ACE Green technology:
Yes, it can be done! Modular hydromet lead recycling – and lithium too

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RECYCLE100 | Borneo | September 2025

ACE Green Recycling

Global electrification is impossible without sustainable battery materials

- ***First, the bit about lead recycling***

Lead battery recycling

An established market still offering growth

Huge and increasing lead battery market

$75 bn

Lead battery market size

Growing
end-market demand

Telecom towers

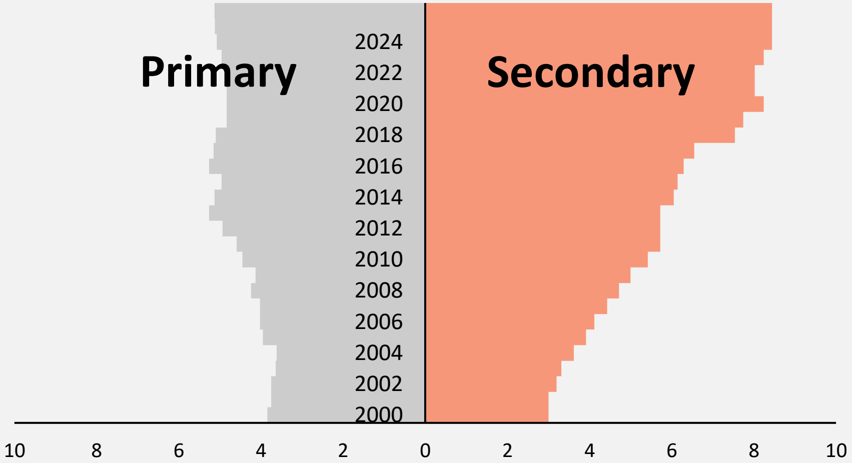
Uninterruptible Power Supply (UPS)

Transport & automotive

Recycling supplies 65% of the global lead

- ☑ Established collection infrastructures and supply chain
- ☑ Negligible growth in primary mine output

Global lead production (million tonnes)



Traditional smelters: how sustainable in the long term?

- **Emissions to air**
- **Pollutants to water**
- **Solid waste**
- **Higher energy demands**
- **Less safe working environment**

Source: ACE internal assessments

Significant headwinds from tightening regulations

Changes will drive increasingly localised battery processing

Lead batteries

Target **> 95%** recovery rate for lead batteries

Californian and New York require retailers to accept and recycle customer returns

Lead batteries

Target recycling rates:

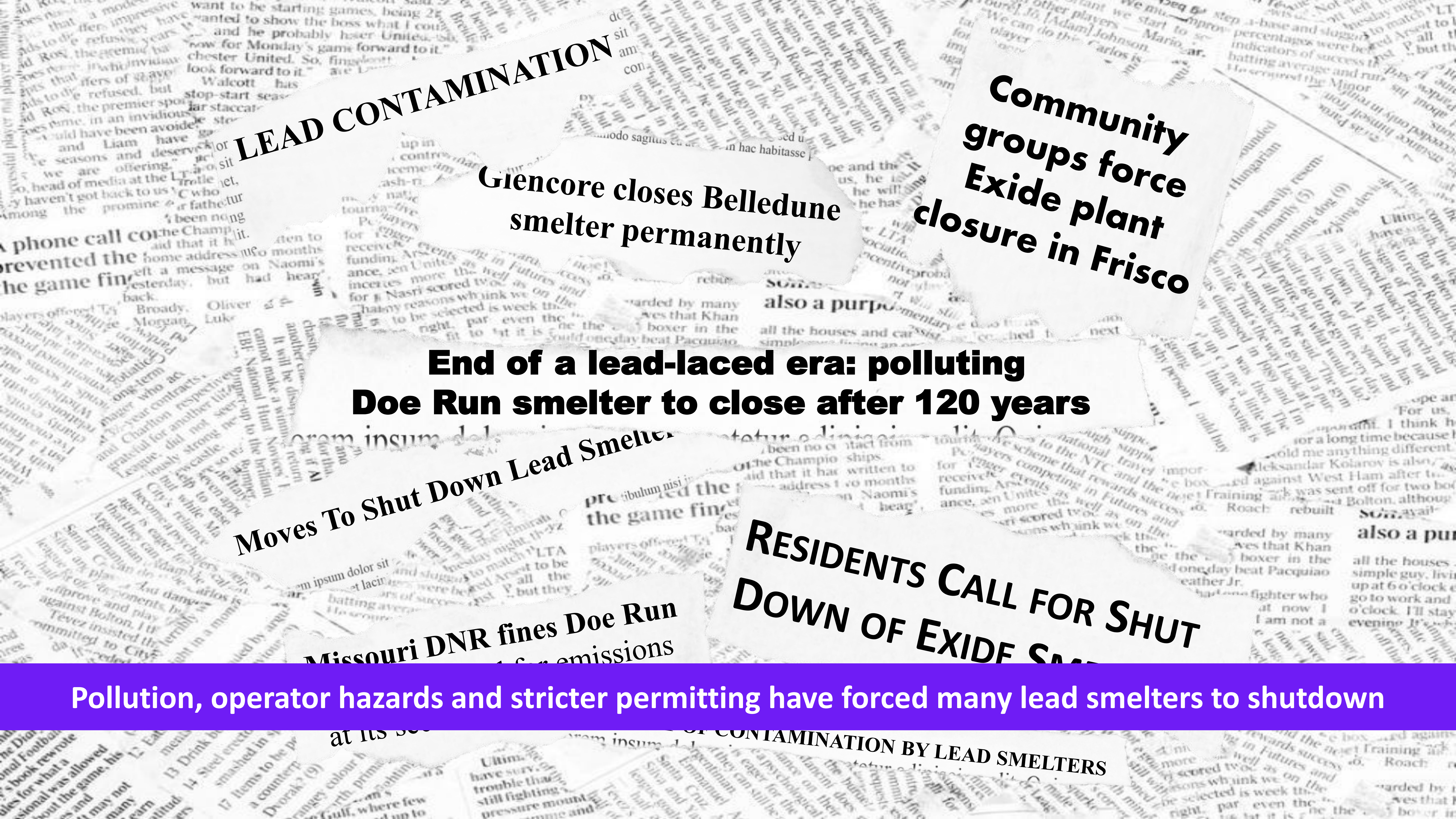
- Portable – **63%** by 2027; **73%** by 2031;
- Light Means of Transport – **51%** by 2027; **61%** by 2031

