BOTREE

BATTERY RECYCLING EXPO NORTH AMERICA · ATLANTA · OCT 28, 2026

A Novel Recycling Solution for Battery Critical Materials

Why the next decade of battery recycling will be won in the midstream

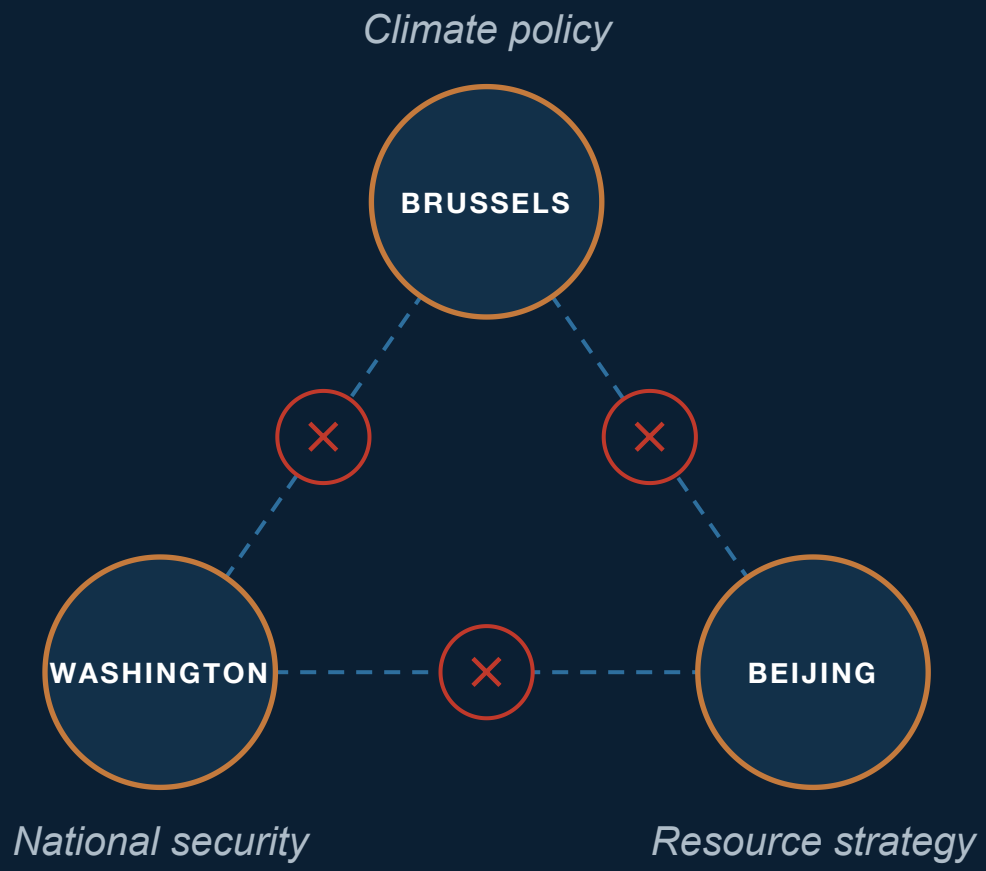
Kai Lun Chiu, PhD
Botree Recycling Technologies



Ten years ago, nobody wanted battery waste.

This year, three superpowers started fighting to keep it.

Three different reasons. The same move: keep the material at home.



black-mass trade routes, 2026

A view from inside the global build-out

From chip fabs to recycling plants.

- **Started in process R&D at TSMC**
  Where purity is measured in parts per billion
- **PhD in battery-metal recovery**
  National Cheng Kung University, Taiwan
- **Built recycling in China, the U.S. and Europe**
  Including process engineering at Northvolt
- **Now helping clients build capacity**
  Across North America, Europe and Asia

Today's lens: what the new rules, the refining gap, carbon and the shift to LFP mean for your next investment decision.

BOTREE RECYCLING TECHNOLOGIES

Battery recycling technology & engineering

- **The full chain**
  Pretreatment, hydromet, direct repair, regeneration
- **60+ engineering projects**
  10+ countries · North America Business Center (U.S.)
- **170+ patent applications**
  60+ granted · 11 PCTs
- **Standards and carbon**
  IEA EV TCP since 2019 · ISO/TC333 WG9 convenor

The game is shifting from chemistry to control.

We already know how to recover the metals. The next decade is about who controls the feedstock, who clears the rules, and who can turn waste into a clean, low-carbon product on home soil.

