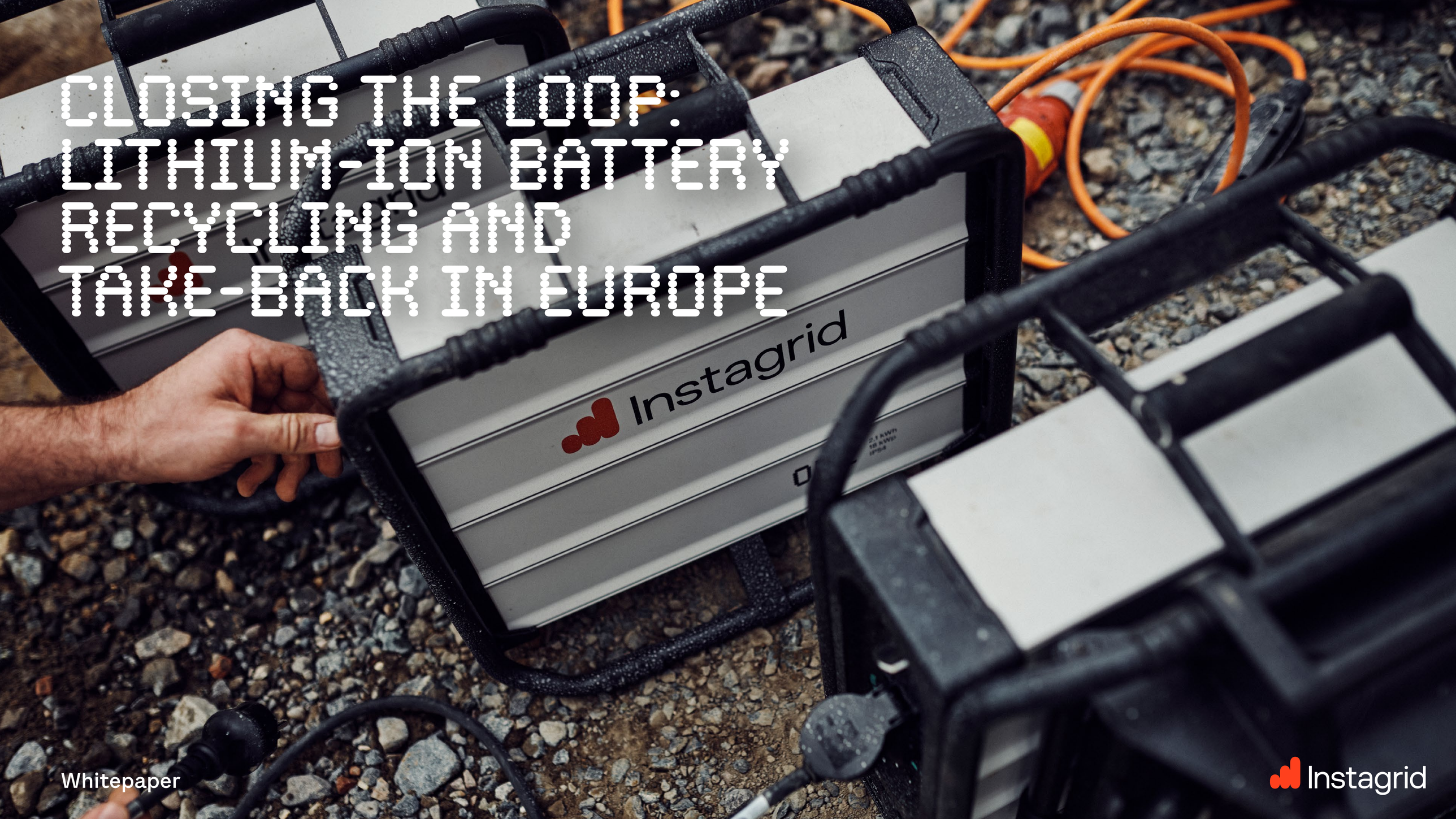
CLOSING THE LOOP: LITHIUM-ION BATTERY RECYCLING AND TAKE-BACK IN EUROPE



Whitepaper

Instagrid

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Background

At Instagrid, sustainability is not only confined to product performance during use, but it is also embedded in how we design, manufacture, deploy and ultimately manage our products at end of life. As regulatory frameworks evolve and the European battery ecosystem matures, we believe it is essential to examine not only the environmental benefits of battery-based portable power during operation, but also what happens after a product's final cycle, which is crucial in closing the loop.

