‘Toward sustainable batteries based on silicon, sulfur and bio-mass derived carbon’

Sustainable batteries for a greener future

Dear readers,

We’re happy to announce the release of our third newsletter, packed with exciting updates on the latest advancements in the exploitation and go-to-market phase of our project. But that’s just the beginning!

In this edition, we’ll delve into the highlights of two recent events where 2BoSS was present: MATSUS & IRTC. What unfolded at these gatherings? What valuable insights did we glean? You’re about to find out!

Furthermore, we’re delighted to share with you an insightful article authored by some of our project partners, focusing on sulfur batteries. This article promise to offer valuable perspectives and cutting-edge research in the field.

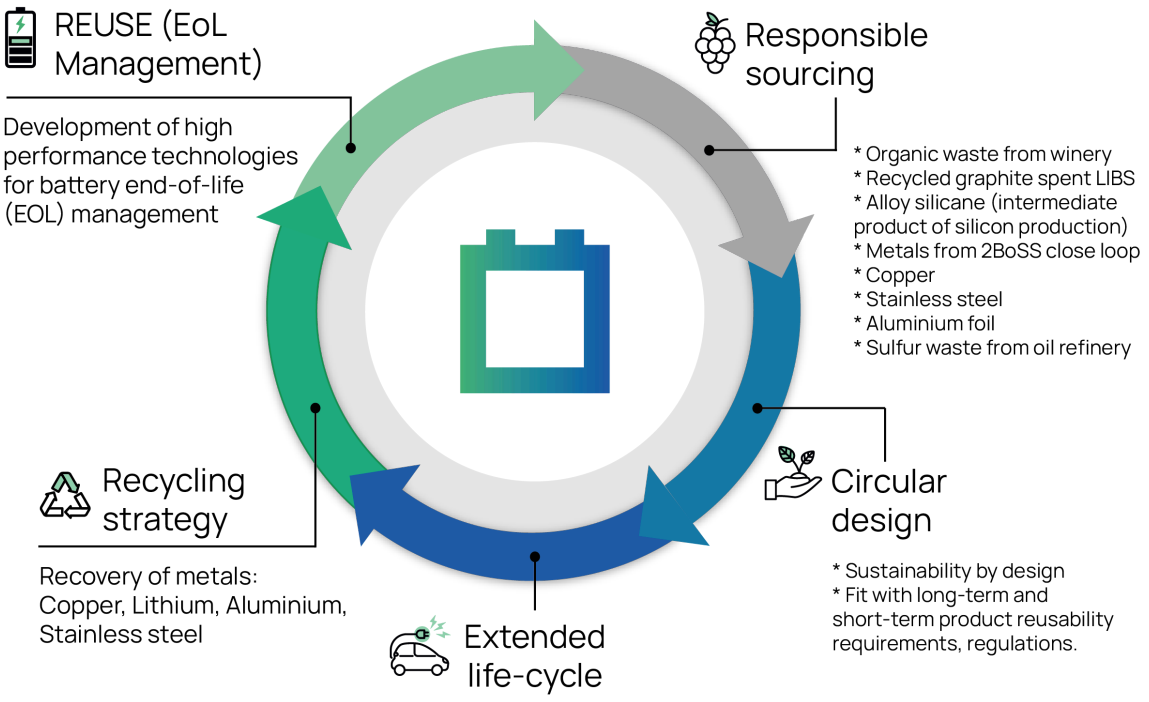
Above all, we’re proud to announce that 2BoSS is forging ahead into the next phase. With unwavering determination, we’re heading to deliver a ground-breaking, sustainable, and competitive battery solution to both the battery industry and the rapidly evolving e-mobility market.

