Sila

# A Battery-Powered American Energy Revolution.

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*U.S.-developed, next-generation battery material is here, in the market, and powering consumer products today. That same material can and will fuel our electric future—from electric vehicles to mass transportation to the electric power grid. Government support of available, proven next-generation battery material will not only enable the U.S. to take a leadership role in the scaling and exporting of new technological innovations in clean energy, but also create substantial economic opportunities.*

## The global battery race has begun.

21st century clean energy technologies such as electric vehicles, next-generation battery materials, and renewable distributed power generation are no longer the next frontiers of technological innovation. The global foot race to achieve clean energy readiness and market dominance is happening now. And silicon (Si)-based anodes for lithium-ion batteries (LIBs) are at the center of it. Si-LIBs deliver fundamental advantages over today's graphite-based LIBs, including significantly higher energy density and reduced cost per kWh. Today, best-in-class Si-based anode materials are being manufactured in the U.S. However, these materials are not commercially available in large volumes for the automotive sector yet.

The current supply of Si-based products, which suffer from relatively poor performance and material limitations (see Appendix, Chart 1), are only produced in China and Japan. The European Union has also begun investing billions of dollars in the battery supply chain and transportation-related technologies. The reality: with increased demand for electric vehicles, the instability of our global supply chain, volatility in metal and mineral pricing, and the need for climate action, energy transformation is not a question of IF it will happen, it's a matter of when and where.

To ensure the U.S. meets the current opportunity for economic growth and climate sustainability, it's important for the federal government to invest in the successful commercialization and high-volume domestic production of next generation Si-dominant anode materials. The development and mass production of these materials can cleanly power our way into the future, while also positioning the U.S. as a leader in the new clean energy economy.

## A new standard for lithium-ion batteries.
## Developed in the U.S., powered with Sila science.

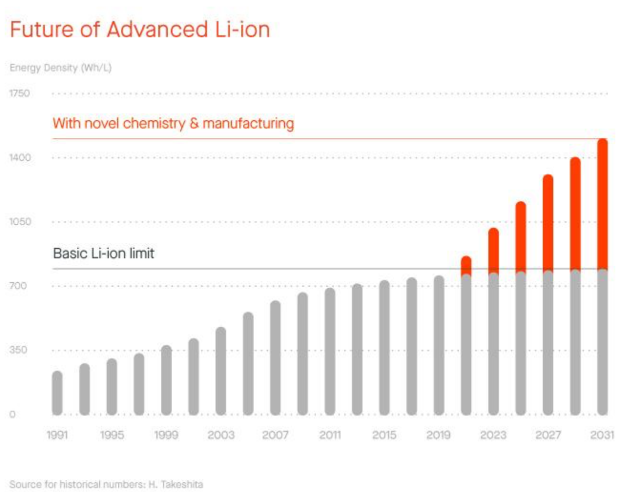
For over a decade, Sila has been developing and manufacturing advanced battery materials that are both commercially viable and deliver revolutionary performance. In 2021, Sila successfully launched their first product: an ultra-high capacity, superior Si-based anode material. This marks only the fifth time in history a fundamentally new battery chemistry made it from the lab to commercial use. The fourth time was the introduction of the intercalation type lithium-ion battery in 1991. To meet the demands of multiple consumer electronics partners and eager automotive OEMs, Sila produces its breakthrough material with efficient high-throughput manufacturing with tight quality controls for safe, versatile, and rapid materials development and deployment.

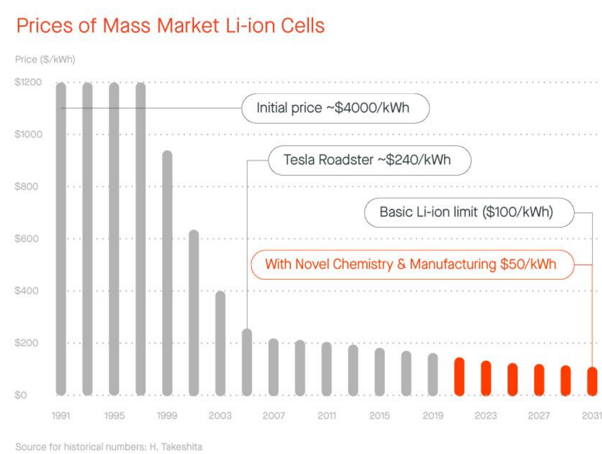
### Increasing the energy density and driving down the cost of LIBs.

The relative simplicity of production and the low cost of synthetic and natural graphite made graphite anode powder a commodity product for LIBs. However, Si-based anodes are the future.

