



Sustainable processing of Europe's low-grade sulphidic and lateritic Nickel / Cobalt ores and tailings into battery-grade metals

Policy Briefing

Background:

Nickel (Ni) and cobalt (Co) remain indispensable for Europe's transition to climate neutrality. These critical materials are needed for the production of advanced lithium-ion batteries that support electric mobility and renewable energy storage. Their relevance is underlined in the Critical Raw Materials Act (CRMA) and the Net-Zero Industry Act (NZIA). Today, global supply chains for battery-grade Ni and Co are heavily concentrated in Indonesia and China.

The project:

The ENICON project conducted a Life Cycle Assessment study, which compared the environmental performance of current global state-of-the-art processes - dominated by high-pressure acid leaching (HPAL) in Indonesia and refining in China—with technologies developed by the project partners.

Findings:

➤ The conventional pathway (HPAL → mixed hydroxide precipitate (MHP) production → refining in China) carries substantial environmental burdens. HPAL alone is responsible for about 30% of the total greenhouse gas (GHG) emissions, while the overall footprint is dominated by upstream activities. Land-use impacts, driven by mining expansion in tropical areas as for example Indonesia, further highlight the unsustainable nature of today's supply chains.

In contrast, ENICON's new hydrochloric acid (HCl) -based hydrometallurgical route, delivers marked reductions across several key impact categories. When applied to battery grade nickel sulphate production from ferronickel, the process achieves a 37% improvement in terms of Global Warming Potential (GWP) against alternative routes (HPAL).

➤ The alkali-activation technologies for ferronickel slag, developed and applied in ENICON, unlock the production of competitive construction materials, achieving high compressive strength and offering a valorisation route to metallurgical residues while reducing dependence on conventional cement.

Conclusion:

Europe has the technological capacity to establish strategic, low-carbon and circular battery-metal supply chains within its borders. Scaling these processes would enhance European strategic autonomy, reduce exposure to environmentally damaging global supply chains, and provide the market foundation for low-carbon Ni and Co aligned with the European Green Deal and the requirements of the European Battery Regulation.

RECOMMENDATION

ENICON's results underline the importance of investing in regional hydrometallurgical hubs and industrial-scale residue valorisation. As global demand for battery grade Ni and Co accelerates, proactive deployment of these technologies will determine whether Europe emerges as a leader in sustainable battery metal production or remains structurally dependent on carbon-intensive imports. Finally, ENICON integrates social license to operate (SLO) aspects into responsible mining and metal production activities.



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