01 The Wave

02 The Rules

03 The Gap

04 Carbon & Cost

05 The Playbook

The feedstock is coming, and it's changing shape

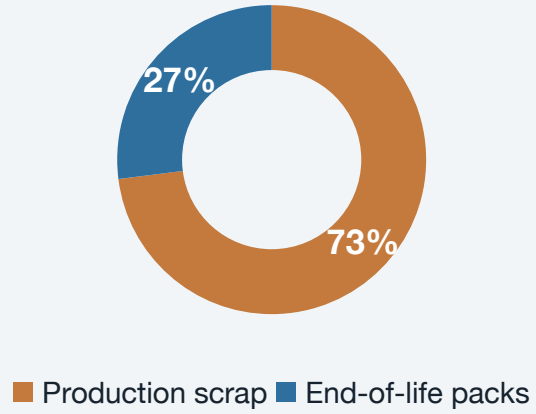
GLOBAL FEEDSTOCK, 2030

>2.5 Mt

of end-of-life batteries and production scrap available to recycle by 2030.

Benchmark Mineral Intelligence

WHAT RECYCLERS PROCESS TODAY



Fastmarkets, 2026

THE CHEMISTRY SHIFT

>50%

of EV batteries deployed globally in 2025 were LFP, and LFP is the default for grid storage.

IEA Global EV Outlook 2026

Three regions, three rulebooks, one direction

CHINA

Spec is the passport

- Imports reopened Aug 2025, but only for black mass meeting GB/T 45203
- Ni + Co ≥ 25% · Li ≥ 3.5% · soluble F ≤ 0.4%
- ~28,000 t imported in the first five months

EUROPE

Regulation first

- From Nov 9, 2026, black mass is hazardous waste: no non-OECD exports
- Lithium recovery: 50% by 2027, 80% by 2031
- Digital Battery Passport from Feb 2027

NORTH AMERICA

Localization race

- DPA black-mass export restriction in force since Aug 27, 2026
- First EV-battery producer-responsibility law: Colorado, 2026
- EPA lithium-battery universal-waste rule in progress

The U.S. border just closed on black mass

1 JUL 30, 2026

Presidential Determination under Defense Production Act §101: recoverable critical minerals declared defense-essential.

2 AUG 6, 2026

Commerce / BIS publishes a Temporary Final Rule on black mass and tungsten scrap exports.

3 AUG 27, 2026

In force: 100% of U.S. black-mass sales go to U.S. buyers unless BIS grants an exception. Runs about 12 months.

4 NOV 4, 2026

Public comments due. Your chance to shape what replaces the rule after year one.

Then on Nov 9, the EU closes its door too. ***The era of freely trading battery waste across borders is ending.***

Sources: Presidential Determination (Jul 30, 2026); BIS Temporary Final Rule (Aug 6, 2026); Commission Delegated Decision (EU) 2025/934.

Too many shredders. Too few refiners.

North America, 2026: thousand tonnes of black mass



Union of Concerned Scientists / Resources, Conservation & Recycling, Sep 2026

~9×

more black mass than domestic refining capacity this year

- Shredding: ~100 kt/yr now, 650 kt+ announced (ICCT).
- Refining stays short until about 2030.
- Scarce refiners can choose, and they will choose clean feed.

Oct 1: first public export exception (ABTC) cited this exact gap.

We built the front door and forgot the engine room.

The chemistry worked. The economics didn't.

Two of North America's best-funded recyclers restructured within a year of each other.

LI-CYCLE — 2025

Built shredding "spokes" across North America. Its refining "hub" in Rochester stalled in 2023 as costs rose from $560M to $850M–$1B.

