

INTERNATIONAL CONGRESS FOR BATTERY RECYCLING 2022



THE IMPORTANCE OF DOMESTIC BLACK MASS PROCESSING
AND INDUSTRIAL-SCALE BATTERY RECYCLING: A UK CASE STUDY

Who We Are

Brought about by the desire to establish a domestic circular economy for battery metals and more environmentally-friendly consumption, the Recyclus Group was founded in 2019 as **the UK's first industrial-scale battery recycler**, capable of recycling the five key Li-ion chemistries, in addition to lead-acid batteries.

Recyclus' first lithium-ion recycling plant is capable of recycling 8,300t of lithium-ion in the first full year of production, with a goal to increase this to a total of 41,500t by 2027.

Through our in-house, industrial-scale **lithium-ion and lead-acid battery recycling** technologies, and UN-certified battery boxes, Recyclus is prioritising the safety and sustainability of battery recycling practices, to ensure that we are taking a responsible approach to the energy transition.

Introduction: The Recyclus Group

8,300t
Li-ion in Y1

41,500t
in 2027



Ralph Harkess Group Commercial Manager

Ralph has worked with major global automotive manufacturers in recycling and re-use services for lithium-ion batteries, specialising in end-of-life disposal and recycling services, processes and logistics, and black mass production.

14

Years' industry
experience

6

Recycling
initiatives

10

Years' experience in
Li-ion battery recycling

- Recyclus Group, **Commercial Manager**
- uRecycle Ltd, **Business Development Manager**
- Belmont Trading Company, **Business Development Manager**
- CeeD, **Business Development Manager**
- Datec Technologies Ltd, **Business Development Manager**
- CKS Group Plc, **Business Development Manager**
- Panasonic UK, **Sales Manager**

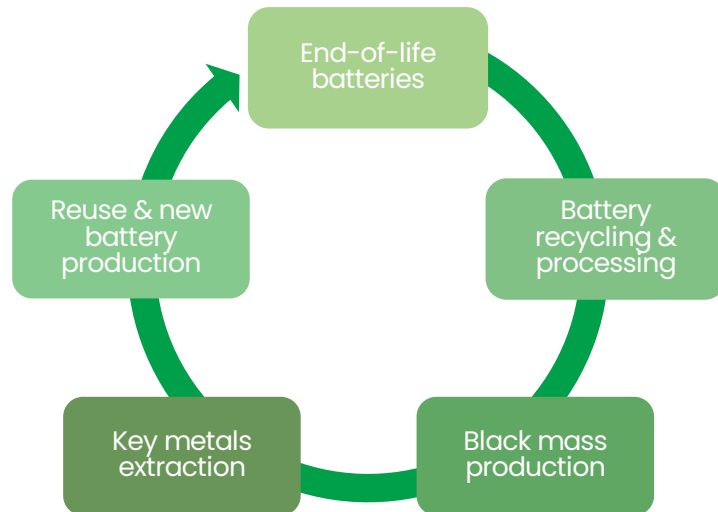
Current Focus

Developing relationships in automotive, energy storage and industrial sectors, where Li-ion usage is expanding.



Overview: importance of black mass in electrification

- Black mass contains large quantities of critical metals: **lithium, nickel, cobalt and manganese**
- Black mass production allows for extraction of key materials for **reuse in new battery production** and other applications
- These refined metals will act as **feedstock** to enable countries to establish a true circular economy



15 million tonnes

Of Li-ion batteries could be scrapped globally by **2030**, necessitating the creation of adequate infrastructure to enable localised supply chains and safeguard critical battery materials [1].