Approaching **100%** of automotive batteries recovered

Lead batteries

Target to collect **> 50%** of waste lead batteries in pilot areas

Enhanced management system for lead battery collection; incorporation of solid waste management system



Pollution, operator hazards and stricter permitting have forced many lead smelters to shutdown

Supporting environmentally and economically sustainable domestic supply chains for recycled battery materials

GREENLEAD® technology revitalising lead recycling

Efficient, safer, greener – and with better costs

		GREENLEAD® recycling technology ACE Green Recycling	Traditional smelting
Energy source	Energy requirement	**Low**	High
	Renewable power	**Yes**	No
Operation	Operating environment	**Room temperature**	> 1000 °C
	Modular	**Yes**	No
	Health & safety risks	**Close to nil**	Elevated
Environmental impact	GHG Emission	**Zero**	500-1000 kg per tonne of batteries
	Oxygen release	**45 kg per tonne of batteries**	None
	Toxic waste creation	**Very low volume**	Higher volume
%	Lead metal recovery %	**> 99%**	95-98%

Source: Company information

ACE Green Recycling – a global leader in sustainable battery recycling

Compelling environmental & economic advantages

- Strong environmental credentials support future regulations
- Zero Scope 1 carbon emissions, zero toxic waste

Proven commercial technology

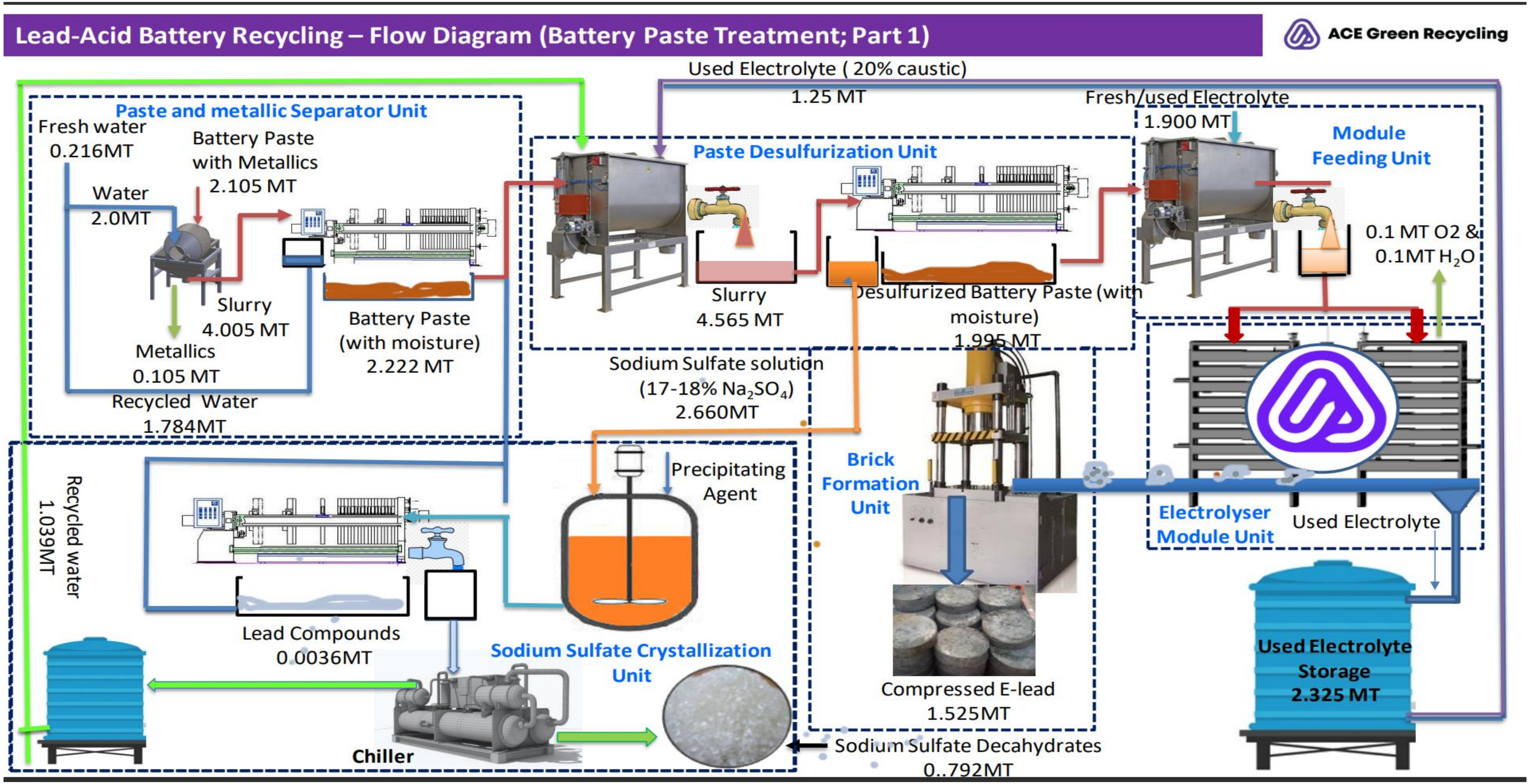
- Enables domestic supply chain and retention of critical metals
- Superior recovery rates – over 99% lead recovery
- IP portfolio with over 100 patent filings

