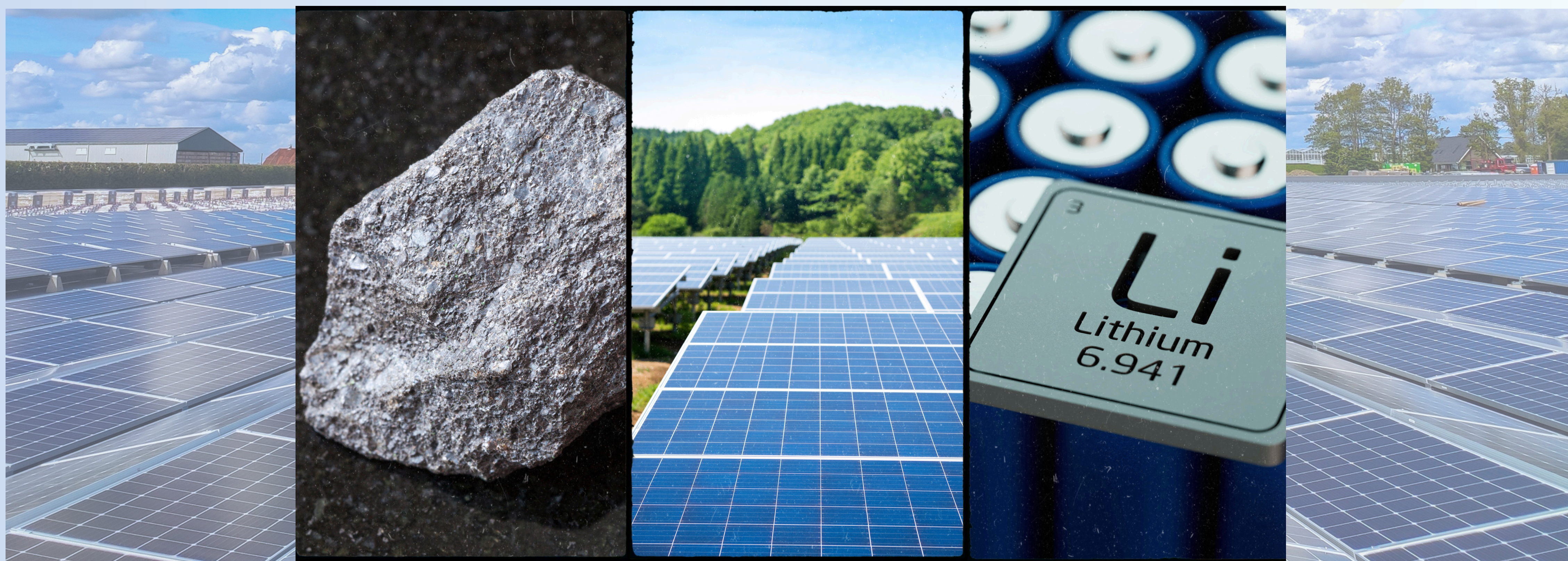


The objective of RESiLEX is to improve the resilience and sustainability of the entire Silicon value chain and reduce EU dependence on critical raw materials for solar panel and battery production. Silicon is considered a critical raw material for the EU due to its high supply risk and economic importance, mainly because of heavy reliance on imports

Securing Critical Raw Materials for the PV and battery industry

Takeaways and recommendations for policy makers from the Resilex workshops series



On the 30th of April 2025, the Resilex project organized a panel discussion in Brussels to discuss a series of topics relevant to the future of Europe. Key stakeholders were invited to engage in an active discussion on the sustainable exploitation and supply of Critical Raw Materials (CRMs) for the PV and battery industries.

Setting the stage, what is at stake with CRMs?

Roman Stiftner from the **European Raw Materials platform – EUMICON**, set the foundation for the discussion by touching very critical points.