This whitepaper has been developed to provide a structured, fact-based assessment of battery recycling and take-back in Europe — and to explain, transparently and pragmatically, how Instagrid approaches this topic.

Executive summary

Europe has invested significantly in recycling infrastructure in recent years. However, public perception of battery recycling remains shaped by a widely cited but misleading statistic: that only 5% of lithium-ion batteries are recycled globally. While frequently used to illustrate a supposed failure of the circular economy, this figure originates from outdated or context-specific collection data and does not reflect actual material recovery rates, regulatory frameworks, or current market dynamics. In reality, lithium-ion batteries are subject to increasing regulatory requirements, landfill restrictions, and strong economic incentives for material recovery in key markets such as Europe, China, and the United States.

This disconnect between perception and reality contributes to an unclear and uneven understanding of the battery recycling landscape. Technological capability and installed capacity in Europe already exceed current end-of-life battery volumes, reflecting the time lag between infrastructure build-up and the future wave of batteries reaching end of life.

At the same time, the market is characterised by strategic partnerships between OEMs, cell manufacturers and recycling companies. Recycling-as-a-Service models are emerging to secure input volumes and enable closed-loop material streams. Proximity, logistics efficiency and predictable return flows are decisive success factors. However, high recycling capacity does not automatically translate into high recycling volumes. The bottleneck is often not technological, but structural.

Recyclability versus take-back feasibility
A central distinction explored in this whitepaper is the difference between recyclability and take-back feasibility.

Recyclability is an inherent product characteristic influenced by design, modularity and material composition. Take-back feasibility, by contrast, is shaped by logistics, regulation, decentralised product distribution and economic viability.

Real-world recycling trials with multiple partners demonstrate that Instagrid ONE is highly recyclable in practice. Its modular design facilitates disassembly, integration into established recycling processes is feasible, and no significant product-specific barriers to material recovery have been identified. Yet recyclability alone does not ensure a fully closed material loop.

For OEMs operating across decentralised markets, structural factors play a decisive role: small and geographically dispersed return volumes; the absence of proprietary collection networks; transport costs; and strict hazardous goods and waste legislation. Under current regulations, batteries being transported for recycling are classified as hazardous waste, triggering significant logistical and compliance requirements, whereas take-back for reuse may be treated differently. These frameworks apply equally to all market participants regardless of size and scale and are designed to ensure safety and environmental protection. They create necessary safeguards — but also organisational and financial complexity and barriers.

A conscious and transparent strategic decision
Instagrid has assessed its preferred take-back scenario — centralised return with full downstream transparency and control over material flows — against existing structural conditions. At present, this model is not economically or organisationally feasible at scale. The company therefore utilises established national take-back schemes that are legally compliant, practical and scalable at this current point, even if they limit direct transparency and control over downstream processes.

This decision reflects a deliberate balancing of ecological ambition, economic responsibility, operational feasibility and legal compliance. It is grounded in real-world testing and transparent

evaluation, rather than theoretical assumptions. We continue to actively monitor the market and engage in initiatives that support the development of more established and widely accessible take-back systems.

Sustainability, in this context, requires not only ambition but also honesty about trade-offs. It means working towards improved circular models through partnerships and actively engaging in more detailed research. The systemic constraints which currently exist cannot unilaterally be changed by a single OEM, or even one specific industry.

A shared path forward

The development of an efficient European battery circular economy will depend on collaboration across the entire value chain — from manufacturers and recyclers to logistics providers, customers and regulatory stakeholders. As end-of-life volumes increase and market structures mature, new opportunities for scalable, transparent and economically viable take-back solutions are likely to emerge.

Instagrid remains committed to monitoring technological and regulatory developments closely; to further enhancing transparency where possible; to engaging in open dialogue with customers, recycling partners and industry stakeholders; and to adopting new solutions when feasible.

The challenge facing the market is not a lack of recycling technology, but the coordinated organisation of material flows within a complex regulatory and logistical environment. Addressing this challenge requires cooperation, shared learning and pragmatic innovation.

We invite stakeholders across the battery ecosystem to contribute to this dialogue and to work jointly towards practical, future-ready solutions that strengthen Europe's battery circular economy.