2BoSS is taking next steps

We're actively testing our prototype, making the last needed laboratory tests, and pushing forward to develop and build the 2BoSS battery prototype. At the same time, we are heading to market and collaborating closely with our existing customers. We are also extending an invitation to new co-innovation partners from the market to collaborate with us in developing a sustainable, efficient, and advanced battery solution. Whether you're an EV manufacturer, an industrial user looking for innovative e-mobility solutions for heavier mobile vehicles or robotics applications, a player in the light e-mobility market, or involved in the energy storage sector, now it's the perfect time to join our co-innovation project as it transitions towards the commercial phase.

Why is the development of new battery solutions crucial in the EU and globally? - The answer lies in our urgent need to safeguard the environment and combat climate change. Transitioning to electric solutions, especially in transportation, is paramount. However, this shift is hindered by the scarcity of critical raw materials (CRM). To address this challenge, we must find new sustainable and abundant materials. Moreover, we must adopt a circular approach to battery production and usage. This involves repurposing existing batteries and integrating waste from other processes into our battery manufacturing cycle. By prioritizing circular design principles from the beginning, we can ensure that our batteries are not only recyclable but also contribute to a closed-loop system. Simultaneously, safety remains a top priority. Batteries must meet safety standards while also delivering optimal energy capacity and density.

Additionally, both within the EU and on a global scale, the battery regulation requires the adoption of the principles above mentioned. The EU battery regulation, alongside the requirement for a digital product passport for batteries - an initiative known as Battery Pass - is currently being implemented. This regulation emphasizes the necessity for batteries to meet strict social and environmental sustainability criteria, a requirement that must be tracked and included in the digital product passport. Furthermore, the state of health in batteries must also be recorded within this passport. As 2BoSS we are heading to this and offering sustainable and efficient battery with digital product passport. We co-operate closely with the Battery Pass consortium in order to bring to market safe, sustainable, and efficient battery solution and with this new digital product passport among the first commercial players.



Source: 2BoSS project

WP6 advancements - Exploitation

To advance towards the commercial phase outlined above, we've achieved significant milestones within our project, particularly in WP6 Communication, Dissemination and Exploitation. Our Communication & Dissemination plan, finalized in October 2023, was a key enabler in orchestrating our Living Lab process and stakeholder mapping efforts. Recently, we've completed the deliverable detailing our Exploitation strategy and plan. This comprehensive document outlines our objectives, stakeholder engagement outcomes form the Living Lab process, and the roadmap for market uptake and full-scale manufacturing. In order to gather all this important information, we have conducted our Living Lab process and workshops, an industrial user survey, and gathered insights from IRTC and MATSUS conferences. Additionally, we engaged in in-depth discussions with global market leaders in the industry, fostering co-innovation and strengthening our concept. These actions, coupled with our C&D plan, exploitation strategy and business model created, have forged strong relationships with our customers, suppliers, and stakeholders, propelling our innovation forward and bringing added value to society, key industries, our customers, and all relevant stakeholders.

The primary objectives of this initial deliverable version were to develop the exploitation strategy and define the IPR protection plan. Key aspects covered include identifying exploitable project results/assets, assessing market strengths and weaknesses, defining potential customers, crafting value propositions, business models, and exploring collaboration opportunities.

Moreover, key achievements over the past two years include the elicitation phase results, the establishment of a knowledge community ecosystem, and the prioritization of use cases. We've identified potential manufacturers and initiated testing dialogues. Insights from industrial knowledge surveys have informed our roadmap to market and post-funding strategies.

Interested in partnering with 2BoSS?

We welcome new customers, users, and business partners to join us in building the innovative battery solution of tomorrow. **Contact the Cleopa team**, who is responsible for the business modelling and go-to-market phase. Join our ongoing Living Lab actions and let's explore how we can innovate together for a sustainable future.