Supportive political & economic tailwinds

- National security, economics and sustainability are driving onshoring of battery production
- Aligns with focus on prioritising domestic supply chains and manufacturing

The ACE technology

Successfully commercialised sustainable lead recycling



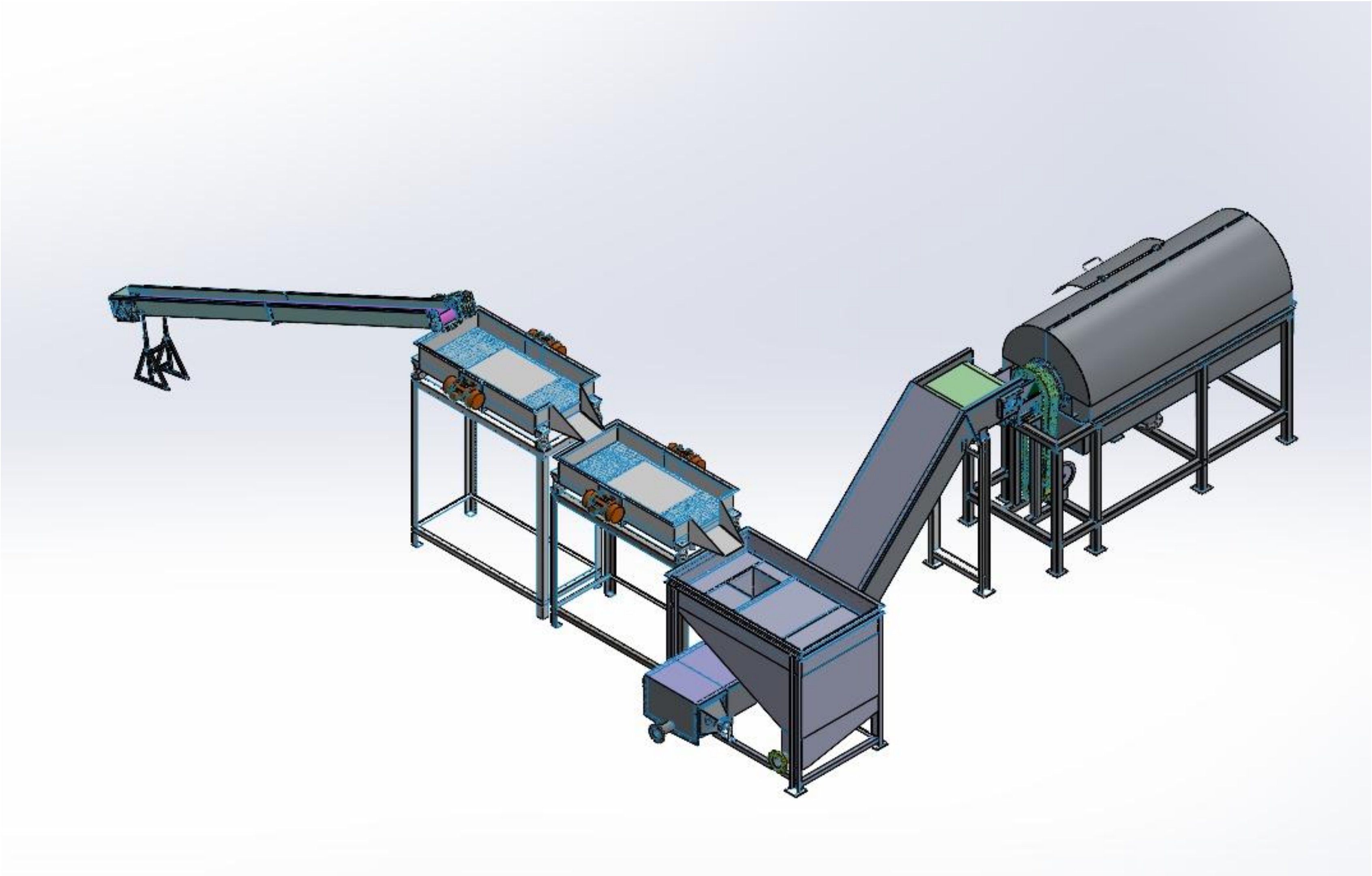
ACE is quietly transforming how lead is recycled