Introduction

As a technology-driven company with the ambition to take a holistic approach to sustainable power supplies, we not only consider the use phase of our products but also their end of life. Public discourse around battery recycling is often shaped by simplified narratives — most notably the widely cited claim that only 5% of lithium-ion batteries are recycled globally. While this figure is frequently used to highlight an urgent need for action, it does not accurately reflect current regulatory frameworks, technological capabilities, or material recovery practices. Instead, it contributes to a perception of a system that appears more dysfunctional than it is, obscuring the more nuanced reality of an evolving and uneven recycling landscape.

Against this backdrop, we conducted a comprehensive analysis of the European Li-ion battery recycling landscape, covering regulatory drivers, infrastructure, capacities, and process technologies. Building on this market-level view, we assessed the recyclability of Instagrid ONE both theoretically and through hands-on recycling trials in collaboration with multiple recycling companies, gaining real-world insights into processing methods, material recovery potential, and operational challenges. In parallel, we examined the practical and regulatory feasibility of a centralised manufacturer take-back system, analysing barriers such as decentralised product distribution, hazardous-waste classification, and cross-border logistics. Based on all these findings, we derived a strategic approach to end-of-life battery management.

The European LIB recycling landscape: sufficient capacity, delayed ramp-up in volume

In recent years, lithium-ion battery (LIB) recycling has gained significant importance in Europe, as it plays a central role in securing access to strategic raw materials. Driven in particular by increased European legislation, the ramp-up of electromobility and cell production, and broader strategic considerations regarding raw material security, recycling infrastructure has expanded rapidly. Numerous facilities have been built or announced, bringing Europe's theoretical recycling capacity to a high level.

Current analyses indicate that these capacities exceed the present and medium-term expected volumes of lithium-ion batteries available for recycling.[1] This imbalance is less a sign of structural oversupply than the result of forward-looking infrastructure development combined with a delayed ramp-up of end-of-life battery volumes.

A key influencing factor is the development of electromobility. The market ramp-up of electric vehicles has progressed more slowly than earlier forecasts assumed, directly affecting the return volumes of traction batteries. At the same time, many batteries — including those from stationary and industrial applications — are still in their first-life use, meaning that significant end-of-life volumes will only arise with a time lag. In parallel, the expansion of European cell production capacities has also slowed, leading to lower-than-expected volumes of production scrap — another important input stream for recycling plants. As a result, current recycling capacity exceeds the volume of batteries available for recycling.[2][3]

For a deeper understanding of global LIB recycling activities, it is essential to distinguish between pretreatment and refinement.

Pretreatment
Pretreatment includes the deactivation and dismantling of battery systems, packs, or modules, as well as the production of so-called black mass through mechanical shredding. Fractions of aluminium, copper, or plastics can be recovered at this stage, but most material recovery takes place during refinement.

Refinement
In Europe, hydrometallurgy has clearly emerged as the core process in the refinement stage. Valuable cathode metals such as lithium, nickel, cobalt, manganese, and potentially anode material, such as graphite, are recovered in this phase.[4]

Recycling capacity in Europe exceeds current return volumes

This imbalance is primarily due to timing. Infrastructure has been established in anticipation of future battery return streams, while many battery systems placed on the market are still in active use.