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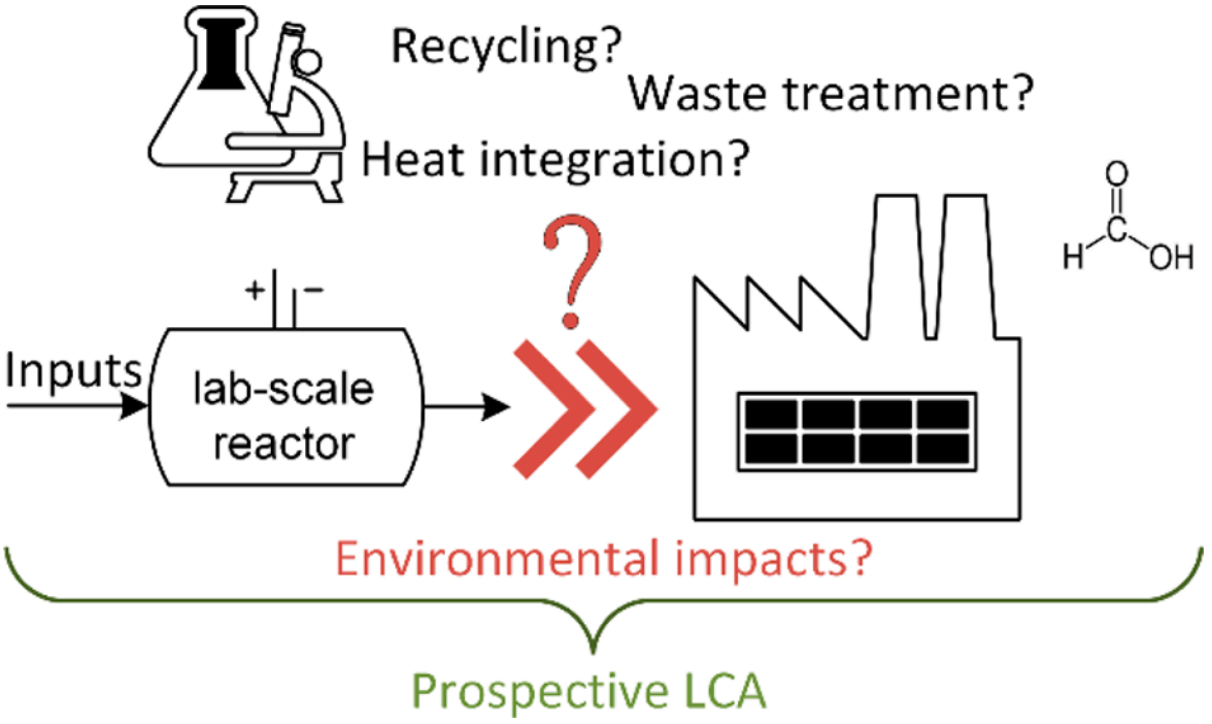
WP5 advancements - Life Cycle Assessment

The Life Cycle Assessment (LCA) is a methodology that compiles and evaluates the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle, from the extraction of the raw materials to the final disposal or recycling. Assessing the environmental impacts over the complete life cycle of a new developing technology is important to help guiding its sustainable and circular design. This is the reason why a LCA study is being carried out as part of the project 2BoSS, following the standardized methodology (ISO 14040-44) and incorporating the latest guidelines and scientific literature.
The 2BoSS battery is an emerging technology that is being currently developed at laboratory scale, so the novel approach of Prospective LCA (pLCA) will be used to estimate the environmental impacts of a possible future industrial production of this battery. pLCA assesses future technological systems and their environmental implications, scaling up emerging technology using likely scenarios of future performance at full operational scale. To reach this objective, the analysis has been split into two main parts:

- Collection of data from laboratory activities to build the bill of materials and modelling the production at laboratory scale.
- Scaling up inventories to industrial scale and conducting life cycle impact assessment.

The first step is being currently performed, with the focus on data collection from laboratories and on developing future scenarios to build inventory datasets suitable to represent industrial scale production, tackling the challenges of pLCA due to the lack of primary data and the need to adapt existent datasets to the future scenarios considered. A preliminary impact assessment based on laboratory scale inventories has been carried out, but since laboratory conditions are little representative of full industrial operations, it will be necessary to continue the analysis towards a life cycle impact assessment at industrial scale to obtain meaningful results. In the

meantime, we keep following closely the progress of 2BoSS laboratories to update the inventories at laboratory scale.



