Iondrive and PEM sign Collaboration Agreement to Commercialise Battery Recycling Technology in Europe

Highlights

- **Iondrive has signed a Collaboration Agreement with Production Engineering of E-Mobility Components at RWTH Aachen University (PEM) and PEM Motion GmbH (PEM Motion), based in Germany.**

- **Whilst the collaboration agreement is non-binding, this is considered a significant step as it formalises a strategic industry partnership in the major target market of Europe and underscores the unique value proposition of Iondrive's sustainable battery recycling process.**

- **PEM is seeking to establish a consortium and the necessary funding to address challenges in complying with the new Batteries Regulation, part of the European Green Deal, which includes targets for recycling efficiency, material recovery, and recycled content, being gradually introduced from 2025 onwards.**

- **The consortium is intended to comprise strategic partners from the entire battery recycling value chain, including automotive OEMs, to validate at scale the performance of battery cells made from recycled metals.**

- **Over the next 3 months, PEM and Iondrive will prepare a detailed project plan and investment case for the establishment of a pilot plant based on Iondrive's recycling technology.**

- **PEM and PEM Motion will leverage their extensive experience in developing consortia with prominent industry leaders to assist formation of the consortium and in conjunction with Iondrive securing the necessary funding.**

Iondrive Limited (ASX: ION) (Iondrive or the Company) is pleased to announce the signing of a collaboration agreement with the Chair of Production Engineering of E-Mobility Components of RWTH Aachen University (PEM) and PEM Motion GmbH (PEM Motion). This collaboration aims to advance sustainable battery recycling technologies by leveraging PEM's extensive expertise in battery technology and recycling, along with Iondrive's innovative Deep Eutectic Solvents (DES) Sustainable Battery Recycling process.

Iondrive CEO Dr Ebbe Dommisse commented: *This development is a major feather in the cap for an Australian technology company to be invited to participate in a European consortium of strategic industry partners to establish a battery recycling "value circle". Partnering with PEM and PEM Motion, leaders in battery technology and recycling, greatly enhances our ability to navigate the commercialisation pathway for our advanced recycling technologies. By forming a consortium, we are looking to strategically position to pool critical resources, expertise, and infrastructure, accelerating the development of commercially viable battery*

recycling solutions. This collaborative approach is essential for engaging key industry partners, facilitating compliance with stringent European regulatory standards, and significantly boosting our appeal for investment from Industry Participants. Our alignment with PEM underscores our commitment to supporting Europe's sustainability goals and marks a significant commercial milestone, establishing us as an early mover in the European market, while advancing innovative solutions within the circular economy.

PEM RWTH Aachen University commented: *"We are thrilled to embark on this collaboration with Iondrive and PEM Motion. This partnership represents a significant stride towards advancing sustainable battery recycling technologies in Europe. By leveraging our research capabilities and industry experience, we aim to address the critical challenges posed by the new Batteries Regulation under the European Green Deal. Together, we are committed to developing innovative solutions that not only enhance recycling efficiency but also support Europe's transition towards a circular economy. This initiative underscores our dedication to fostering impactful industry collaborations that drive technological advancements and sustainability."*

PEM Motion commented: *"We are excited to join forces with Iondrive and PEM RWTH Aachen University in this initiative. Our combined expertise in battery technology and industrialisation will be instrumental in forming a robust consortium that addresses the pressing need for sustainable battery recycling solutions. This collaboration aligns perfectly with our mission to drive innovation in e-mobility and support the development of environmentally friendly technologies. We look forward to leveraging our extensive network and experience, ultimately contributing to Europe's sustainability goals."*

About PEM

The Chair of Production Engineering of E-Mobility Components of RWTH Aachen University is a leading research unit dedicated to advancing electric mobility technologies. Headed by Professor Achim Kampker, PEM focuses on developing innovative solutions for the production and integration of e-mobility components. Their work spans various domains, including battery technology, battery recycling, electric powertrains, and sustainable manufacturing processes. The Chair collaborates closely with industry partners to translate cutting-edge research into practical applications, fostering the commercialisation of new technologies that contribute to the evolution of sustainable transportation. PEM has extensive experience in developing consortia with prominent industry leaders, demonstrating their ability to drive impactful battery projects with substantial industry support.