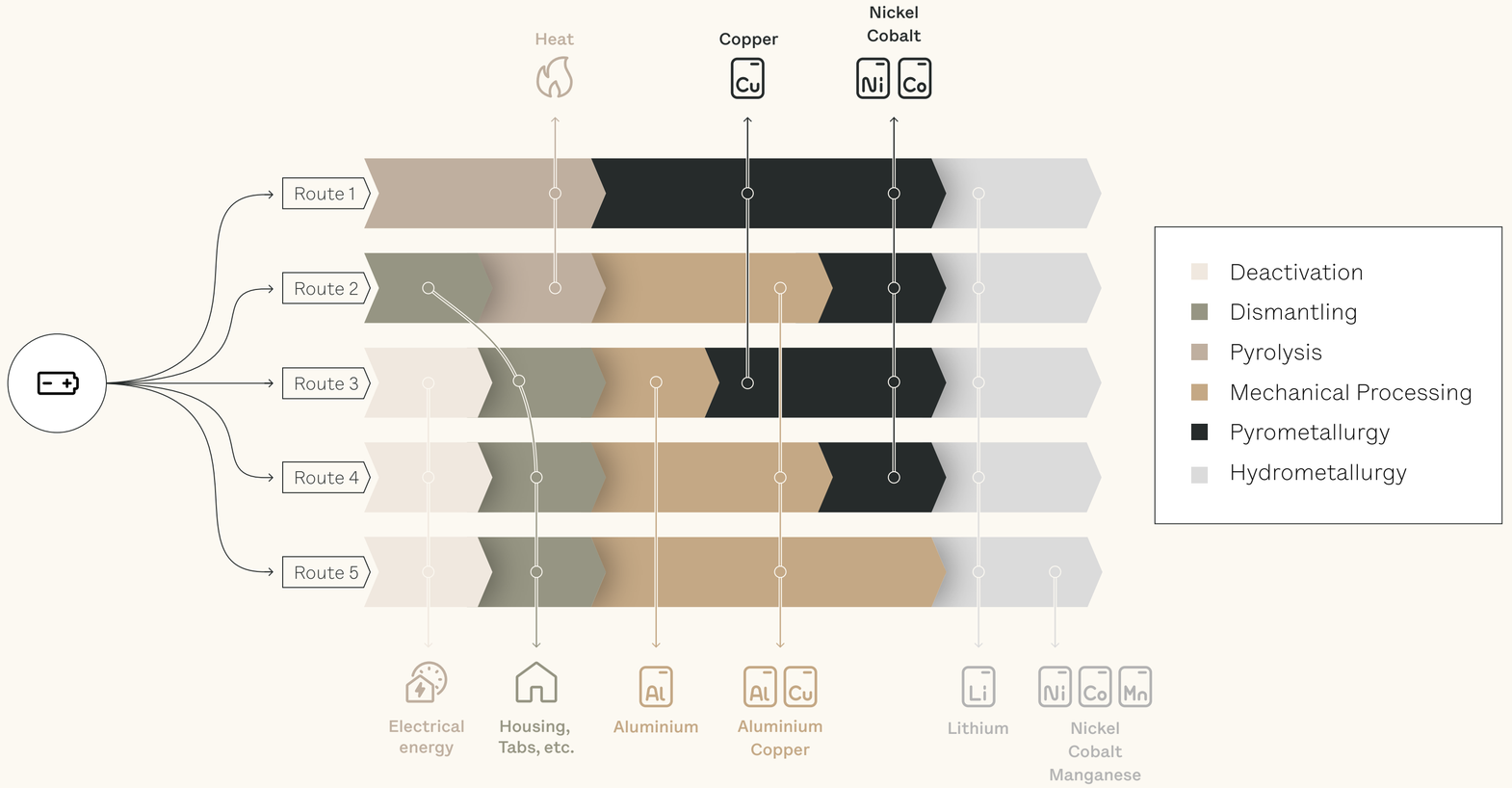
[1] [2] Fraunhofer ISI (2025): *Recycling capacities for lithium-ion batteries in Europe are expected to exceed demand in Europe for the time being.* Battery Update, 24 July 2025.
[3] EUWID (2024): *Batterierecycling in Europa und weltweit vor großen Herausforderungen.* EUWID Recycling und Entsorgung, 21 September 2024.
[4] Fraunhofer ISI (2025): *Recycling capacities for lithium-ion batteries in Europe are expected to exceed demand in Europe for the time being.* Battery Update, 24 July 2025.

Different recycling process routes

Pretreatment and refinement processes
There is no single standardised recycling pathway for lithium-ion batteries. Instead, different process steps — including dismantling, mechanical shredding and separation, pyrolytic treatment, pyrometallurgy, and hydrometallurgy — can be combined in varying sequences and processing depths.

Overall, the mechanical–hydrometallurgical process route without thermal treatment steps (Route 5) is expected to offer the highest robustness, economic viability, environmental compatibility, and recycling efficiency in the medium to long term. In addition, it enables the recovery of graphite, which accounts for roughly 20% of the mass of a lithium-ion battery cell.[5] Pyrolysis in pretreatment and pyrometallurgy as a (partial) process in refinement are now applied only in isolated cases.

The following figure provides an overview of the different possible configurations of recycling process routes.[6]



[5] TraWeBa; Fraunhofer IKTS (2024): *20 Herausforderungen und Potentiale aus der Batterieforschung – Von Anoden bis zum Recycling*. 21 October 2024. Available online.
[6] Doose, S., Mayer, J., Michalowski, P., & Kwade, A. (2021): *Challenges in Ecofriendly Battery Recycling and Closed Material Cycles: A Perspective on Future Lithium Battery Generations*. MDPI.