Source: Thonemann N, Schulte A. From Laboratory to Industrial Scale: A Prospective LCA for Electrochemical Reduction of CO2 to Formic Acid. Environ Sci Technol. 2019 Nov 5;53(21):12320-12329. doi: 10.1021/acs.est.9b02944. Epub 2019 Oct 25. PMID: 31603653

2BoSS at MATSUS & IRTC: recap & highlights

The Materials for Sustainable Development Conference (MATSUS24), March 4-8, 2024 | Barcelona, Spain 🇪🇸

2BoSS project members played a crucial role in organizing a symposium featuring four engaging panels. The event was a success, drawing considerable interest in the synthesis of new materials derived from the recycling of spent batteries and innovative ways to optimize sulfur cathodes and silicon anodes while minimizing the use of Critical Raw Materials. Discussions were fruitful, paving the way for potential partnerships and collaborations in the future.

Here are some key takeaways from the symposium:

- Participants had the opportunity to learn from their peers and gain insights from various EU-funded projects.
- There was a comprehensive analysis of the state-of-the-art in sulfur batteries, focusing on identifying batteries and challenges.
- The symposium delved into the latest advancements in recycling strategies and end-of-life management.
- Attendees explored innovative approaches in hydrogen production, in situ operando techniques, synthesis of recycled materials, and quantum physics.

Notably, the event served as a catalyst for initiating new partnerships and collaborations, with well-known organizations such as Montréal University, BASF Batteries, University of Limerick, and the National Institute of Chemistry Ljubljana expressing interest in future collaboration opportunities. Additionally, discussions at the symposium sparked new project and business ideas, particularly in the realm of batteries derived from recycled materials.

In summary, participation of the 2BoSS project at the MATSUS symposium proved to be significant and invaluable. Beyond establishing connections, the event served as an effective platform for disseminating our research findings and fostering networking opportunities. Such engagements are vital in advancing our project goals and fostering innovation within the industry.

Source: 2BoSS consortium

IRTC24 - Raw Materials in a changing world, February 21-23, 2024 | Torino, Italy 🇮🇹

We had the pleasure of participating in the IRTC Conference in Turin from February 21 to 23, 2024, representing the 2BoSS project. Our engagement at the event was multifaceted, with presentations, discussions, and networking opportunities aimed at achieving various objectives.

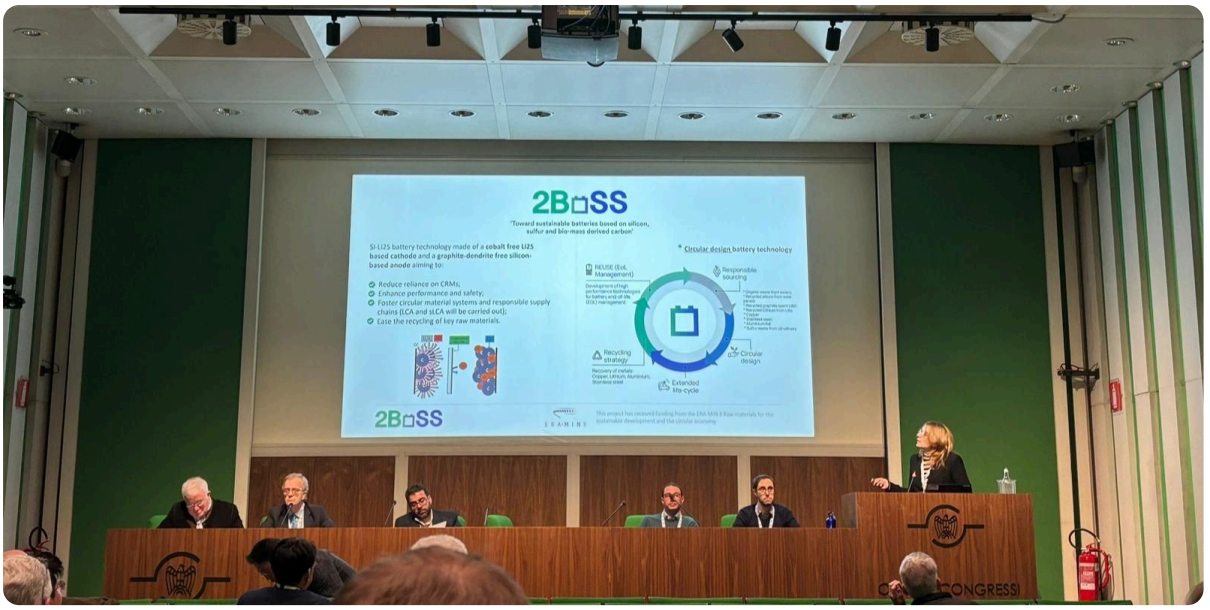
Our primary goal included presenting a paper in the session on “Emerging technologies and markets” and showcasing a poster during the speed poster session. Throughout the conference, we engaged in meetings with stakeholders from the policy sector and other peer researchers, allowing us to gain valuable insights into material flow analysis methodologies and stay updated on criticality assessments.