Black mass processing: benefits of domestic capabilities



Supply chain pressure

Stabilising supply chain, and minimising vulnerability to geopolitical tensions



Circular economy

Re-use of critical metals, “closing the loop” on their lifecycle



Carbon footprint

Reducing need for virgin materials and associated carbon footprint



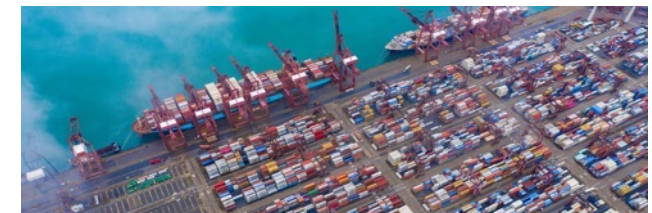
Affordability

Reducing lead time and optimising affordability by keeping valuable materials within the country



Battery volumes

Domestic shredding facilities needed to deal with huge volumes of batteries approaching end-of-life



Trade export purposes

Reducing GHG emissions associated with imports/exports, while minimising transportation of hazardous batteries



In carbon emission by remanufacturing batteries through recycled materials, compared to battery production with raw materials [2].



Global processing and Li-ion recycling market current state of play

Asia dominating battery ecosystems

81%

Of the world's
battery cathode
manufacturing
capacity*

75%

Of the world's
cobalt refining
capacity*

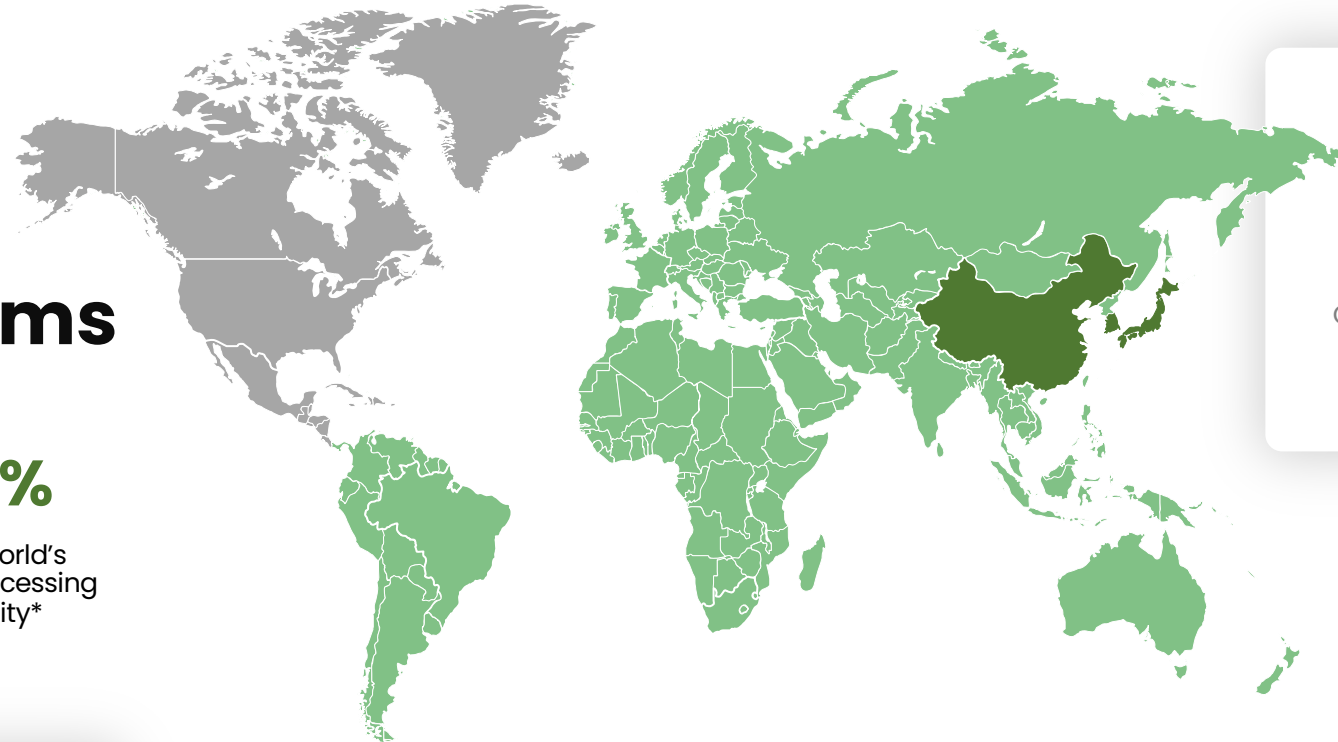
59%

Of the world's
lithium processing
capacity*

*Benchmark Minerals

To put Asia's dominance into perspective,
combined, the US and Canada refine only:

3% of the world's lithium 3.5% of the world's cobalt



Of raw materials
currently flow
through China

China's output feeds domestic markets, but the country's export prowess allows output to reach far beyond China's borders, becoming central to global supply chains.