ACE electrolyser modules

ACE technology deployment

The ACE metallics cleaning process

Straight from breaker to alloying kettle – no furnace, no loss of antimony



ACE metallics cleaning process

The ACE metallics cleaning process

Paste and residual plastics removed from metallics

Dirty metallics ex-breaker

Clean metallics ex-ACE process

Recovered plastic ex-ACE process

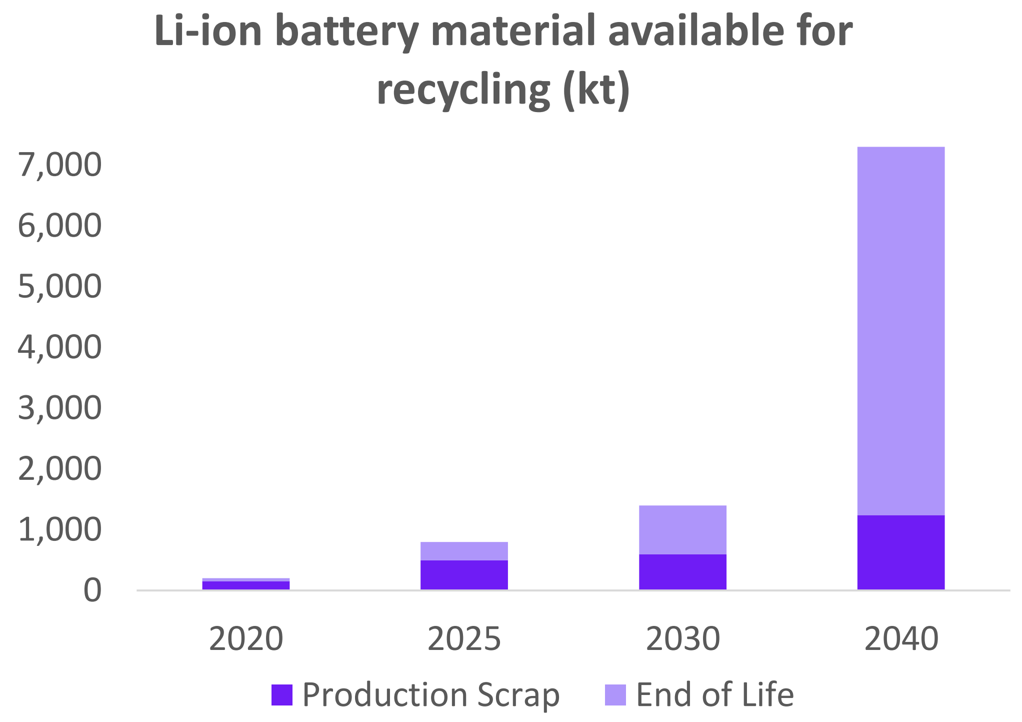
- ***Next, the bit about lithium-ion recycling***

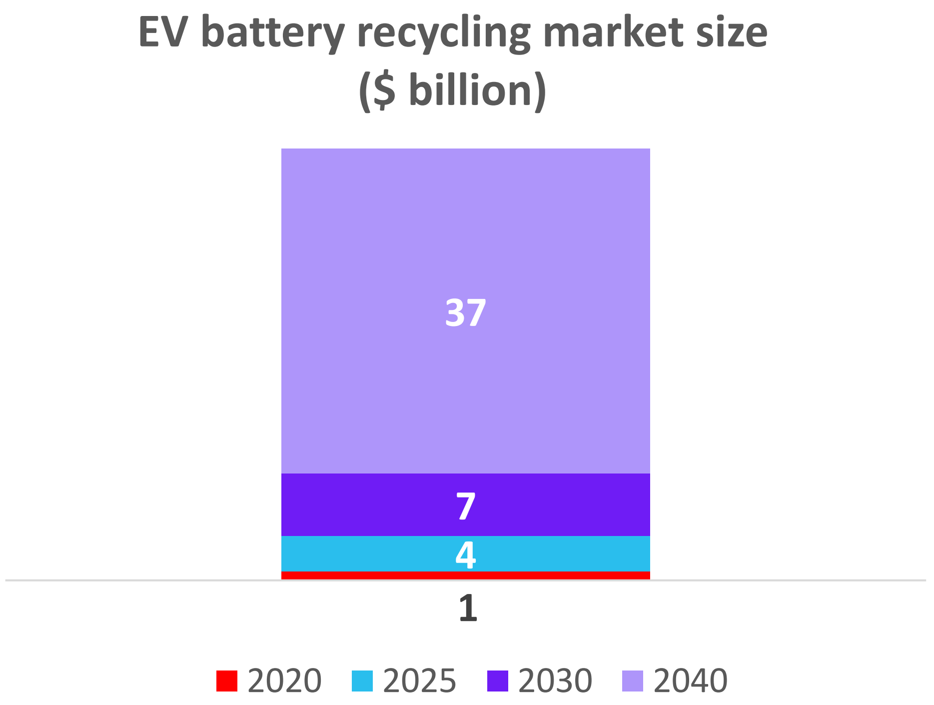
A spectrum of battery chemistries

Diverse uses will require the right battery for the right application

Lithium-ion battery recycling market by 2040[2]

$37 billion





- Battery chemistries will differ by application (ESS, EV, personal devices) and by market.
- Cheaper lead and LFP will be preferred over more expensive NMC for an increasing proportion of applications.

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1. Wood Mackenzie, Commodity Market Report Global lead strategic planning outlook; 2. Adapted from McKinsey Batter Insights

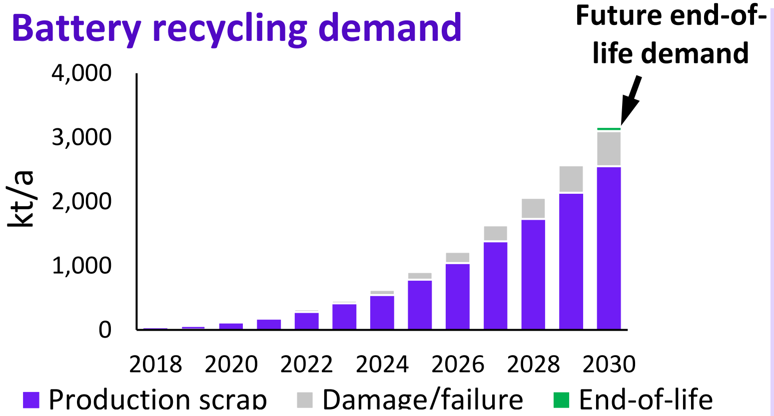
Sustainable Li-ion recycling is economically and ecologically essential