Tensions in the European pretreatment and refinement landscape

Europe currently has an oversupply of pretreatment facilities, with significant additional refinement capacities expected by 2030.[7] Currently the refinement capacities in operation are, in some regions, below available processing volumes.

In contrast to smaller scale, more locally oriented pretreatment facilities, technologically complex refinement plants require substantial capital investment and therefore depend even more heavily on large and stable input streams to operate economically. The delayed ramp-up of end-of-life batteries and production scrap has thus reduced investment security for recycling organisations, contributing to a slower expansion of refinement capacities in Europe.

At the same time globally dominant Asian markets such as China and South Korea possess large refinement capacities but face insufficient input material to achieve higher utilisation rates. As a result, they can offer higher prices for European black mass, leading to a continued outflow of valuable secondary raw materials from Europe in the medium term.[8]

In 2025, European legislation responded to this by introducing a uniform classification of black mass as 'hazardous waste', taking initial steps to restrict exports from Europe.[9] In the long term, this may support the establishment of a closed European material loop and more resilient supply chains.

Overall, the analysis of the European recycling landscape reveals a structural tension between installed capacities and available return volumes. Against this backdrop, key questions arise regarding how recycling companies can secure their economic position and which cooperation models are likely to emerge in the market.

[7] Fraunhofer ISI (2025): *Recycling capacities for lithium-ion batteries in Europe are expected to exceed demand in Europe for the time being*. Battery Update, 24 July 2025.
[8] EUWID (2024): *Batterierecycling in Europa und weltweit vor großen Herausforderungen*. EUWID Recycling und Entsorgung, 21 September 2024.
[9] Fraunhofer ISI (2025): *Recycling capacities for lithium-ion batteries in Europe are expected to exceed demand in Europe for the time being*. Battery Update, 24 July 2025.

Partnerships and market mechanisms in battery recycling

In the global battery recycling market, a wide range of cooperation models is emerging. The most common partnerships can be observed between battery cell manufacturers or automotive OEMs and recycling companies, covering both production scrap and end-of-life batteries. Through such collaborations, recyclers secure sufficient input material to ensure the economic utilisation of their facilities. Cell manufacturers and OEMs, in turn, aim to close the loop by reintroducing recycled battery raw materials into the production of new batteries. In this context, Recycling-as-a-Service has proven to be a suitable business model, whereby recycling companies act as service providers and charge a recycling fee, while cell manufacturers or OEMs retain ownership of both input and output materials.

A key success factor for these partnerships, given the sharp increase in end-of-life batteries, is efficient take-back logistics. A very clear success case in Europe is in the automotive manufacturing industry. Its ability to leverage existing physical networks of service and sales locations to collect used traction batteries from end users, consolidate them, and transport them to recycling facilities creates a very appealing model that Instagrid has considered more broadly. The proximity to cell manufacturers or automotive OEMs has become a decisive factor in the location selection of recycling infrastructure, not only in Europe but globally. This is further reinforced by the classification of lithium-ion batteries destined for disposal as hazardous waste, which significantly increases transportation costs; closer proximity minimises this.

These cooperation models demonstrate that technological recyclability alone is not sufficient. The decisive factor is whether end-of-life batteries can actually be consolidated, transported, and directed into suitable recycling processes. This brings a key distinction into focus: recyclability versus take-back feasibility.

Partnerships between OEMs, cell manufacturers and recyclers define the market

Proximity, predictable volumes and efficient logistics are decisive success factors. For larger manufacturers with concentrated return streams, or established collection networks, integrated partnerships can enable high levels of transparency and material traceability.

Recyclability and take-back feasibility: why good recyclability alone is not enough

In practice, high recycling capacities do not automatically translate into high recycling volumes. The bottleneck lies less in the available recycling infrastructure and more in the framework conditions governing take-back and logistics. End-of-life batteries are commonly found in decentralised locations, and are subject to strict dangerous goods regulations. Transport, collection, and consolidation of suitable volumes are therefore complex and cost intensive. A realistic understanding of battery recycling requires a clear distinction between recyclability and take-back feasibility across the battery life cycle.

Recyclability is primarily a product-specific characteristic. It is largely determined by design decisions, such as material selection, modularity, and ease of disassembly. A highly recyclable product enables recycling companies, in principle, to recover valuable raw materials and integrate the battery efficiently into existing process routes. In this sense, recyclability is a necessary precondition for effective material recovery.