- **Now part of Glencore, which plans to resume the hub.**

ASCEND ELEMENTS — 2026

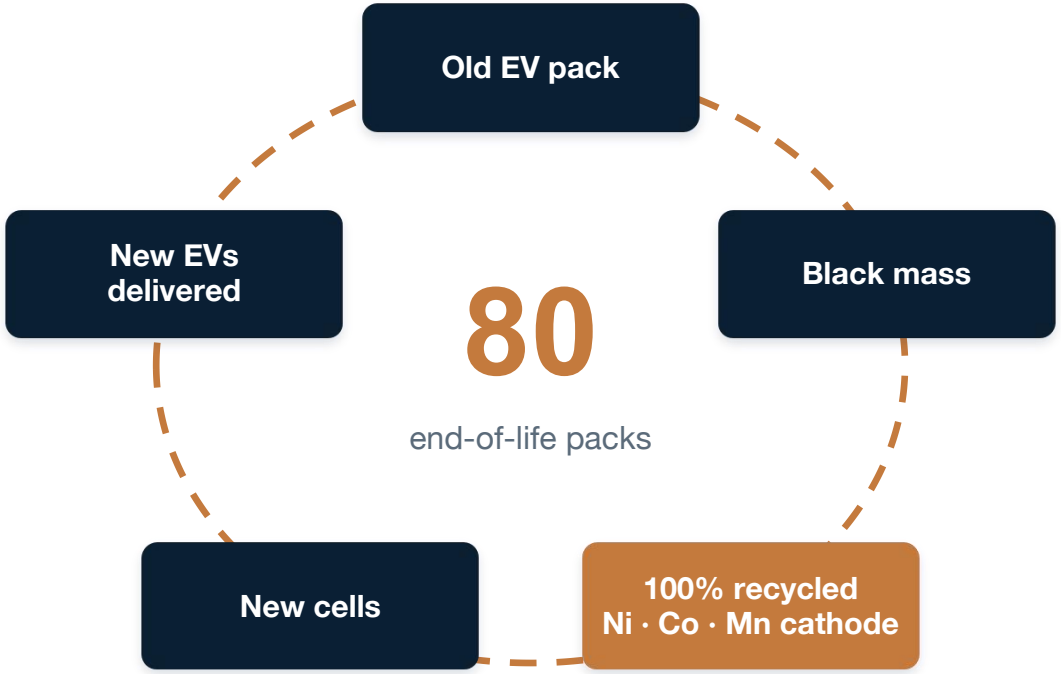
Raised more than $1.1B and made 99%+ recycled lithium carbonate at commercial scale. Filed Chapter 11 in April.

- **Covington, GA plant restarted under R3 Lithium in Sept 2026.**

The lesson: *the hard part was never the chemistry. It was financing the refining step. Both plants live on under new owners, so the assets clearly have value.*

Sources: Rochester Business Journal and Recycling Today (2025); Ascend Elements Chapter 11 filings (2026); Recycling Today, Oct 2026.

The loop is closed. Now it has to scale.



SEPTEMBER 2026

GM and Cirba Solutions turned 80 end-of-life packs into new cells with 100% recycled nickel, cobalt and manganese. The cars are already with customers. Porsche has built cells the same way.

~8 million

EV batteries expected to reach end of life worldwide by 2040

80 packs proved the loop. Millions will test the midstream.

Sources: GM / Cirba Solutions closed-loop pilot (Sep 2026); Electrive (Sep 24, 2026); industry estimate cited by GM.

The greenest lithium is the lithium we've already mined

−72%

life-cycle CO_2e: recycled lithium hydroxide vs. hard-rock ore

−37%

life-cycle CO_2e: recycled lithium hydroxide vs. brine

−40 to 48%

life-cycle CO_2e: NCM811 cathode made from recycled materials

Argonne National Laboratory, GREET life-cycle analysis

BUT IT ISN'T AUTOMATIC

A 2026 study found the carbon saving from recycled content ranged from about 1% to 23%, depending on the process route and the power grid. Energy-hungry routes give back most of the win.

AND SOON IT WILL BE REQUIRED

EU recycled-content minimums from 2031: 16% cobalt, 6% lithium, 6% nickel. Carbon-footprint limits follow once the EU finalizes its method.

Recycling is a climate strategy only if the process is.

Sources: Argonne National Laboratory (GREET); regionalized LCA of closed-loop recycling, Québec (2026); Regulation (EU) 2023/1542.

Same LFP battery. Worth money in China, costs money here.

CHINA

Recyclers pay for it

LFP black mass trades at a positive price, set by its lithium content.

SMM black mass report, H1 2026

NORTH AMERICA & EUROPE

The owner pays to recycle it

Typical gate fee in North America: about $1.50–2.00 per kg.

Battery Design, 2026

WHAT CLOSES THE GAP

1 Lower process cost

Scale, plus processes built for LFP, like direct repair and full-component recovery.

2 Contracts first

Gate-fee and closed-loop deals with automakers and storage owners make volumes bankable.