LIBs based on conventional intercalation compounds have reached their theoretical limits, hindering performance and stalling the cost-efficiency our energy needs demand. This limit is primarily due to the use of graphite material for the anode, which not only inhibits improvements in energy density but also significantly impedes the creation of cathode substitute technology thereby restricting any additional gains from other material, cell, and pack innovations.

Recognizing the opportunity and game-changing performance that could be achieved through anode innovation, Sila developed and refined a unique nano-composite silicon anode as a drop-in replacement for graphite. Sila's next-generation anode, using their novel chemistry and manufacturing process, boosts LIB energy density by 20-40% and power density by up to 100%. Sila's ultra-high capacity anode also creates new opportunities for revolutionary conversion-type cathode chemistries over the next 3-5 years, which can increase LIB performance into the next decade. This increase in energy density provided by Sila's anode also drives down cost. At their limit, the cost of graphite-anode LIBs will remain around $100/kWh at the pack level. Sila's nano-composite silicon anode can help reduce LIB pack costs down to $50/kWh, making it a suitable technology to power the booming EV market.




## Engineered for max performance and simplified manufacturing.

Sila's products and manufacturing were developed with the world's biggest markets in mind. To effectively address one of the most pressing issues of our time—sustainable supply chain development for critical minerals and materials—and offer partners revolutionary results, Sila's anode was engineered for performance, safety, and efficiency of manufacturing.

**Increases energy density by 20% today and up to 40% in the future:** Sila's nano-composite silicon anode significantly increases LIB energy density and is the only technology in market with a full graphite replacement solution for maximum performance and partial graphite replacement solutions for faster speed to market.

**No compromise on LIB performance and safety:** Sila's anode has been independently validated over the past decade and exhibits truly outstanding performance characteristics, unmatched by alternative Si anode materials. Sila's anode delivers boosted energy density, while matching the cycle and calendar life of conventional LIB cells. Sila's nano-composite silicon material also minimizes undesirable side reactions (such as electrolyte decomposition) and, most importantly, it uniquely presents minimal swelling during cycling to maintain:

- Excellent mechanical integrity;
- High coulombic efficiency (comparable to conventional graphite anodes and much higher than alternative Si anodes) because of stable solid electrolyte interphase (SEI);
- Minimal irreversible first cycle capacity losses;
- Outstanding rate performance for fast charging and excellent cycle stability; and
- Superior calendar life.

**Drop-in solution compatible with existing LIB factories:** Given the significant infrastructure investment necessary to construct new cell manufacturing facilities, Sila's anode was engineered to be a simple drop-in replacement for graphite, with no additional CapEx or labor required for use. Sila's material is mechanically stable and fully compatible with all LIBs and gigafactories in the U.S. and abroad, whether built or being built in the coming years.

**Manufacturable economically at global scale:** Sila's anode material is produced using only global commodity precursors and bulk manufacturing techniques to ensure economies of scale. Sila's material also has tunable particle properties and can scale for all LIB applications. Additionally, Sila's anode material opens the door to the use of low-cost earth-abundant metals (such as iron) for LIB cathodes. This could eliminate our dependency on cobalt (Co) and nickel (Ni) as well as eradicate supply chain risks related to the use of rare, toxic, and expensive transition metals.

### Anodes are the beginning.

Sila's first product was a revolutionary silicon-based anode. However, additional opportunities for innovations within LIBs are on the horizon with the support of investor funding and grants, including a 2012 Advanced Research Project Agency grant awarded by the Department of Energy.

Sila has 200+ patents granted and pending worldwide across the areas of cell architectures, materials, components, and processes. Sila actively engages in R&D to enhance the performance of other parts of LIBs such as cathodes, separators, and electrolytes. Sila's continued innovation aims to enhance the safety and dramatically extend the cycle and calendar life of LIBs for consumer electronics and EVs as well as new applications, including long-haul trucking and grid-scale storage.

## Powering consumer electronics today and driving our mass EV future forward.

Sila delivered the first next-generation battery material to go from the lab to the market. And with Sila's game-changing material, product designers, battery makers, and automotive OEMs no longer have to choose between better product design, more features, and battery performance.

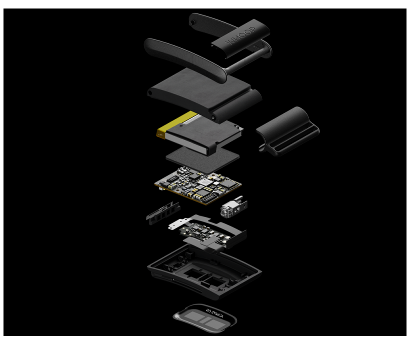
## Innovative consumer electronics powered with Sila science.

