deep-pocketed entrant, or a customer like Tokamak Energy internalizing magnet conductor sourcing, or even Furukawa's own downstream Japan base, could compress or route around SuperPower's position.

8. Risks and Open Questions

The picture turns on a few specific unknowns, most tracing back to fusion-program timing and to thin disclosure.

› **Customer concentration and capex cyclicality.** Demand is leveraged to a handful of privately funded fusion developers, so the AI-style picks-and-shovels exposure cuts both ways: if that capital cycle cools or a major program slips, orders could evaporate quickly. What share of revenue does the Tokamak Energy relationship represent, and how diversified is the order book?

› **Capacity reality.** A 700 km/year figure has been cited as a goal for end-2024; no source confirms it was met. What is actual realized output today, and what is yield at full piece length?

› **Differentiation durability.** With the field more crowded and Bi-2212 a live alternative for some uses, is SuperPower's cost per kiloamp-meter competitive, and where does its critical-current-in-field performance actually sit against rival REBCO suppliers?

› **Platform dependency.** What governs the Furukawa–Tokamak Energy relationship, spanning the December 2023 investment and the June 2025 joint Japan base for the FAST program? Does SuperPower capture that value or get disintermediated by its own parent's downstream moves?

9. Bottom Line

SuperPower is a credible, decades-seasoned REBCO manufacturer whose relevance has been revived by compact fusion, sitting upstream of a supply chain that is real but still forming. It works if the privately funded fusion-magnet wave sustains its capital and SuperPower's manufacturing yield stays ahead of a crowding field; it stumbles if that capex cycle turns or a rival locks up the anchor programs first. The single thing to watch is how the Furukawa–Tokamak Energy axis evolves, specifically the June 2025 Japan manufacturing base, which could either pull SuperPower's tape into a larger system or route value around it.

10. For the Nerds

The performance-to-cost calculus is governed by the tape's critical-current surface Ic(B, T, ε) and the engineering current density Je once stabilizer and packaging are accounted for. Fusion magnets drive operation toward lower temperatures, often 20 to 30 K or 4.2 K, and high background fields, which impose stricter Ic under load and strain. Pinning matters here: REBCO's flux-pinning landscape, often engineered with artificial pinning centers, determines whether current holds up as field rises, and lab records are frequently quoted at favorable field angles rather than the orientation a tokamak coil actually sees.

A persistent integration challenge is translating tape-level properties into cable- and coil-level performance. Joint resistance, current sharing among stacked tapes, and AC losses under ramping fields can erase headline Ic advantages if not managed, and REBCO's c-axis brittleness limits the bending radius in tight winding geometries. The >40 Tesla magnet and >10,000 Ampere cable demonstrations show feasibility envelopes, but catalog capability depends on uniformity over hundreds of meters, splice strategies that preserve margins, and quench detection schemes appropriate for HTS, where normal-zone propagation is slow and a fault can stay hidden long enough to damage the coil. Program data from delivered reels therefore compounds as an economic asset, because it narrows the qualification gap on subsequent orders.

WHERE SOURCES DISAGREE

What is SuperPower's revenue?
One market report lists ~US $90 million (2024). A separate business-information profile lists ~US $11 million with ~40–50 employees
Unresolved: both are low-rigor secondary sources that disagree by nearly an order of magnitude, with no audited filing to arbitrate

Has SuperPower reached 700 km/year HTS wire production capacity?
A Furukawa Electric Review article states 700 km/year as a goal for end-2024. No source confirms the target was met
Unresolved: the corpus documents only the ambition, not realized output

Is SuperPower a "leading" manufacturer, and is REBCO the cost-winning conductor?
At 2012 acquisition it was described as "one of only two" commercial 2G-HTS producers. A cost-model paper in the corpus argues low-loss Bi-2212 can beat REBCO for some fusion magnet uses, and the competitive field is now more crowded
Unresolved: the corpus supports neither a current leadership ranking nor REBCO's universal cost superiority

Do the >40 T / >10 kA figures reflect catalog wire capability or one-off partner records?
The company presents them as a differentiating envelope, and NHMFL >40 T records are independently real. But independent literature ties them to specific lab demonstrations, not guaranteed product ratings
Unresolved: the gap between "a partner demonstrated this" and "what the standard wire does" is not closed by the corpus