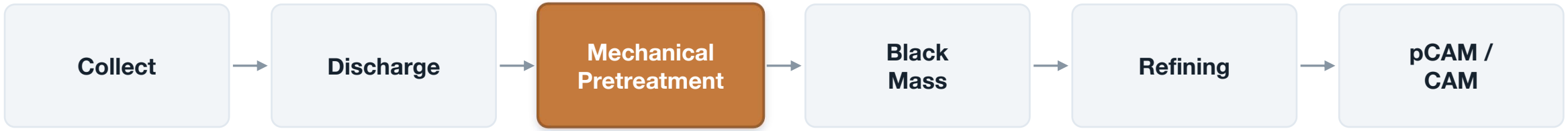
3 The lithium price

When lithium rises, LFP recycling picks up, as Europe and the U.S. are seeing now.

LFP is a cost-and-contract problem, not a chemistry problem.

Sources: SMM 2026 H1 black mass report; Battery Design (2026); Fastmarkets battery raw materials update (Oct 2026).

Why pretreatment quality decides who gets refined



1 Scarce refiners pick clean feed

With ~9× more black mass than refining capacity, consistent spec-grade material gets refined first, on better terms.

2 Spec sets payable and market access

Copper, aluminum and fluoride decide purity, payable, even eligibility (China's F ≤ 0.4%).

3 Safety, compliance and carbon live here

Discharge, fire control, electrolyte handling and energy use are all decided at the front end.

In a buyer's market for black mass, quality is a shredder's only leverage.

Climb the value ladder

STEP 1

Shred and ship

Export-blocked onshore. Domestic payables ~93–95%, competing for scarce refining.

STEP 2

Spec-grade black mass

Consistent, low-impurity feed that refiners choose first, and pay for.

STEP 3

Integrate refining

Modular Li_2CO_3, MHP or pCAM at or near the shredder: a product, not a waste, and outside the export rule.

Your next 90 days

BY NOV 4	File comments on the BIS rule, or request an exception if your black mass is stranded.
NOW	Audit black-mass contracts and Schedule B codes against the new rule.
Q4 2026	Characterize your feedstock: chemistry mix, formats, state of charge, monthly volumes.
Q4 2026	Agree a written spec with your refiner: Cu, Al, F, moisture, lithium content.
Q1 2027	Start measuring the carbon footprint of your recycled output. EU buyers will ask.
Q1 2027	Decide phase 1: upgrade an existing line, build modular, or integrate refining.

What "novel" means: the whole chain, not just the shredder

1 PRETREATMENT

Matched to the battery

Three routes, chosen by chemistry and cell format. Electrolyte is recovered by low-temperature vacuum distillation, or removed thermally in high-temperature routes.

>98% black-mass recovery
Cu + Al impurities < 0.5%

2 HYDROMETALLURGY

Selective recovery

Selective lithium extraction and NCM / LFP multi-component recovery, using our own extractants and fluorine-removal resins.

Lithium recovery 90–95%
Ni & Co recovery > 98%

3 DIRECT REPAIR

Restore, don't dissolve

A short, dry process repairs LFP cathode from scrap and spent cells, without breaking it all the way down to metal salts.

Repaired LFP: 98% of virgin performance
Up to 60% lower cost vs. traditional routes

And we measure the carbon: convenor of the ISO/TC333 lithium carbon-footprint working group, and an approved ILiA carbon-footprint verifier.

Source: Botree 2026 company brochure. Recovery, performance and cost figures are Botree data.

Proven in the field

60+ engineering projects | **10+** countries | **170+** patent applications | **10+** Fortune Global 500 clients



USA

Pretreatment lines

Engineering design and equipment for spent batteries and electrode scrap.



SPAIN

LFP full-process line

Process design covering pretreatment and hydromet.



HUAIBEI, CHINA · 40,000 tpa

NMC & LFP full-process line

Pretreatment, hydromet and direct repair on one site.



CHANGZHOU, CHINA · 1 t/h

Full-process line

Pretreatment plus a 1,000 tpa LFP hydromet line, commissioned.

Also: **USA** NCM hydromet line **Poland** CE-certified skid-mounted NCM hydromet **Langfang, China** LFP direct repair

Source: Botree project data and 2026 company brochure.

LET'S WORK TOGETHER

Five ways to start. Pick your entry point.

01

Feedstock, spec & carbon review

Your chemistry, formats and volumes against refiner specs and carbon targets.

02

Pilot testing

Run your material at pilot scale. See the black mass, or product, you'd get.

03

Upgrade a line

Revamp an existing shredder for spec-grade output and safety.

04

Modular lines

Skid-mounted, containerized or full-scale: pretreatment, hydromet or repair.