Japan and South Korea equally have large treatment facilities, many of which treat black mass using hydrometallurgical processes.

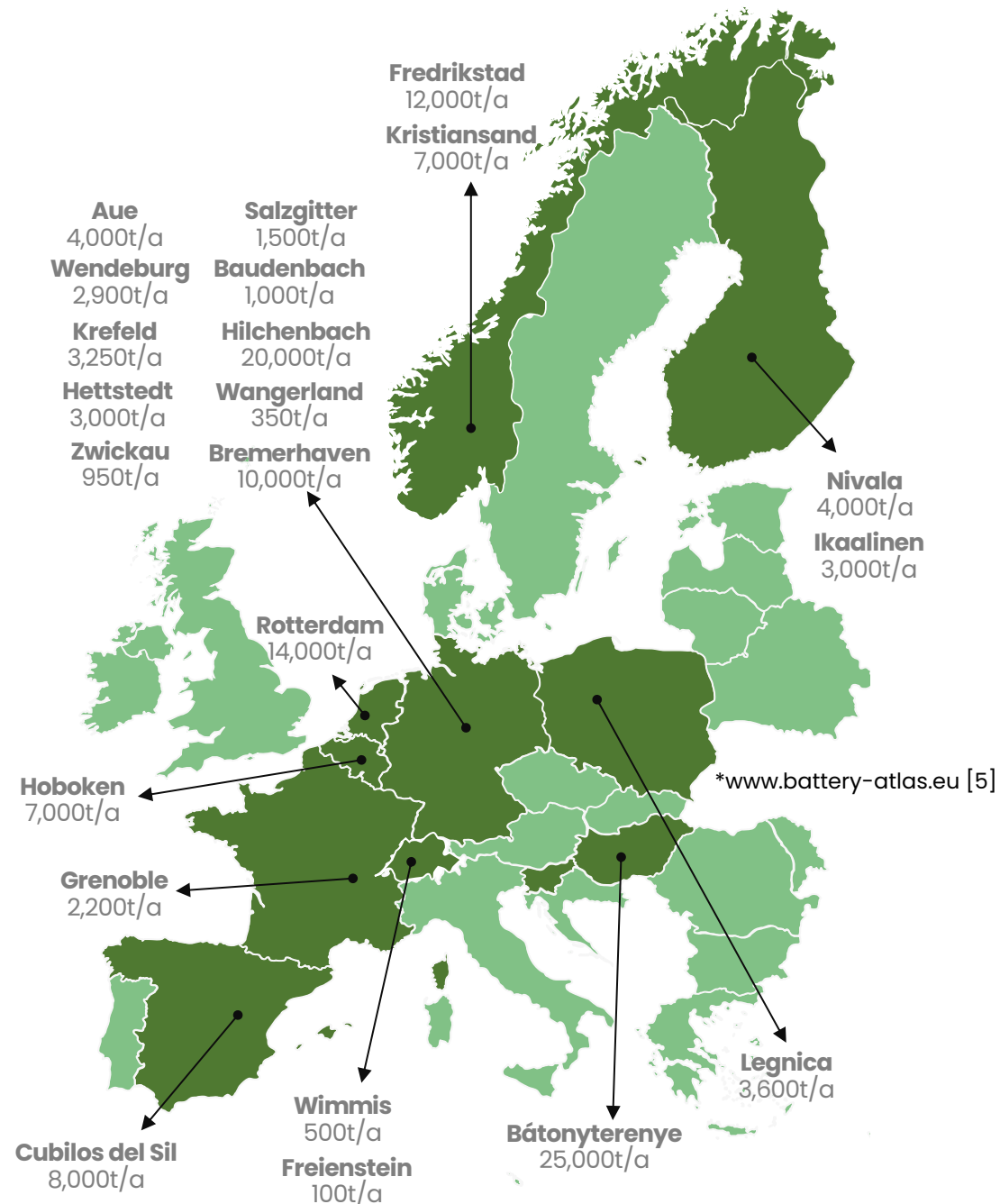


European market current state of play

Playing catch-up

Europe's battery industry is accelerating at an encouraging rate, with commercial-scale recycling plants planned across the region [3].

Despite this momentum, however, most European recycling facilities are currently operating at pilot or test-scale, and lithium refiners do not have the capacity to process batteries, instead having to export primarily to Asia [4].





Of batteries in the UK
currently go to landfill



This equates to around
20,000t of household
batteries every year



UK market current state of play