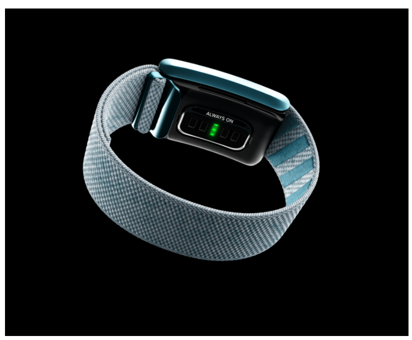
WHOOP 4.0 is one of the most advanced health and wellness wearables in the market and it's the first product powered with Sila science. Within a mobile phone or wearable, the LIB takes up as much as half of the space and weight of the device, thereby creating limitations with features and size. By partially replacing conventional graphite material with Sila's nano-composite silicon anode, WHOOP unlocked radical product innovation with increased energy density, while alleviating the squeeze of a big, underperforming LIB.

Partnering with Sila, WHOOP was able to go from anode material testing and validation to launch within 10 months. As a result, the differences between the WHOOP 3.0 and 4.0 are sweeping:

- 17% higher energy density with adjusted cell configuration and partial graphite replacement
- 33% reduction in device size
- 5-day battery life with an upgraded, waterproof battery pack
- Upgraded sensor configuration for new biometric features

Sila's anode enabled higher energy density in a smaller LIB footprint, and facilitated a reimagined industrial design that integrates with WHOOP® Body—an advanced line of technical apparel. This new, category-defining form factor enables consumers to wear their WHOOP 4.0 device across multiple areas of the body for continuous data collection and truly redefines what wearables can be and accomplish.





## Driving the next wave of EV innovation.

Sila's path to electrification consists of serving the consumer electronics markets first, before scaling to the luxury EV market, then the mass EV market. To meet the needs of the EV industry in the short and long-term, Sila's anode was engineered to address the key concerns of both automotive OEMs and consumers: range, acceleration, charge time, cost, and viability.

**Long-range performance:** Sila's anode delivers a 20% increase in range today, which could be up to 100 extra miles for some EVs, allowing automotive OEMs to pack more mileage into the same battery footprint.

**Light-weight energy:** Delivering the opportunity for a smaller, more efficient battery pack, Sila's anode can achieve up to a 15% reduction in battery weight, which can improve handling, acceleration, and create room for new car features.

**Charge time:** Sila's anode helps enable faster charging and can recharge a battery from 10% to 80% in just 20 minutes today, with a path to reducing charge time to less than 10 minutes.

**Lower cost batteries:** Higher energy density drives down the cost per kWh. Also, using less anode material reduces the amount of electrolytes, separator, packaging, and other materials needed for cell completion, which further reduces LIB costs.

**Successful, continued validation:** There are multiple data sources supporting the performance of Sila's anode technology, inclusive of numerous on-going customer validation programs held with a growing number of automakers around the world.

## Scaling economically in the U.S. for global production.

To serve current partners, Sila's Alameda plant located in California's SF Bay Area has been operating for three years. Sila has also begun the build-out of its first auto-scale manufacturing plant in Moses Lake, Washington.

It's also worth noting that integrity in innovation and engineering is a focus for Sila. Sila intends to manufacture and scale-up its technology directly and not license its technology to other technology developers in other nations. Sila designs the chemical synthesis process and key manufacturing equipment in-house and will retain related in-house tool design and process control IP as well as control over its product and manufacturing for global supply and distribution.

### Mass-scale manufacturing.

**Alameda Plant | Capacity up to 50 MWh/year**

With automated, 24/7 production, Sila's Alameda plant produces high-quality nano-composite silicon anode material using a highly specialized process that allows for batch production. This plant consists of a consumer-scale line capable of supplying enough material to power millions of LIBs for small consumer devices, including wearables and earbuds. The Alameda plant will also produce qualification batches for the first auto launches that will be supplied in production from the Moses Lake plant.

**Moses Lake Plant | Capacity of up to 150 GWh/year | Start-Up in 2025**

Sila's Moses Lake plant represents a step-change in Sila's capacity and consists of a scale-up of advanced reactor designs with continuous material processing, on-line diagnostics, improved utilization of precursors, and improved material handling to increase efficiency and throughput of its synthesis platform. The Moses Lake plant will deliver enough anode material to power a million cars in the next five years and serve several of Sila's automotive customers including Mercedes-Benz and Panasonic. Initial start of production for Sila's Moses Lake plant is set for 2025.