EV sales will exceed **50%** by **2030**

Challenge 1

Growth of battery waste

Battery recycling demand



New plants produce significant **production scrap**

End-of-life (EoL) scrap creates long-term recycling demand

Challenge 2

Existing waste management ineffective and unsustainable

Smelting

- High air pollution
- Toxic solid waste
- Hazardous work environment

Waste disposal

- Toxic liquids, solids and air pollution
- Explosion hazards during transportation and shredding

Challenge 3

Increasing constraints impact battery raw materials sourcing

- High environmental impact from mining and refining
- Need for supply chain localisation
- Expected mining supply shortages
- Requirement for supply chain transparency

Source: management estimates

Comparing ACE tech with conventional processes

		ACE Lithium technology (ACE Green Recycling)	Pyrometallurgy	Standard hydromet process (solvent extraction)
Operations	Minimum viable plant size	**5,000 tonnes/year**	**50,000+ tonnes/year**	**20,000+ tonnes/year**
	NMC battery recycling	**Yes**	Yes	Yes
	LFP battery recycling	**Yes**	No	Emerging
	Lithium recovery	**75%***	None	30-75%
	Graphite recovery	**Yes**	None	Yes
	Output flexibility	**Yes**	No (metal only)	No
Environmental impact	Scope 1 carbon emissions	**None**	High	High
	Solid waste generation	**None**	High	Medium
	Liquid effluents	**None**	Low	High
Planning efficiency	Intellectual property defensibility	**High**	Very low	Very low
	Relative energy requirements	**Low**	High	Low
	Long-term ease of permitting	**High**	Low (landfilling & emissions)	Low (liquid effluents)

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Source: Ace Company information; *Lithium recovery is expected to be up to 75% with deployment of newer equipment (a part of capital raise) and continued R&D.

LithiumFirst™ – chemistry agnostic processes for LFP, NMC, LCO,…

Proven technology recycling small & large format Li-ion batteries

*ACE's proprietary battery discharging technology is **safer and environmentally friendly***

Step 1: Safe storage & discharging

Step 2: Battery breaking

*Proprietary Al/Cu cleaning gives **greater black mass recovery**; upgrades Cu and Al to valuable by-products*

29 Cu 13 Al

*ACE's technology **recovers Lithium carbonate**; produces Mixed Hydroxide Precipitates (MHP), Mixed Metal Oxides (MMO) and graphite*