No industrial-scale facilities operational in the UK

While there are plans in the pipeline, there are currently no industrial-scale battery recycling facilities operational in the UK, and very little actual processing – even on a project-scale.

The lack of black mass processing capabilities is partly due to a lack of smelters, but also a lack of investment and infrastructure.

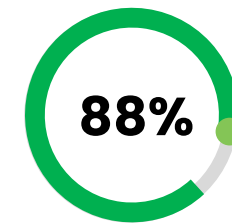


Consequences of failing to establish domestic capabilities: manufacturing & industry

Continued reliance on offshore supply chains

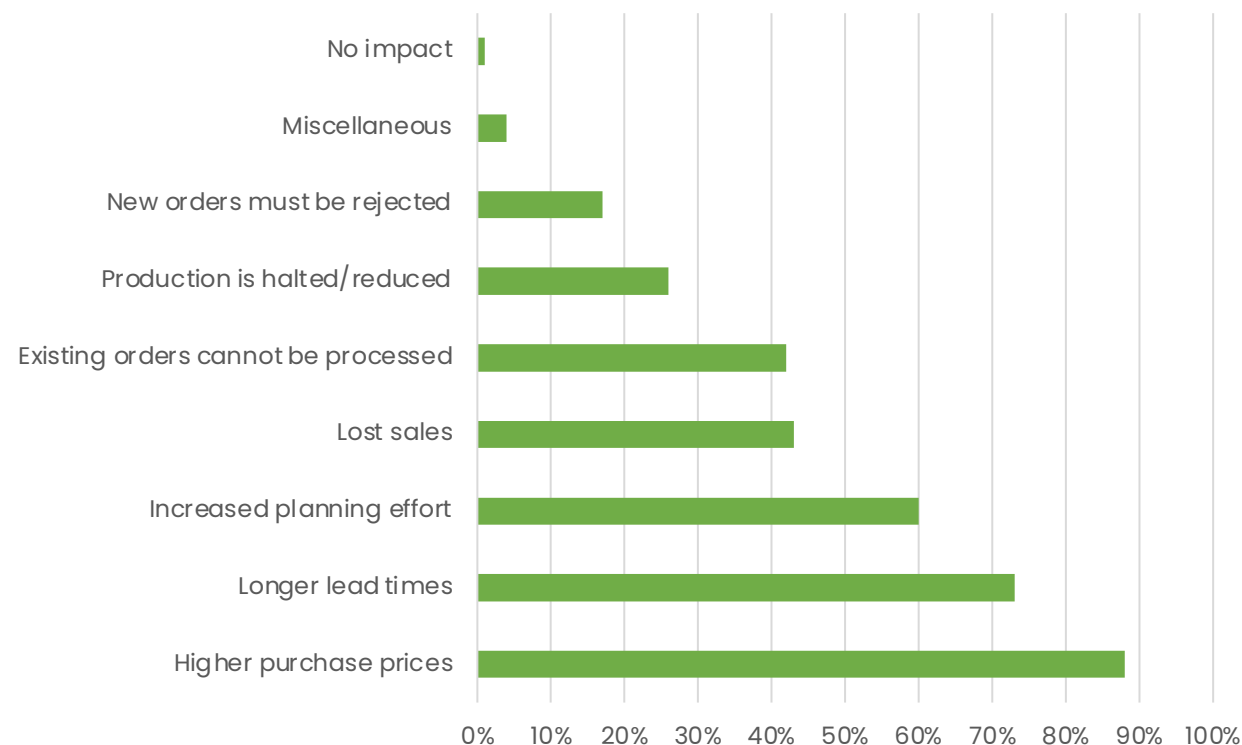
So long as Europe remains unable to sufficiently recycle, process and repurpose critical battery metals on an industrial-scale, the region will be forced to rely on overseas capabilities.