Take-back feasibility is not a product property but a systemic issue. It describes whether and how a battery system truly enters recycling after its use phase. Numerous external factors influence this process, many of which lie outside the direct scope of product design. These include regulatory requirements, logistics, economic incentives, and the structure of existing take-back systems in the respective markets.

In practice, even a highly recyclable product can only be effectively recycled if efficient take-back processes are in place.

End-of-life batteries are typically found in decentralised settings at end-user locations, often in small quantities, and may be returned in varying conditions. At the same time, once transported for disposal and classified as hazardous waste, they are subject to stringent dangerous goods regulations. These requirements significantly increase organizational effort and can make take-back complex and costly — even where recycling infrastructure and capacity are available.

Essentially, battery take-back systems in Europe are primarily designed to ensure regulatory compliance. While they guarantee legally compliant disposal, they do not necessarily provide transparency regarding subsequent material flows or the specific recycling routes applied. For companies such as Instagrid, this means that while extended producer responsibility obligations can be formally fulfilled, influence over the actual recycling pathway remains limited. The reality is that while recyclability can be improved over time through product design adjustments, enhancing take-back feasibility often requires systemic changes — including the development of appropriate logistics solutions, new cooperation models, or adapted regulatory frameworks. The distinction between recyclability and take-back feasibility is therefore central to understanding and evaluating the strategic decisions discussed in the remainder of this whitepaper.

Recyclability is not the same as take-back feasibility

- Recyclability – a product characteristic influenced by design and material composition.
- Take-back feasibility – a systemic issue shaped by logistics, regulation, hazardous goods classification and cost structures.

High recyclability does not automatically guarantee effective recycling in practice.

Instagrid ONE: insights into real-world recyclability

Assessing the recyclability of a battery system requires a differentiated analysis of product design, material composition, and practical feasibility within real-world recycling processes. As part of the underlying assessment, Instagrid ONE was evaluated both theoretically, and in practice, in collaboration with several recycling companies. The objective was to gain hands-on insights into different recycling technologies and the specific processing steps applied to Instagrid ONE battery systems and modules, to identify opportunities and challenges in material recovery, and to obtain feedback on recyclability and achievable recycling efficiencies.

Overall, the design of Instagrid ONE can be classified as recycling friendly. The modular architecture of the battery system enabled comparatively straightforward disassembly, a point explicitly confirmed by the participating recycling companies. In particular, the separation of key components could be carried out without specific instructions from Instagrid or prior product-specific knowledge. This represents a significant advantage, as simplified disassembly enhances safety and improves the efficiency of downstream recycling processes. Looking ahead, this effect could be further strengthened by the upcoming digital battery passport. As of February 2027, this passport will be mandatory for newly placed LV, industrial, and electric vehicle batteries under EU Battery Regulation.[10] By providing structured information on chemical composition and disassembly guidance, the digital battery passport has the potential to reduce operational recycling costs in the long term by an estimated 10–20 percent.[11]

In one of the recycling trials, it was evident that the polymer potting of the individual battery modules complicates automated deep discharge via direct contact with the battery cells. This design feature was deliberately implemented, though not primarily from a recycling perspective. Rather, it serves key product requirements such as safety, robustness, and reliable performance in mobile applications. The polymer potting protects the underlying circuit boards and mounted electronics against moisture, dirt, accidental contact, mechanical shock, vibration, and elevated temperatures.

From the perspective of the recycling company involved, this does not constitute a fundamental barrier to integration into existing recycling processes. Instead, it represents a familiar trade-off between product performance and simplification of recycling operations. The advantages of polymer potting from a manufacturer's standpoint are well understood, and no specific recommendations for changes to the module design were made. In the case of larger volumes of Instagrid ONE battery modules — where establishing an automated deep discharge process would be economically viable — automated discharge could also be implemented with the current module design by removing the entire module cover and exposing the battery cells.

The practical recycling trials further demonstrated that Instagrid ONE is fundamentally compatible with existing recycling processes. However, achievable recovery rates for the contained materials vary depending on the selected process route — whether purely mechanical-hydrometallurgical or pyrolytic-mechanical with subsequent pyro- and/or hydrometallurgical treatment. In practice, the mechanical-hydrometallurgical route shows the greatest potential for recovering valuable anode and cathode materials. By contrast, process routes involving thermal treatment steps — such as pyrolysis or pyrometallurgy — tend to result in comparatively higher material losses due to combustion effects.