Step 3: Lithium extraction

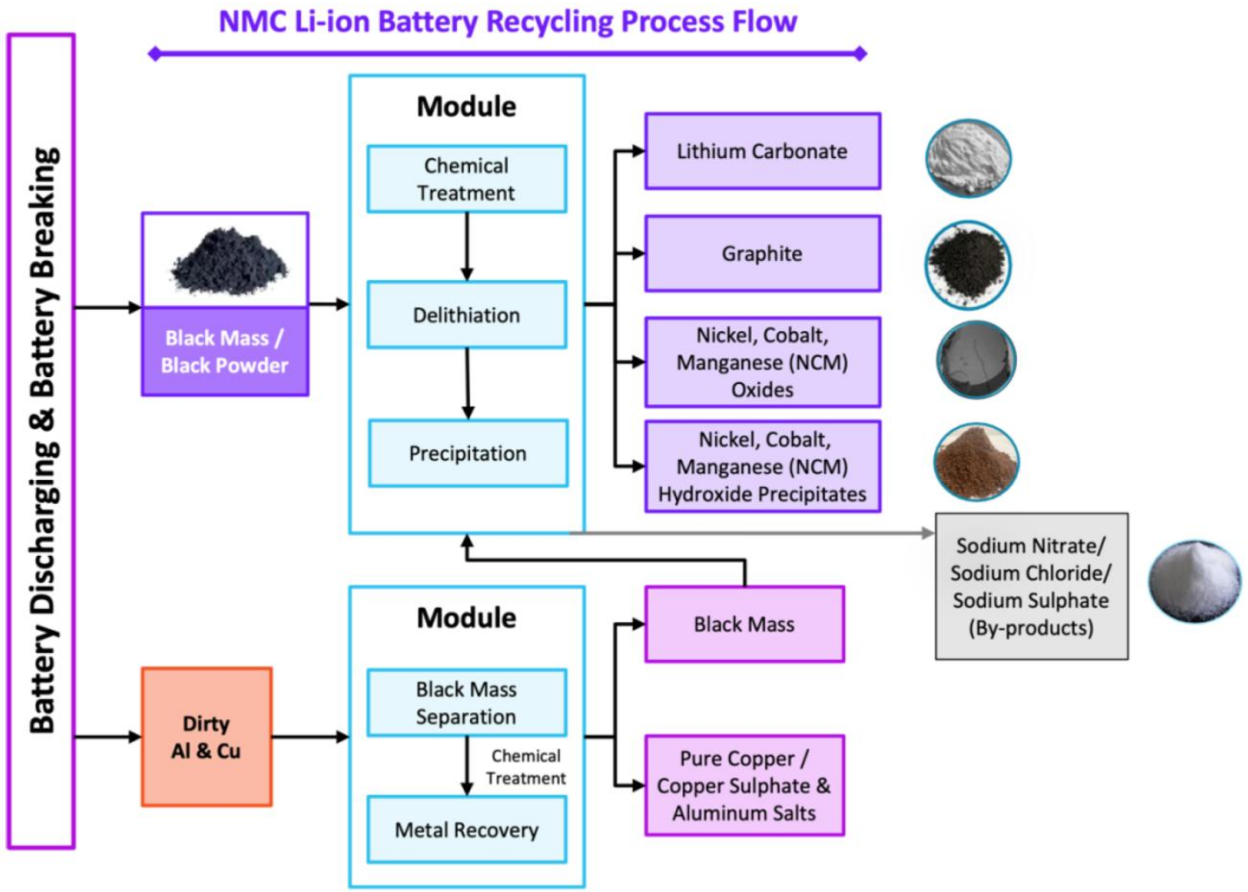
Step 4: Technical & battery grade salts

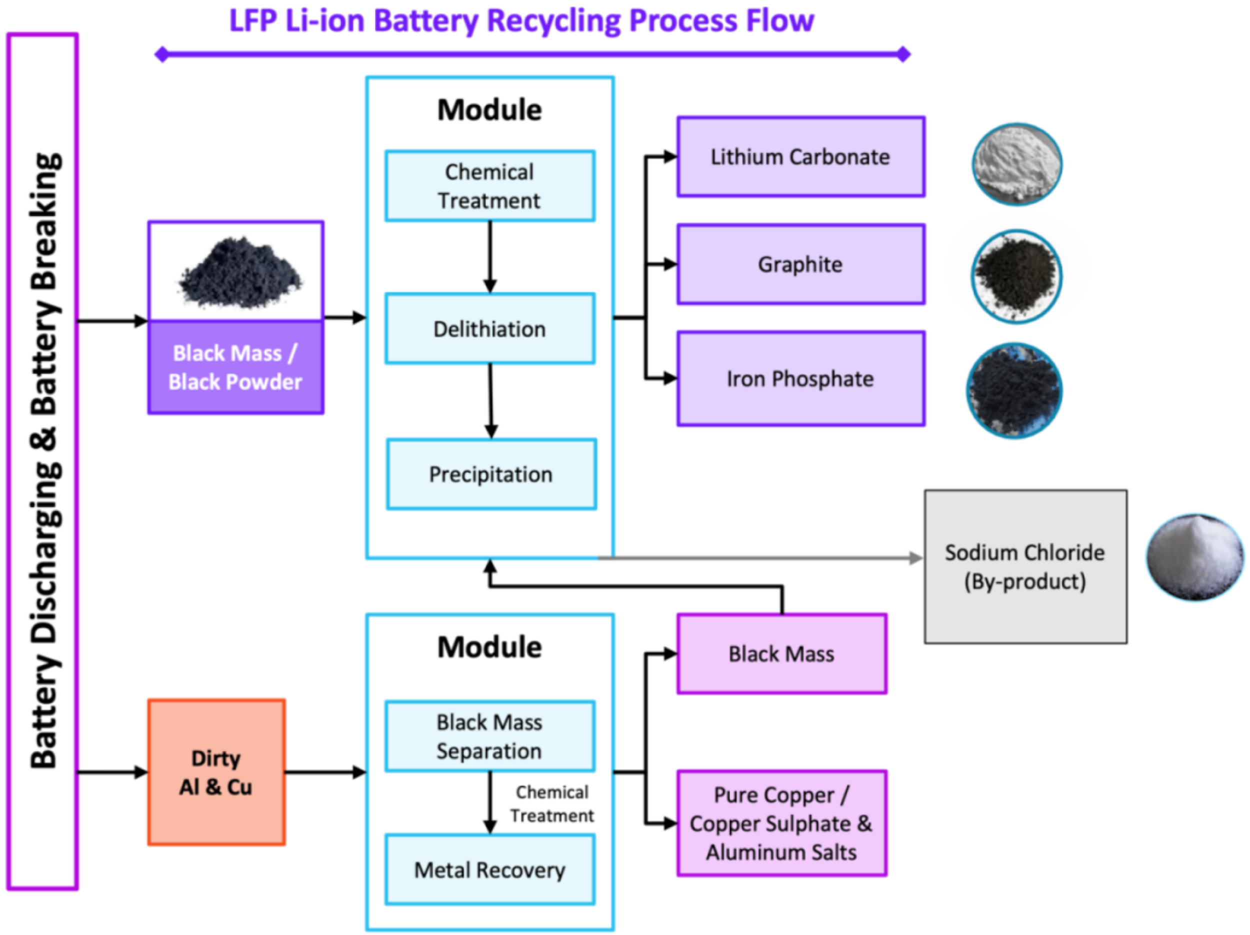
Technical grade material from ACE's hydrometallurgical process; battery grade salts through standardised purification