To mitigate the lengthy qualification process, the Moses Lake plant build-out will be conducted in parallel with auto LIB cell qualification with OEM partners. Sila has five customer supply agreements, including Mercedes-Benz and Panasonic, and has shipped material for qualification to all major global cell manufacturers.

## Re-energizing the U.S. battery industry.

Sila began as a Georgia Tech startup, is a recipient of several U.S. DOE grants, and has successfully brought breakthrough LIB chemistries to market. With that said, Sila is strongly committed to U.S. innovation and manufacturing and is invested in the domestic scaling of new clean energy technology products.

> **Investments in jobs:** Sila has already invested ~$200 million in U.S.-based jobs and manufacturing, which has created ~300 new, high-quality US-based jobs at its Alameda plant. Sila is also investing an additional $1 to $1.5 billion over the next 5 years in the Moses Lake plant, which will create up to 500 additional full-time jobs.
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> **Investments in training:** Sila has been funding university research in several U.S. states. Sila has provided training for Alameda plant employees and plans to provide extensive training across all roles for the Moses Lake plant, including hands-on training and qualification of engineers, technicians, managers, and administrative personnel. In 2022, the U.S. Department of Energy (DOE)'s Office of Manufacturing and Energy Supply Chains (MESC) selected Sila to receive $100 million in funds to accelerate the build-out of its Moses Lake plant. A portion of that money is being used to invest $2 million in local workforce development through partnerships with Big Bend Community College and Columbia Basin Technical Skills Center, a local high school. This first-of-its-kind educational program, inclusive of coursework development and hands-on training, is geared towards training the future battery workforce.
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> **Building partnerships:** Sila investments provide additional value to our supply chain partners and adjacent suppliers in the battery industry. Furthermore, Sila's current U.S. investment alone will have downstream effects for the battery supply chain and, in turn, make it significantly more feasible and likely that more battery cells will be manufactured in the U.S.

## Establishing U.S. leadership in next-generation battery material production.

From Thomas Edison and Gordon Moore to Henry Ford, the U.S. has historically led in the creation, manufacturing, and export of new innovations. Today, the U.S. has another opportunity to lead with the domestic development of superior silicon anode material.

Sila's anode technology is proven, commercially available, and is currently the leading solution for maximum LIB performance and advancement. For the U.S. to capitalize on this strategic and economic opportunity, and replicate a history of American innovation, the U.S. needs to support the commercialization of next generation technologies such as those developed by Sila.

# Appendix

### Comparing Sila's anodes to other LIB technologies

While there are other Si-anode solutions in the market, Sila's technology is the one that delivers elevated energy-density without sacrificing performance.

| | Technology | Key Technical Limitations | In Market Today | Higher Energy Density | Demonstrated in Consumer & Auto Cells | Drops-into Gigafactories | Readily Scalable to Automotive Volumes |
|---|---|---|---|---|---|---|---|
| Silicon | Sila Structurally Engineered Material | • None | ● | ● | ● | ● | ● |
| | Silicon & Simple Silicon-Carbon Composites | • Si volume changes damage SEI, yields poor cycling, cell swell and safety hazards<br>• Has not reached the market in spite of 20+ years of R&D | ○ | ◕ | ◑ | ◕ | ◑ |
| | 2D Silicon Electrodes | • Poor SEI stability and safety<br>• Remains expensive at scale and hard to integrate into existing Li-ion factories | ○ | ◕ | ◑ | ◔ | ◔ |
| | Silicon Oxides | • High first cycle losses, limited to <5wt.% additives to graphite anodes<br>• Cell swell and safety issues, unless used in cylindrical cells in small quantities | ● | ◕ | ◕ | ◕ | ◕ |
| Lithium | Polymer Electrolyte Membranes "Partial Solid State" | • Do not prevent "dead" Li and "dendrite" Li formations, yield poor cycling and major safety hazards<br>• High resistance and poor rate performance, especially at low temperatures | ○ | ◕ | ◑ | ◔ | ◕ |
| | Ceramic Electrolyte Membranes "Partial Solid State" | • Ceramic membranes are very brittle, very heavy and hard to integrate into battery production factories<br>• Uneconomical for high-volume applications; nearly unavoidable defects lead to cracks and safety issues | ○ | ◕ | ◔ | ◔ | ◔ |
| Carbon | Graphite (Incumbent) | • Low tech & therefore low margin business<br>• Carbon capacity reached theoretical limits | ● | ○ | ● | ● | ● |

*Chart 1*