The recycling trials resulted in various recycling efficiencies; however, these can only be compared to a limited extent. The primary reason for this lies less in the different process routes themselves and more in the inconsistent definitions of reference bases and calculation methodologies. While some assessments consider only the battery cells, others additionally include module housings, electronics, and cabling. Furthermore, the underlying cell chemistries differ — for example, some calculations are chemistry-specific, while others are based on averaged values across various lithium-ion systems. There are also differences in how individual input and output fractions are allocated and weighted. Oxygen, for instance, is sometimes reported as a separate fraction and in other cases accounted for as part of oxidic nickel, cobalt, and manganese compounds. Consequently, differing numerical results arise that cannot readily be used as direct comparison metrics. The following table therefore presents a qualitative, rather than quantitative, comparison of the recycling trial outcomes, assessed across different process routes and their resulting material recovery.

[10] *EU Battery Regulation (EU) 2023/1542, Article 77*
[11] Battery Pass Consortium (2024): *Battery Passport Value Assessment* – Synthesis of Results. November 2024. Available online.

Recycing Trial	Process route (excluding dismantling)	Recovery of							
		Al, Cu, Fe	Li	Ni	Co	Mn	C (Graphite)	Electro-lyte	Separator/ plastics
Trial 1	Pyrolysis, Mechanical, Pyrometallurgy, Hydrometallurgy.	✓	✗	✓	✓	✗	✗	✗	✗
Trial 2	Pyrolysis, Mechanical, Pyrometallurgy, Hydrometallurgy.	✓	✗	✓	✓	✗	✗	✗	✗
Trial 3	Mechanical, Hydrometallurgy.	✓	✓	✓	✓	✓	✓	✓	✗

Against this backdrop, a harmonized methodology for calculating and verifying recycling efficiency and material recovery rates of waste batteries has been introduced under EU Battery Regulation. The Delegated Regulation (EU) 2025/606, published in July 2025, establishes binding, EU-wide rules for the calculation and documentation of recycling efficiency.[12] It creates a standardised framework intended to improve long-term comparability and reliability of reported data. The regulation defines harmonised requirements for the identification and reporting of input and output fractions, documentation formats, and verification procedures by the competent authorities.

Regardless of the recycling trials conducted, a material recovery rate of up to 73.5% can be derived for Instagrid ONE under ideal conditions. This best-case estimate is based on the product's material composition and the recycling routes theoretically available for the respective input fractions. The largest material losses are attributable to electronic and plastic components, whereas comparatively high recycling efficiencies can be expected for metallic components (battery cells, aluminium housing, copper, and steel). Accordingly, the overall material recoverability increases with a higher metal content of the product.

In summary, the Instagrid ONE battery system demonstrates in principle a high level of recyclability and does not exhibit any significant product-specific characteristics that would fundamentally hinder efficient material recovery. At the same time, the question remains as to how these technical potentials can be realised under real-world market and regulatory conditions. This shifts the focus toward the practical organisation of take-back processes.

Instagrid ONE has proved to be highly recyclable

Recycling trials confirm that Instagrid ONE can be processed within existing European recycling systems without technical barriers. The modular architecture supports dismantling, and material fractions are compatible with established recovery processes.

[12] European Commission (2025): *Delegated Regulation (EU) 2025/606.*

Take-back strategy in practice: between ambition and feasibility

In practice, the take-back of lithium-ion batteries represents one of the greatest challenges along the product life cycle. While sufficient recycling capacities are available in Europe and battery systems such as Instagrid's demonstrate strong recyclability in principle, day-to-day operations reveal that the path from end-of-use to actual recycling is complex and shaped by numerous structural and regulatory framework conditions. A central obstacle lies in the decentralised occurrence of end-of-life batteries. Instagrid ONE battery systems are deployed across Europe by a wide range of end users, typically in small to medium quantities at geographically dispersed locations. This widespread distribution significantly complicates bundled take-back, consolidation, and targeted transport of spent batteries within the framework of a potential strategic recycling partnership. Unlike large automotive manufacturers or battery cell producers, Instagrid, as a young and small company, does not have a dense, Europe-wide network of its own collection points such as sales or service locations, nor does it have sufficiently large quantities in a single location to establish economically efficient collection and transport processes.