Commercial operations are in place for Steps 1-3, with phased capacity scaled up

Step 4 capability developed to pre-pilot stage, ready for scale-up

ACE Green's Li-ion recycling processes





First ACE Li-ion facility started operation in April 2023

Pre-processing operations

Battery collection and safe storage

Chemical and electrical discharging

Battery breaking, black mass production, Al/Cu fractions, polypropylene

Post-processing operations

Al/Cu electrode material cleaning

Modular line for post-processing of black mass

Modular line for product filtration

Hydro-processing plant

Source: Company information

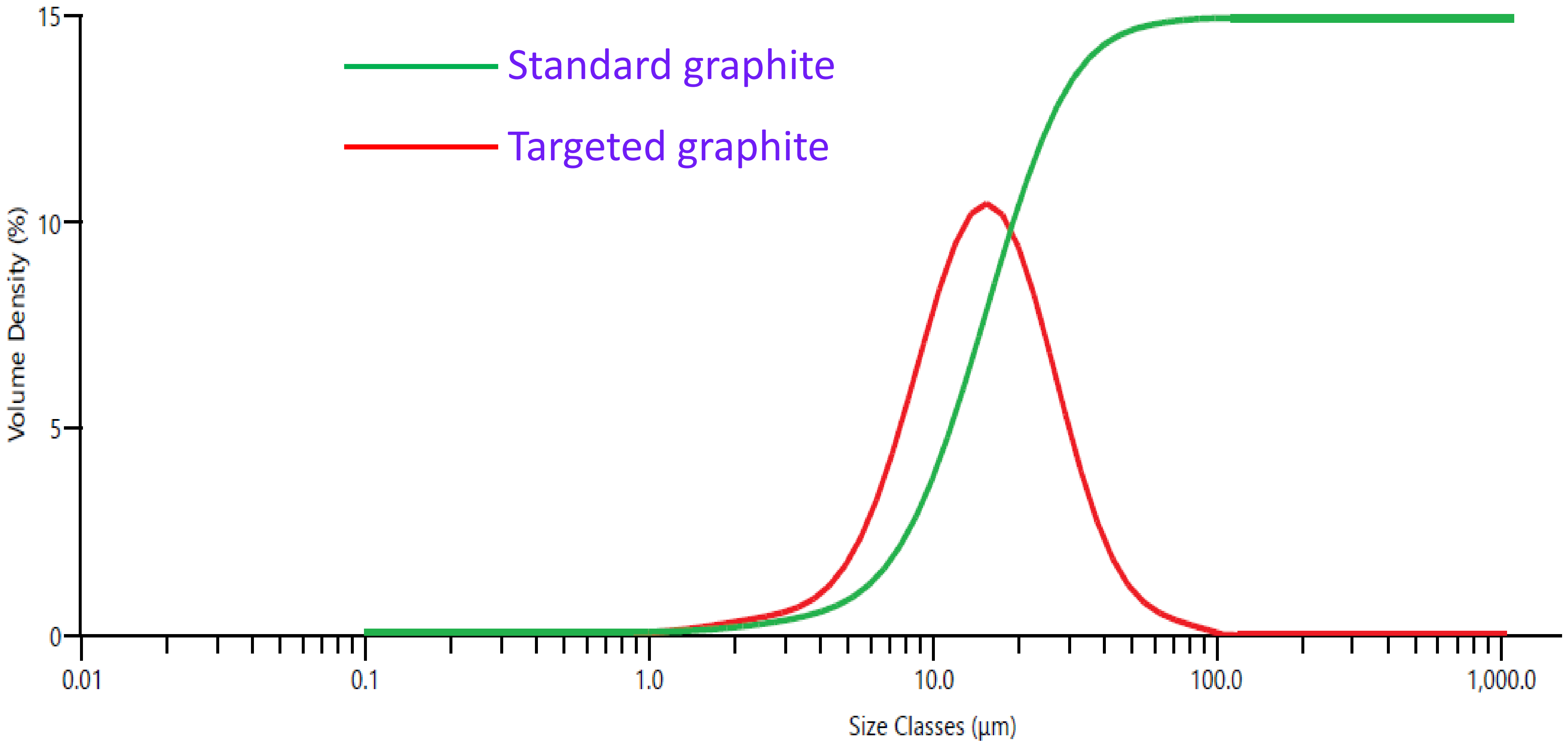
Graphite ICP-OES analysis

Impurities present in graphite

Element	ICP Reading	Final Conc. (in ppm)	Element Percent (%)
Al	0.023	512.20	0.05
Li	0.113	1902.44	0.19
Co	0.155	3756.10	0.38
Mn	0.011	243.90	0.02
Cu	0.012	-48.78	0.00
Fe	0.069	1634.15	0.16
Mg	0.042	1000.00	0.10
Ca	0.162	3902.44	0.39
Zn	0.004	0.00	0.00
Ni	0.011	268.29	0.03
Na	0.16	3756.10	0.38

