

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
-------------------------	-----------------------	----------------	-----------	------------------------

# Redwood Materials' Battery Metals Recovery Cuts Mine Mess

Part of the ['Opportunity Blossoms'](#) series on real economy investments in nature

Mining and processing battery metals such as lithium, nickel, manganese and cobalt entails substantial emissions, water and biodiversity impacts. Mines are located in some of the most biodiversity-rich regions, with 14% of land used in producing global raw materials falling within a protected area. Conventional mining methods typically account for over 30% of the environmental footprint of mined battery cathode materials. Mines supplying critical minerals are set to quadruple to 180,000km<sup>2</sup> – an area the size of Uruguay – by 2041 in BNEF's [Net Zero Scenario](#). An anticipated five-fold increase in lithium-ion battery demand by 2035 could negatively impact natural habitats. However, utilizing scrap or end-of-life battery materials can offset demand for virgin metals and limit the environmental impact of the energy transition.

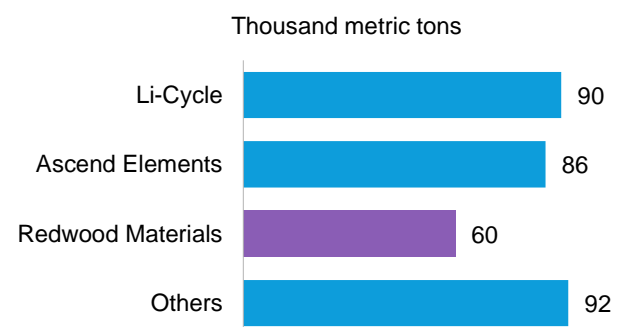
Nevada-based [Redwood Materials](#) is a lithium-ion battery recycling company and battery material producer. Its end-to-end recycling processes have been [assessed](#) to reduce energy use by up to 80%, water use by 80% and produce 70% less carbon dioxide than mined materials. The company has raised \$2 billion in equity and secured a \$2 billion loan commitment from the US Department of Energy.

## The nature-friendly product

Founded in 2017 by Tesla co-founder and ex-CTO JB Straubel, Redwood Materials employs 1,600 people. The company uses a hydrometallurgy process to recycle battery manufacturing scrap into raw nickel, cobalt and a commercial-scale source of lithium. Hydrometallurgical procedures are used by a number of players in battery recycling and involve pretreatment of the spent lithium-ion batteries, a leaching process and then separation of valuable metals from the leaching solution. Redwood uses these metal salts to produce battery materials that can be used in place of virgin materials.

Redwood has recycled hundreds of tons of battery packs. A pilot EV battery recycling program in its first year collected 1,268 battery packs from 19 different EV and hybrid models. The majority were lithium-ion (82%) with the rest nickel metal hydride batteries. More than 95% of the lithium, cobalt, nickel and copper was recovered from the over 200 metric tons of battery packs collected.

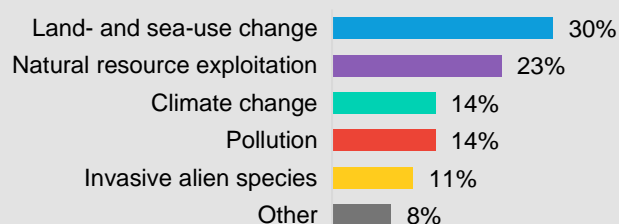
## Total announced battery recycling annual capacity by company in the US



Source: BloombergNEF. Note: 'Others' includes capacity from four other companies. Company announcements covering the period to the end of 2025.

### Mitigating nature loss

Five drivers account for over 90% of global biodiversity and ecosystem decline; Redwood's technologies address the first four of these drivers.



Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
-------------------------	-----------------------	----------------	-----------	------------------------

Redwood has built partnerships with several notable players in the US battery market. For example, Panasonic agreed to source Redwood’s cathode material for battery cell production in its new 30GWh Kansas plant, slated to come online in 2025.

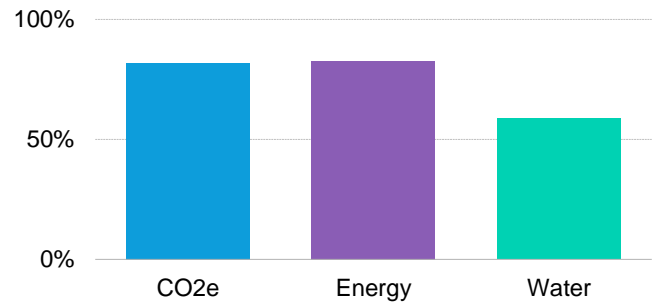
A circular agreement with Envision AESC gives Redwood access to the manufacturing scrap from a plant in Smyrna, Georgia, which Redwood recycles and then sells back to Envision AESC. Toyota has also agreed to source Redwood’s cathode active material and copper foil for its upcoming North Carolina battery manufacturing plant. Redwood is establishing a battery collection network in California, which has been supported by Ford Motor Co. and Volvo, as well as partnering with Volkswagen Group of America to recycle all end-of-life batteries from Volkswagen and Audi electric vehicles.