An additional challenge arises from the regulatory classification of battery systems under German waste law where Instagrid is headquartered. Lithium-ion batteries are generally classified as hazardous waste once an "intention to discard" exists on the part of the end user — that is, when the battery can no longer fulfil its original purpose and is no longer intended for use. This interpretation has been explicitly confirmed by the responsible waste authority for Instagrid. In the case of take-back primarily intended for recycling, the battery systems are therefore already considered hazardous waste at the moment of shipment from the end user back to Instagrid, provided no immediate new purpose is assigned.

The situation is different, however, in the context of a second-life strategy, where the take-back of batteries is explicitly intended for reuse and thus immediately establishes a new purpose for the battery systems. A prerequisite is that prior to collection — and without significant inspection or refurbishment — it is already determined that the batteries are suitable for reuse.

In such cases, the batteries are no longer classified as waste under waste law but are treated as regular products. Regardless, the dangerous goods regulations for transporting lithium-ion batteries must still be observed. Due to a technical feature of Instagrid ONE (transport mode), Instagrid can make use of the ADR special provision SV 188, which under certain conditions allows simplified transport as 'excepted' dangerous goods. To clarify: if transport is carried out with the primary goal of recycling, the applicable regulations change. Instagrid ONE is then no longer considered a regular product or 'excepted' dangerous good but instead is classified as waste dangerous good and, under waste law, as hazardous waste.

In a disposal scenario, end-of-life Instagrid ONE battery systems are therefore subject to strict regulations regarding packaging, labelling, transport, and storage. These requirements are safety-critical and necessary but significantly increase the organisational and financial burden for the company. In particular, single returns or cross-border transportation can quickly drive costs to an unsustainable level.

We analysed operational and regulatory barriers — including decentralised product distribution, hazardous-waste classification, ADR transport requirements, and cross-border logistics costs — and determined that a centralised manufacturer take-back system is not economically scalable. By contrast, the take-back solution currently used in the EU — through established battery take-back schemes — represents a pragmatic and legally compliant alternative. It allows end users to return battery systems free of charge and with minimal effort, while ensuring that manufacturers meet their statutory take-back obligations under the EU Battery Regulation and the Extended Producer Responsibility. At the same time, the organisational burden for Instagrid is kept to a manageable level, ensuring that take-back can be maintained reliably over the long term.

Based on these findings, we continue participating in established European battery take-back schemes as a pragmatic, legally compliant, scalable, and customer-friendly solution for end-of-life battery management. In markets outside Europe, such as North America, where established collection systems for our specific type of batteries are not available, we provide customer-friendly return solutions to ensure responsible end-of-life handling, but we do also proactively engage in initiatives, where appropriate, to inform and evolve policy making. In total, we ensure take-back solutions across 29 countries.

Our Limitations lie in the take-back infrastructure

For Instagrid, structural challenges include:

- Decentralised and comparatively small return volumes;
- The absence of a proprietary Europe-wide collection network;
- Strict hazardous goods requirements when products are classified as waste under applicable legislation.

Preparing for the future

This decision to continue participating in existing battery take-back schemes reflects a deliberate balance between environmental objectives, economic feasibility, and practical feasibility. It does not preclude more advanced solutions in the future.

Looking ahead, we will continue to systematically advance our end-of-life strategy in alignment with the EU Battery Regulation and evolving market conditions. Our focus for the coming years will be on further embedding circularity principles into product development, strengthening internal expertise on battery recycling, and aiming for more transparency regarding material flows and recycling pathways.

We aim to continuously improve Design for Repair and Design for Recycling principles in future product generations to extend product lifetimes, simplify dismantling, and increase material recovery potential.

As we expand into new markets, we will broaden our participation in national battery take-back schemes, and drive the development of such by participating in national initiatives, where available. At the same time, we seek to reduce the complexity of market-specific return processes by providing clearer information to customers on their role in waste prevention and battery collection, and by offering additional support wherever returning our products via established take-back schemes is not reasonably feasible.

With growing return volumes and maturing regulatory frameworks, we will periodically reassess additional take-back and recycling models. Despite administrative and policy-related challenges, we remain committed to exploring innovative recycling approaches in the long-term and to building strategic partnerships in this field. Our current participation in established collection schemes therefore serves as a scalable and compliant foundation on which future circular solutions can be developed.



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