About PEM Motion

PEM Motion is a business consulting and engineering service provider focusing on batteries and electric motors, as well as the industrialisation of mobility products. Focus areas are battery cells, battery systems, e-motors, hardware and software as well as e-mobility products.

Iondrive's DES Battery Recycling Process

Iondrive utilises Deep Eutectic Solvents (DES) and benign, biodegradable organic solvents in a non-toxic, closed-loop process. This eco-friendly method avoids toxic mineral acid leaching, ensuring a minimal environmental footprint.

Currently, most battery recycling processes involve pre-treating and shredding waste batteries to create a substance known as black mass. Black mass is a powdered mixture of the shredded anodes and cathodes containing various critical minerals, including lithium, cobalt, nickel, and manganese. This material is then typically exported to Asia for further processing to extract these critical minerals and then refining to battery-grade materials for reuse.

The prevailing methods for processing black mass are energy-intensive pyrometallurgical processes, which involve high-temperature smelting, and hydrometallurgical processes, which use acid leaching with large environmental footprints. These methods are predominantly used in Asia, where most of the world's battery recycling capacity is currently located.

Iondrive's recycling technology is positioned to convert these recovered critical minerals (black mass) into battery-grade materials and further valorise to pCAM to supply the growing EV market, providing a sustainable and efficient solution to the global battery recycling challenge while closing the projected deficit for demand of critical minerals.

In November 2023, leading battery market consultant, RhoMotion, were engaged by Iondrive to undertake a study of the global battery recycling market. The study concluded that Iondrive's DES process offers an attractive environmental value proposition in this rapidly growing battery recycling market, particularly in the EU, US and Australia[1] as these regions seek to retain the economic value of the recycled critical minerals.

In the EU in particular, the new Batteries Regulation, part of the European Green Deal[2], creates strong market dynamics for the adoption of new environmentally sustainable recycling technology. The regulation aims to improve the environmental performance of batteries throughout their lifecycle, including production, use, and recycling. Key elements of the regulation include targets for recycling efficiency, material recovery, and recycled content, which will be gradually introduced from 2025 onwards, creating a real sense of urgency and call to action. The regulation mandates that all collected waste batteries must be recycled (ban on landfilling), with high levels of recovery for critical raw materials such as cobalt, lithium, and nickel. In addition, the Critical Raw Materials Act[3] (CRMA) supports these efforts by setting benchmarks for recycling at least 25% of the EU's annual consumption of critical raw materials by 2030. The CRMA serves as a major driver for advancing recycling initiatives and securing funding to achieve these goals. By adopting stricter targets for recycling, the regulations seek to minimise environmental impacts and reduce dependency on raw material imports.

[1] https://wcsecure.weblink.com.au/pdf/ION/02744673.pdf
[2] https://environment.ec.europa.eu/news/new-law-more-sustainable-circular-and-safe-batteries-enters-force-2023-08-17_en
[3] https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials/critical-raw-materials-act_en

Collaboration Agreement

The primary objectives of the collaboration agreement are to attract investment to validate the Iondrive DES recycling technology at pilot plant scale and to form a consortium of strategic industry partners to solve a pressing industry need, being the establishment of a robust and scalable process for recycling lithium-ion batteries within the EU, with a focus on converting recycled materials into high-quality precursors for battery active materials for the expanding EV market. The pilot plant, as part of the proposed consortium utilising Iondrive's battery recycling technology, is likely to be located at PEM's facilities in Germany.

PEM, PEM Motion, and Iondrive will collaborate to bring together a consortium of industry participants representing the entire battery recycling value chain from the collection of end-of-life batteries to the production of battery active materials. The consortium will aim to validate technologies of all the processes in the battery recycling value chain at pilot plant scale, including ensuring that the resultant battery cells manufactured from recycled metals meet the performance standards of those produced from virgin materials. This is expected to involve the qualification processes of leading automotive OEMs. PEM and PEM Motion will also play a crucial role in optimising the recycling process and securing necessary funding.

Iondrive's early invitation to participate in the formation of this consortium, formalises a strategic industry partnership in Europe, a key target market, and underscores the value proposition of its unique sustainable battery recycling process.

Iondrive is positioned to play a key role in the planned consortium, being the recovery of critical minerals for battery-grade materials (being the "Material recovery and separation" step in the diagram below) and potentially participate in pre-treatment and the further processing into pCAM.