This could impact countries' ability to control domestic progress, with high transportation costs, reduced production, lost sales and longer lead times.



Of German companies found that supply bottlenecks led to an increase in purchase prices

Impact of supply chain bottlenecks on German companies globally [6]



Carbon footprint & NDCs

GHG emissions embedded in imports/exports threaten NDCs

>30%

Of domestic emissions in European countries are embedded in imported goods [7].

20–30%

Of global GHG emissions are generated by the transport of exported and imported goods [8].

With stringent global regulations and new emission reduction targets coming into play, a continuation of this trend would threaten to derail countries' NDCs (Nationally Determined Contributions), and further hinder the transition to green energy.

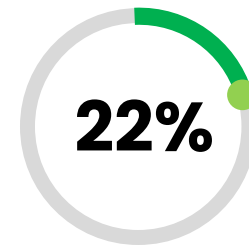


Where do we go from here? infrastructure & approval

Streamlining & expediting approval process

One of the reasons for Asia's continued dominance is that the infrastructure is better, and the issuing of permits to construct a factory is simpler and more efficient than elsewhere in the world [9].

If countries outside of Asia are to establish domestic recycling and processing capabilities in time, the approval process – currently complex, timely and subject to delays – needs to be streamlined and expedited by regulatory agencies.



Of battery metals demand could be supplied by battery recycling by 2040, but a shift in urgency is needed to meet these figures.



18%

Reduction in net GHG impacts could be achieved through end-of-life battery recycling [10].

Government legislation

Driving further legislation

Legislation is an important lever of change. Europe is already in the process of enacting legislation to encourage domestic capabilities. The Rules of Origin, for example, dictates that a certain percentage of material must be manufactured in the EU in order to avoid taxes.

Legislation such as this will make it difficult – and less appealing – to export material outside of Europe’s borders, making the prospect of onshore capabilities even more attractive.



Investment & talent development

Seizing opportunities

Europe's market is expected to see a compound annual growth rate of 39.9% [11]. In order to meet/maintain this trend, the region needs to encourage investment and talent development by capitalising on the opportunities and readily available feedstock.

- **Cash-rich companies & market stakeholders** should invest in battery recycling, capitalising on the unprecedented demand and 'promising value-grab opportunities' [12].
- Forming **joint ventures** to reduce the costs of establishing industrial-scale facilities, making the process more appealing while encouraging further investment.

39.9%

Expected CAGR of Europe's lithium battery recycling market by 2030 [11].