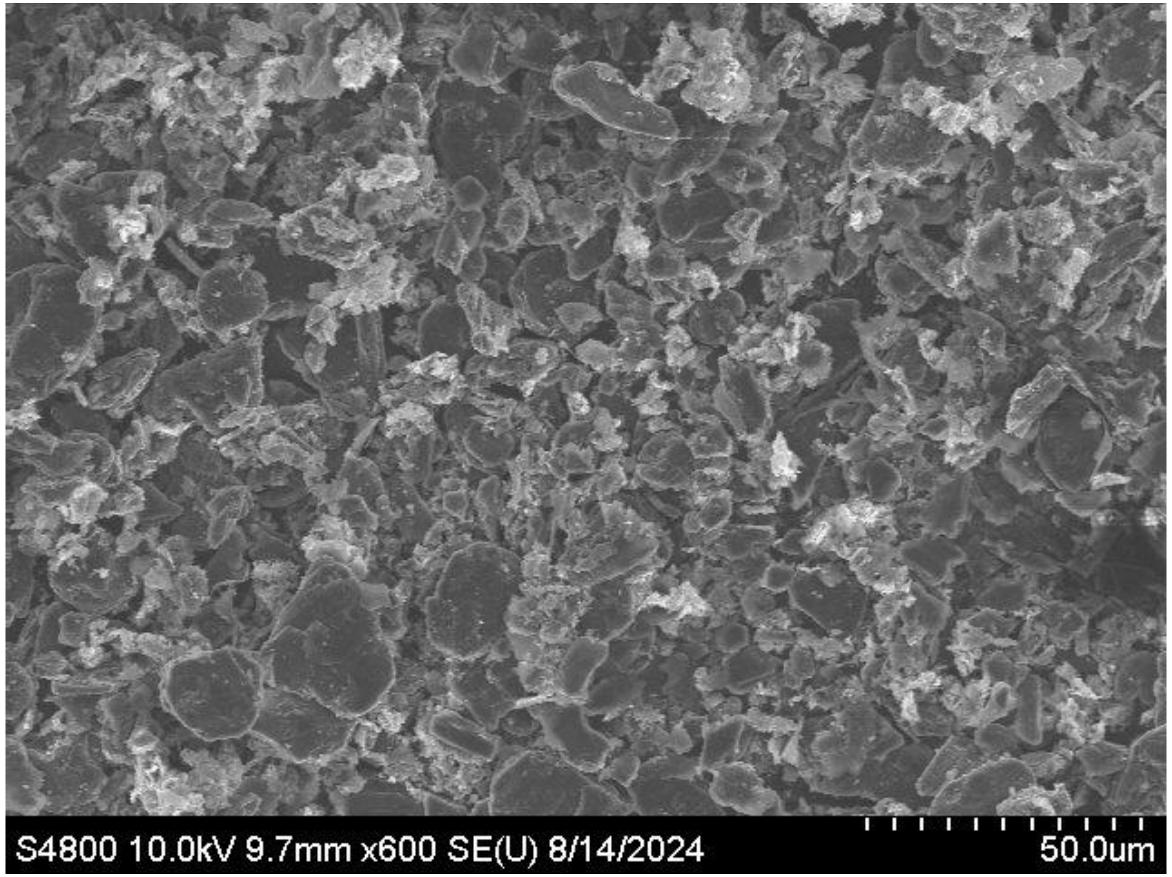
Targeted graphite

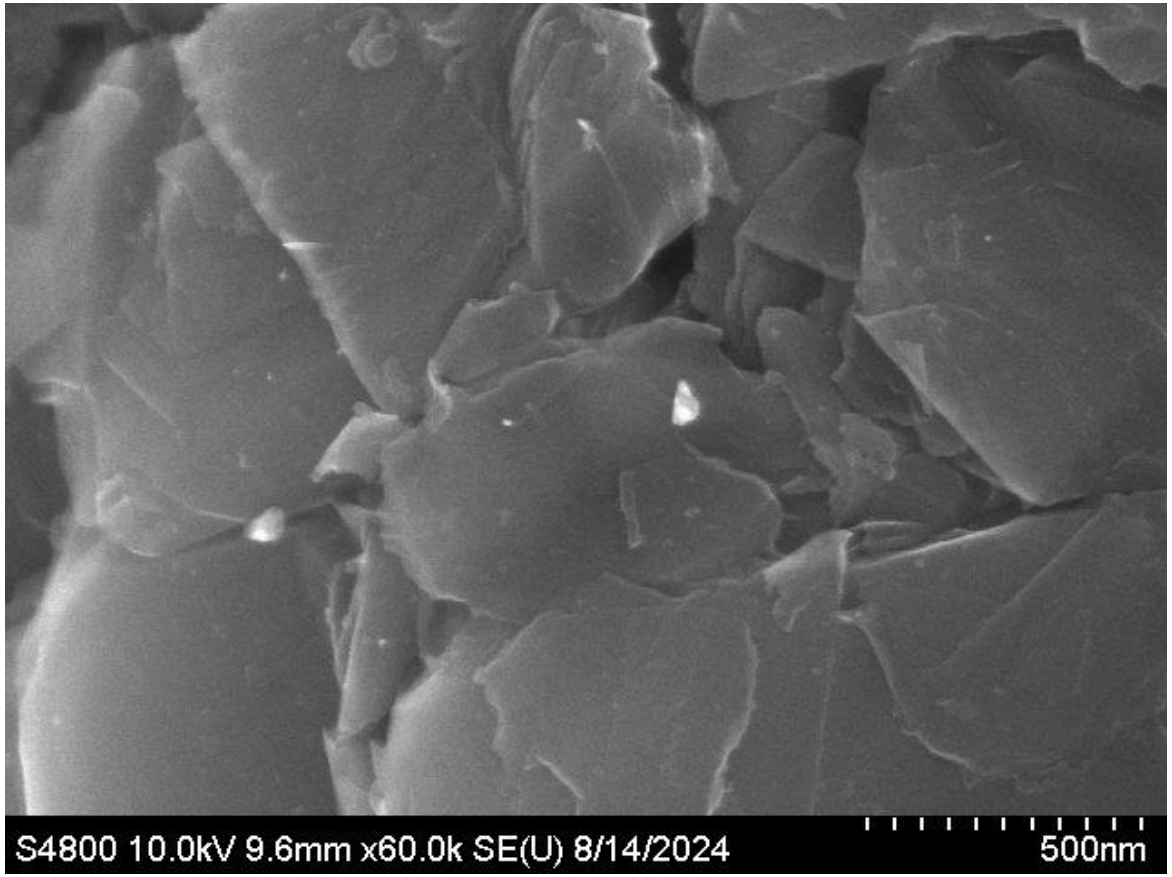
Particle size distribution



Compared to standard graphite particle size distribution (D10 - 10µm, D50 - 20µm, D90 - 40µm), targeted graphite (D10 - 6.6µm, D50 - 14.8µm, D90 - 30.8µm) demonstrates a narrower distribution, indicating effective size control during processing and suitability for anode reuse.

SEM analysis of targeted graphite microstructure





- SEM images reveal a layered morphology and surface texture.
- High magnification shows well-defined edges and interlayer spacing, confirming structural integrity suitable for anode applications.

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Q&A

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