05

Integrated plant + O&M

The full chain on one site, with commissioning and O&M support.

small commitment → *full partnership*

WHO WE'D LIKE TO MEET

- **Cell makers & OEMs with scrap**
- **Shredders stranded by the rule**
- **Refiners that need spec feed**
- **Storage & LFP asset owners**
- **Developers & investors**

Four things to take back to your desk

1. The cross-border era is ending, in the U.S. and the EU. Build where the feedstock lands.
2. We built the front door and forgot the engine room. Refining is the gap.
3. When refiners are scarce, spec-grade black mass wins.
4. Recycling's carbon win isn't automatic. The process decides it.

Let's build the engine room together.

Are we building a recycling industry, or a very expensive way to store batteries we can't process yet?

Book a 30-minute project review at the Botree booth

Scan to connect

botree.tech

Thank you.

- **Kai Lun Chiu, PhD**
  Botree Recycling Technologies

What the rule actually does, and what it doesn't

WHAT IT DOES

- Keeps shredded feedstock onshore. Exports now need BIS approval.
- Splits the market: offshore payables ~100–105% vs. domestic ~93–95%.
- Leaves stranded shredders three options: store it, seek an exception, or landfill it.

WHAT IT DOESN'T

- Cover refined products: lithium carbonate, nickel and cobalt salts and pCAM still move freely.
- Block toll refining abroad when the refined material comes back to the U.S.
- Require recycling or set minimum recovery rates. Capacity is left to the market.

The move: value shifts to whoever can turn black mass into a product on U.S. soil.

Sources: BIS Temporary Final Rule; Union of Concerned Scientists (Sep 2026); U.S. market payable reports (Sep 2026).

Key rules shaping battery recycling, 2025–2031

Region	Measure	Key date	What it means
U.S.	DPA §101 Presidential Determination	Jul 30, 2026	Recoverable critical minerals declared defense-essential
U.S.	BIS Temporary Final Rule: black mass & tungsten scrap	In force Aug 27, 2026 (~12 mo.)	100% domestic sales unless BIS grants an exception
U.S.	BIS public comment period	Closes Nov 4, 2026	Industry input on what follows year one
U.S.	First public BIS export license (ABTC)	Oct 1, 2026	Up to $100M of black mass; exceptions are possible
U.S.	EPA lithium-battery universal-waste rule	In rulemaking	New handling, storage and transport standards
U.S. (CO)	Colorado EV-battery producer responsibility	Enacted 2026	Automakers responsible for stranded EV batteries
EU	Delegated Decision 2025/934: hazardous code 19 14 02	Applies Nov 9, 2026	No black-mass exports to non-OECD countries
EU	Battery Regulation 2023/1542: lithium recovery	50% end-2027, 80% end-2031	Recovery targets drive refining build-out
EU	Recycled-content minimums	2031	16% cobalt, 6% lithium, 6% nickel in new batteries
EU	Battery carbon-footprint declaration	Pending methodology act	Not yet enforceable; limits to follow
EU	Digital Battery Passport	Feb 2027	Traceability for EV and industrial batteries
China	GB/T 45203-2024 + MEE import notice	Imports from Aug 1, 2025	Spec-compliant black mass importable (Ni+Co ≥25%, Li ≥3.5%, F ≤0.4%)

Three pretreatment routes, matched to your feedstock

1 High-temperature route

Best for: electrolyte-containing prismatic, pouch and cylindrical cells. Electrolyte is removed thermally.

Reference: Changzhou, China · 1 t/h line

2 Low + high temperature route

Best for: mixed LFP / NCM / LMO cells and electrode foils

Reference: Huaibei, China

3 Low-temperature vacuum distillation

Best for: LFP and sites where electrolyte must be recovered (e.g. EU). Electrolyte is recovered.

Reference: Spain LFP line · Phase I 1,000 tpa

COMMON DOWNSTREAM SEPARATION

Primary break → screening → two-stage air classification → secondary break → screening → milling → gravity separation

What bankable North American capacity looks like

1 Modular, phased capex

Earn the next tranche. Don't bet the company on one mega-line.

2 Co-locate with feedstock

Sit near cell plants and collection hubs. Scrap follows the gigafactories.

3 Chemistry-flexible

Run today's NCM and the fast-rising LFP stream on the same site.

4 Compliance and carbon by design

DPA rules, RCRA, fire safety, emissions and energy use built in, not bolted on.

5 Partner over greenfield heroics

Buy proven front-end technology. Spend your capital on feedstock and offtake.

The test: would this plant survive a lithium-price slump and a policy reversal?

Sources

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