### Nature impact of battery material production

Transition metal mining has been associated with a wide range of nature issues, from destroying great ape habitat in Africa to water pollution and forest degradation in Papua, to exacerbated water stress in Chile. Approximately 350 mines where energy transition metals are produced – including those used in lithium-ion batteries – are located within sites contributing significantly to the global persistence of biodiversity. Expanding battery recycling reduces the demand for virgin materials sourced from these mines, lessening the attendant biodiversity impacts.

Mining battery metals is also energy- and water-intensive. Producing a metric ton of NCA (lithium-nickel-cobalt-aluminum-oxide) cathode salts – a first step in the process – from conventional methods consumes 73 megawatt-hours of energy, 92,000 liters of water and produces 21 metric tons of carbon dioxide equivalent. Redwood’s processes for producing the material salts for NCA cathodes requires almost 60% less water and uses over 80% less energy than mining and refining virgin materials. The associated emissions are also reduced by over 80%.

### Reduction in carbon dioxide emissions, energy consumption and water use for producing NCA cathode salts for Redwood’s circular methods compared to conventional methods



Source: BloombergNEF, Department of Energy Resources Engineering, Stanford University. Note: Conventional supply chain values reflect dominant global supply chains. The circular supply chain represents recycling of NCA-based battery packs in California as described in the [Stanford study](#). CO2e is carbon dioxide equivalent.

### Financial performance

After six rounds of funding, Redwood has raised almost \$2 billion from investors across the financial and industry sectors including Breakthrough Energy, Capricorn Investment Group, Amazon, Ford, Goldman Sachs Asset Management, Fidelity Investments and Caterpillar Ventures. In February 2023, Redwood also secured a conditional commitment for a \$2 billion loan from the US DOE’s Loan Program Office. The most recent investment round in August 2023 valued Redwood at \$4.25 billion.

The company’s current facilities can process 60,000 metric tons of materials each year, equivalent to around 15GWh of output and enough to manufacture batteries for 190,000 electric vehicles. Redwood aims to increase this capacity to 100GWh of materials which would be able to support the production of 1.25 million new EVs each year, growing the business more than sixfold.

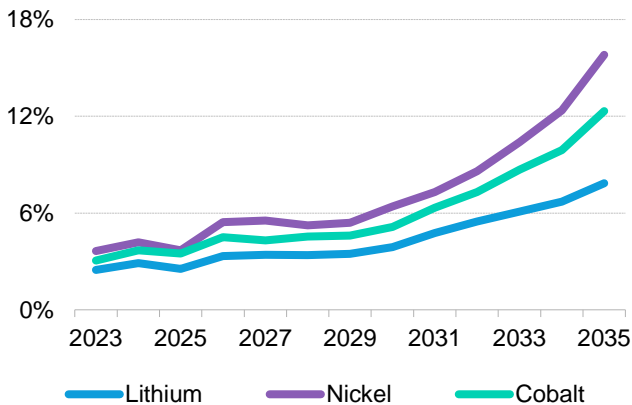
### Broader opportunities within the sector

The amount of battery materials which can be recovered from spent batteries and production scrap is set to surge more than 10-fold in the coming decade.

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
-------------------------	-----------------------	----------------	-----------	------------------------

In 2035, the cobalt, nickel and lithium sourced from recycled batteries could account for 7-16% of new demand across passenger EVs, commercial EVs, e-buses, two-/three-wheelers and stationary storage.

### Ratio of recovered material to demand in the US



Source: BloombergNEF. Note: Assumes the metal recovery rate is 80% for lithium, and 95% for cobalt and nickel. The calculations are based on end-of-life batteries and new metal demand across transport and stationary storage sectors.

The US Inflation Reduction Act offers significant financial incentives to early movers in the US clean energy industries, including battery recycling. Production tax credits for critical minerals and battery electrode materials (such as graphite for anodes and NCA for cathodes), provide direct support for the sector, while EV tax credits offer indirect support.

The production tax credits for critical minerals and electrode active materials can be leveraged by recyclers who produce each of these components. To access these tax credits, production – or in this case, recycling – must take place in the US. The 10% production tax credit for manufacturing battery electrode active materials is set to decline from 2030 and will be phased out at the end of 2032.

Battery recycling is a competitive industry. Within the US some of the notable competitors include Li-Cycle and Ascend Elements, both of which have plans to build out over 50,000 metric tons of recycling capacity and have raised hundreds of millions of dollars.

### Notable battery recycling competitors

Company	Description	Financial gain
<b>Li-Cycle</b>	Glencore-backed battery recycling company which has plans to build facilities across the US. At the end of 2023, however, Li-Cycle paused construction at its 35,000 ton per year black mass battery recycling plant in Rochester, New York.	Went public in November 2020 and has been valued at over \$1.5 billion. However, its valuation as of October 2024 is \$50 million.
<b>Ascend Elements</b>	Massachusetts-based battery recycling and engineered-materials company, has a supply agreement for SK Battery America to recycle both cell and module lithium-ion battery manufacturing scrap.	Raised \$1.7 billion through equity, debt and grant funding from public and private sources.