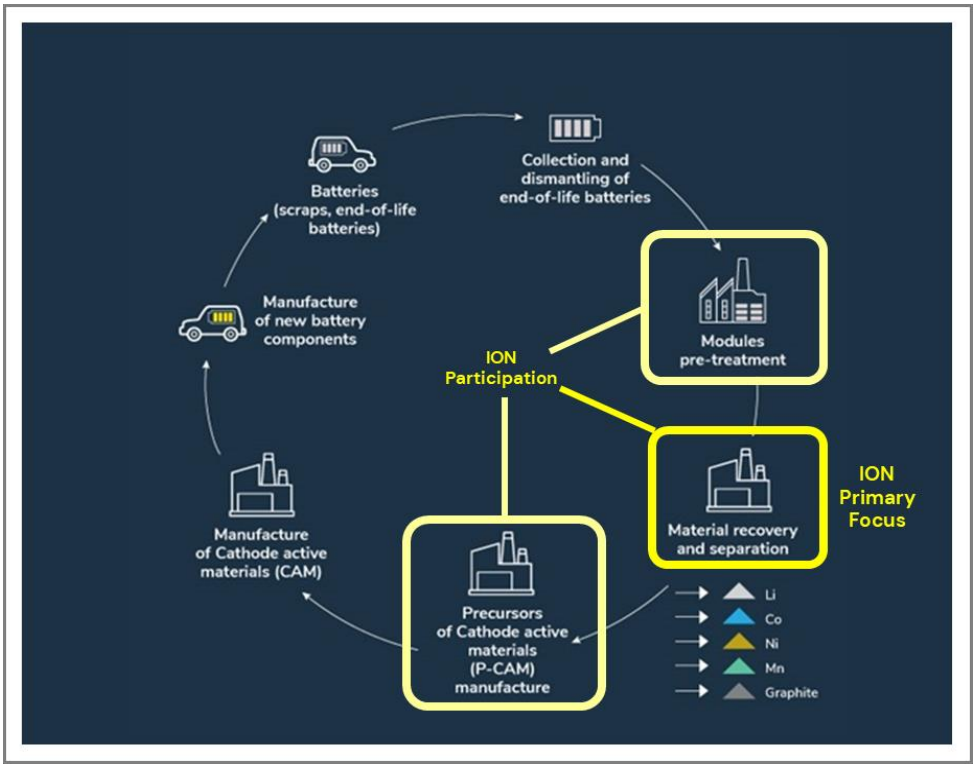

Figure 1: The Battery Recycling Value Chain

Securing funding for the recycling pilot plant and the broader activities of the consortium is a pivotal aim of this agreement. The parties will pursue financial backing from both private and public investors, with a particular focus on attracting strategic investments from industry partners.

Next Steps

PEM and PEM Motion, with input from Iondrive, will prepare a detailed project plan for the establishment of a recycling pilot plant based on Iondrive's technology and an investment pitch-deck. This will include preparation of applications for relevant government grants available in the EU for the renewable energy sector and environmental/recycling initiatives. It is expected that these outputs will be completed within the next three months.

PEM and PEM Motion will also take the lead in the formation of the consortium using the project plan and pitch deck noted above, leveraging their extensive experience and track record in establishing similar consortia and collaborating with major industry players.

This Collaboration Agreement is a significant milestone in Iondrive's journey toward becoming a leader in sustainable battery recycling technologies.

Authorised for release by the Board of Iondrive Limited.

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Iondrive Limited: Company Profile

Iondrive is an emerging leader in battery recycling technology, listed on the Australian Securities Exchange (ASX ticker "ION"). The company's primary focus is on developing and commercialising innovative solutions for lithium battery recycling. Iondrive's Hydrometallurgical Battery Recycling project employs a patented, environmentally safe solvent to gently separate critical components from used batteries, providing a safer and more efficient alternative to traditional methods.
In addition to its battery recycling initiatives, Iondrive holds exclusive worldwide licenses from the University of Adelaide for next-generation battery technologies, including an enhanced performance non-flammable lithium-ion based battery and a low-cost, high cycle life water-based battery.
While the main emphasis is on battery technology, Iondrive also maintains a portfolio of exploration projects in South Korea, focusing on lithium. Backed by a first-class technical team, Iondrive is dedicated to advancing sustainable battery technologies and contributing to the circular economy in both Europe and Australia.