Our participation provided numerous takeaways including:

- Enhance knowledge of material flow analysis.
- Discussions on the elicitation phase results.
- Potential collaborations with various stakeholders.
- Explore LCA analysis tools and strategic partnerships in the raw material sector.
- Delving into debate about the future of the next generation batteries, market penetration rates of battery innovation technologies and tools to support decision making about in-house chemistry selection for OEMs.

The new partnerships and collaborations made during the event were associated to potential publications, research projects, and discussions around LCA analysis. The feedback received was overwhelmingly interesting, with lively discussions on the results of our survey to end-users and industry experts leading to new conclusions for our dissemination paper.

Overall, our participation in the IRTC Conference was highly enriching as we had the opportunity to disseminate the results of our project and foster discussions around them with an expanding knowledge community.



Source: 2BoSS consortium

Interested in our research? - Check out our recently published article!

Nanostructured Li_2S Cathodes for Silicon-Sulfur Batteries

The article **Nanostructured Li_2S Cathodes for Silicon–Sulfur batteries** discusses the potential of lithium-sulfur (Li-S) batteries to address the need for high-density storage, despite current limitations with sulfur cathodes and lithium metal anodes. The study introduces a novel approach utilizing lithium sulfide (Li2S) cathodes grown on a catalytic host composed of CoFeP nanoparticles supported on tubular carbon nitride. The incorporation of nanosized Li2S into the host material is achieved through a scalable liquid infiltration – evaporation method. Theoretical calculations and experimental results demonstrate that this composite enhances polysulfide adsorption/conversion reaction kinetics and reduces the initial over-potential activation barrier. The Li2S CoFeP-CN electrodes exhibit promising characteristics, including low activation barriers, high initial capacity, and excellent cyclability. Additionally, silicon/lithium sulfide (Si/Li2S) full cells utilizing the nano-structured Li2S-CoFeP-CN cathode and pre-lithiated silicon-based anode display high initial discharge capacities and good long-term cyclability.

Read the full article here

The **2BoSS project** aims at developing a battery technology based on silicon, sulfur, and biomass-derived carbon, supported on a cobalt-free Li2S based cathode and a graphite and lithium-dendrite-free silicon-based anode. It's being designed for a circular economy, minimizing the use of Critical Raw Materials

(CRMs) while optimizing performance and incorporating effective recycling strategies, overall aiming to reduce negative environmental, health, and safety impacts.

For more information about the 2BoSS project, please visit our website

The 2BoSS website

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This newsletter is sent to you as a subscriber to the 2BoSS mailing list. It is intended for informative purposes only. We send it twice a year to keep you informed about upcoming events and developments related to the 2BoSS project that may be of interest to you. 2BoSS has received funding from the European Research & Innovation Program on raw materials to foster circular economy under ID:235

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