### Analyst take

Redwood Materials is a successful startup with operations predicated on less resource exploitation and energy consumption. It is valued at \$4.25 billion and backed by credible investors. An ecosystem proved by robust pilots and partnerships with both consumers and producers of batteries paves the way for its ongoing expansion, closing the loop for the battery industry in the US and reducing emissions and resource use associated with new clean technologies.

US policy supports the local production of battery materials and taxes battery imports, aiding the local industry. Recycling offers a product competitive with mined material, demonstrated by deals with battery makers, while better for the natural world.

#### More from BNEF:

[Lithium-Ion Battery Recycling Availability Model \(LIBRA\)](#) ([web](#) | [terminal](#))

[Lithium-Ion Battery Recycling Market Outlook 2024](#) ([web](#) | [terminal](#))

[Everything EV All at Once: New US Tax Credits Explained](#) ([web](#) | [terminal](#))

[New US Rules on Foreign EV Batteries Set High Bar to Clear](#) ([web](#) | [terminal](#)).

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
-------------------------	-----------------------	----------------	-----------	------------------------

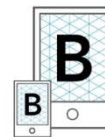
## About us

## Contact details

### Client enquiries:

- Bloomberg Terminal: press <Help> key twice
- Email: [support.bnef@bloomberg.net](mailto:support.bnef@bloomberg.net)

Get the app



On IOS + Android  
[about.bnef.com/mobile](http://about.bnef.com/mobile)

Dr Andy Leach	Associate, Energy Storage	<a href="mailto:aleach26@bloomberg.net">aleach26@bloomberg.net</a>
Alistair Purdie	Analyst, Nature and Biodiversity	<a href="mailto:apurdie2@bloomberg.net">apurdie2@bloomberg.net</a>
Hugh Bromley	Manager, Food, Agriculture and Nature	<a href="mailto:hbromley1@bloomberg.net">hbromley1@bloomberg.net</a>

## Copyright

© Bloomberg Finance L.P. 2024. This publication is the copyright of Bloomberg Finance L.P. in connection with BloombergNEF. No portion of this document may be photocopied, reproduced, scanned into an electronic system or transmitted, forwarded or distributed in any way without prior consent of BloombergNEF.

## Disclaimer

The BloombergNEF ("BNEF"), service/information is derived from selected public sources. Bloomberg Finance L.P. and its affiliates, in providing the service/information, believe that the information it uses comes from reliable sources, but do not guarantee the accuracy or completeness of this information, which is subject to change without notice, and nothing in this document shall be construed as such a guarantee. The statements in this service/document reflect the current judgment of the authors of the relevant articles or features, and do not necessarily reflect the opinion of Bloomberg Finance L.P., Bloomberg L.P. or any of their affiliates ("Bloomberg"). Bloomberg disclaims any liability arising from use of this document, its contents and/or this service. Nothing herein shall constitute or be construed as an offering of financial instruments or as investment advice or recommendations by Bloomberg of an investment or other strategy (e.g., whether or not to "buy", "sell", or "hold" an investment). The information available through this service is not based on consideration of a subscriber's individual circumstances and should not be considered as information sufficient upon which to base an investment decision. You should determine on your own whether you agree with the content. This service should not be construed as tax or accounting advice or as a service designed to facilitate any subscriber's compliance with its tax, accounting or other legal obligations. Employees involved in this service may hold positions in the companies mentioned in the services/information.

The data included in these materials are for illustrative purposes only. The BLOOMBERG TERMINAL service and Bloomberg data products (the "Services") are owned and distributed by Bloomberg Finance L.P. ("BFLP") except (i) in Argentina, Australia and certain jurisdictions in the Pacific islands, Bermuda, China, India, Japan, Korea and New Zealand, where Bloomberg L.P. and its subsidiaries ("BLP") distribute these products, and (ii) in Singapore and the jurisdictions serviced by Bloomberg's Singapore office, where a subsidiary of BFLP distributes these products. BLP provides BFLP and its subsidiaries with global marketing and operational support and service. Certain features, functions, products and services are available only to sophisticated investors and only where permitted. BFLP, BLP and their affiliates do not guarantee the accuracy of prices or other information in the Services. Nothing in the Services shall constitute or be construed as an offering of financial instruments by BFLP, BLP or their affiliates, or as investment advice or recommendations by BFLP, BLP or their affiliates of an investment strategy or whether or not to "buy", "sell" or "hold" an investment. Information available via the Services should not be considered as information sufficient upon which to base an investment decision. The following are trademarks and service marks of BFLP, a Delaware limited partnership, or its subsidiaries: BLOOMBERG, BLOOMBERG ANYWHERE, BLOOMBERG MARKETS, BLOOMBERG NEWS, BLOOMBERG PROFESSIONAL, BLOOMBERG TERMINAL and BLOOMBERG.COM. Absence of any trademark or service mark from this list does not waive Bloomberg's intellectual property rights in that name, mark or logo. All rights reserved. © 2024 Bloomberg.