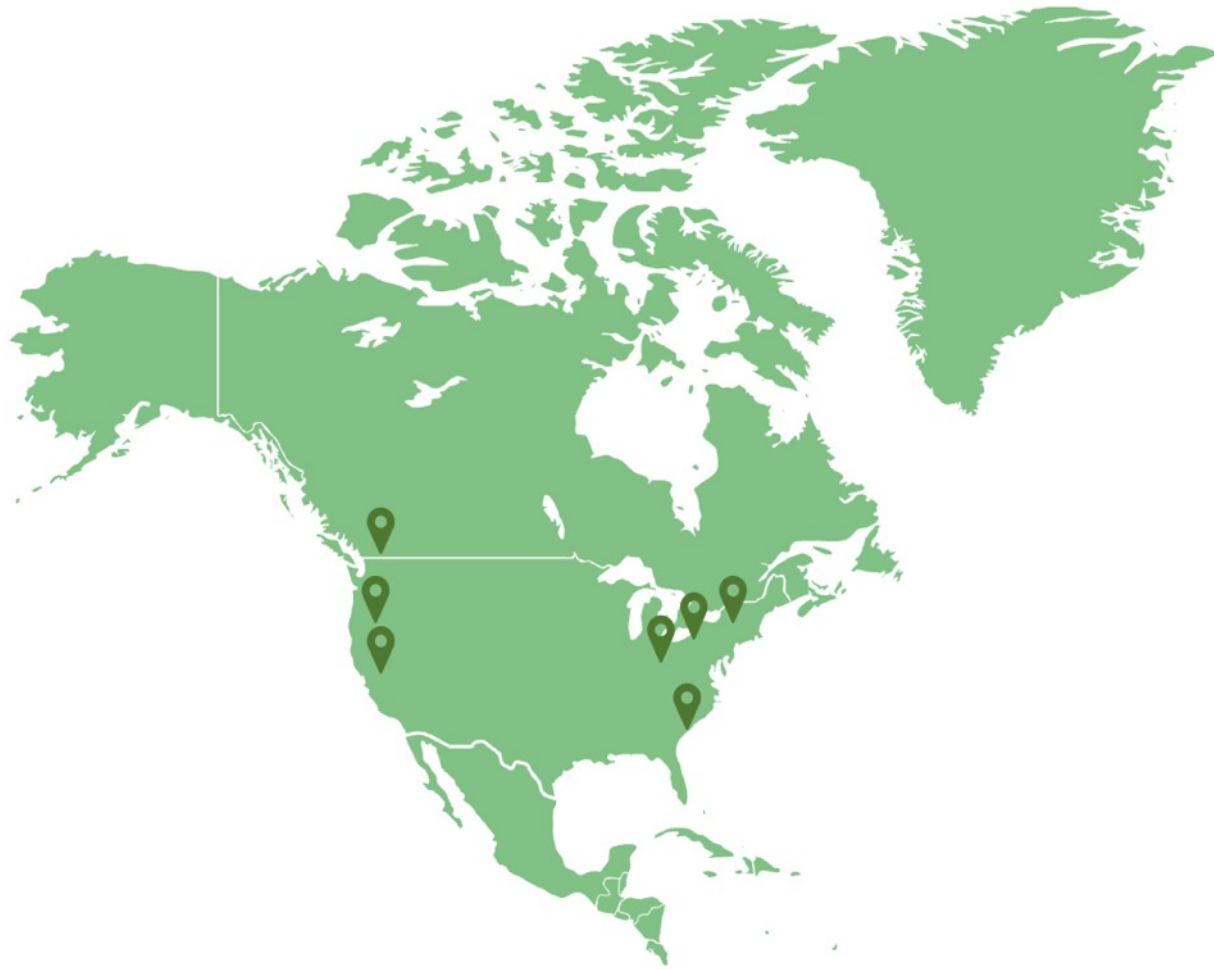
\$38bn

Estimated global lithium battery recycling market by 2030 [11].

18%

Reduction in net GHG impacts could be achieved through end-of-life battery recycling [10].





Building back better

Establishing efficient recycling processes

In the US, recycling facilities are currently concentrated on the east and west coasts, meaning that spent batteries in the middle of the country must be transported across a great distance [13].

Given that only a few countries currently have the capacity to process and recycle lithium-ion batteries locally, others must establish domestic facilities that are distributed across the country to minimise the cost, carbon footprint and transportation risks.



References

- [1] <https://www.innovationnewsnetwork.com/meeting-global-ev-battery-demand-battery-recycling-innovation/22012/>
- [2] <https://www.sciencedirect.com/science/article/abs/pii/S0959652622029286>
- [3] <https://www.idtechex.com/en/research-report/li-ion-battery-recycling-market-2022-2042/848>
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- [12] <https://recyclinginternational.com/batteries/were-almost-in-the-golden-age-of-battery-recycling/49557/>
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