It was emphasised that Europe's green transition hinges on critical raw materials like lithium and rare earths—nearly all of which are imported, often from single, politically sensitive sources, and that global demand will increase significantly (e.g., x12 for Lithium, x6 for Rare Earths). Despite the geological availability of raw materials, processing capacity in Europe is scarce and the outsourcing of mining, refining, and recycling has created a strategic vulnerability, leaving the EU dependent on countries with lower environmental and labor standards.



Roman Stiftner during the introduction

The Critical Raw Materials Act (CRMA) is a step forward, setting 2030 targets and identifying strategic projects—but lacks the capital and speed needed to compete globally. One goal is for 10% of raw materials to come from European mining, but this faces practical difficulties, particularly due to bottlenecks in permitting that can take up to 10 years.

Europe must adopt a three-pronged strategy: responsibly mine locally, build trusted international supply partnerships, and treat recycling as a core industrial asset.

Then the following points were also listed:

- Balancing security and sustainability is crucial.
- The European mining industry is committed to sustainability and strict environmental rules.
- Energy is a crucial issue, as metal industries are energy-intensive and costs in Europe are high. Therefore, very urgent measures to provide cheap energy are largely needed by the industry.
- Policy must now translate into action, with faster permitting, real investment, and alignment across industry, government, and research to secure Europe's clean-tech future.

Panel 1: Building resilient CRM supply chains for the PV and battery industries

This panel, moderated by Claire Morin from **SolarPower Europe**, included speakers such as Pia Alina Lange (**Trina Solar**), Roman Stiftner (**EUMICON**), and Kinga Timaru-Kast (**Recharge**). Topics covered included the diversification and securing of CRM supplies, geopolitical risk management, and policy measures.

Challenges in supply chains were discussed. For raw materials production taking place in Europe, the main urgencies are energy prices, regulation (permits), financing, and trade barriers. Kinga Timaru-Kast commented that for batteries, there are challenges related to the geographical concentration of extraction (Africa, South America, Australia) and processing (China).



The speakers of Panel 1

The facilitation of permits is viewed positively but requires concrete implementation. Diversification of supplies, both primary and secondary, is considered fundamental.

In the solar sector, Pia Alina Lange underlined that the focus is on “strategic” materials (not necessarily scarce), and costs are a key factor when considering primary or secondary sources given the lower costs for non-scarce materials.

Corporate sustainability for PV is reinforced by consumer expectations and regulatory aspects; carbon footprint is a good indicator. On circularity, European companies face competitiveness issues, especially with China, which has high recycled content due to available waste volumes. Trina Solar has developed fully recycled PV modules, although obtaining recycled content is not easy given the long lifetime of solar modules.

Roman Stieftner added that the issue of materials “dispersion” outside of Europe emerged strongly. A lot of scrap leaves the EU. Keeping materials in Europe is considered fundamental for independence and resilience. The idea of banning exports of scrap materials was suggested as a measure to tackle this aspect.

To prevent material leakage, a quality definition for end-of-life waste is also considered important. Competing with China on costs is extremely difficult, but Europe can compete on innovation and sustainability criteria. To unlock needed investments, local content requirements (like “Made in EU”) are important to ensure investment in Europe.

Following a question about the actual permitting facilitation granted by the CRM act, EUMICON commented that a lot of projects are moving on and an overall evaluation is not yet possible, however, in some occasions, there are conflicts arising between EU, National and Regional legislation that intervene.

Panel 2: Scaling up circularity solutions for the PV and batteries industry



The speakers of Panel 2

Moderated by Giulio Poggiaroni from the **ETA Florence**, this panel explored advancements in recycling and recovery techniques, reducing reliance on extraction, and policies supporting circularity. Speakers included Hamid Oubaha (**University of Liege**), Rana Pant (**European Commission**), Pierre Fiasse (**Groupe Comet**), and Manfred Spiesberger (**Centre for Social Innovation-ZSI**).

The discussion opened with Rana Pant referencing to the CRM Act and especially the Batteries Regulation, which covers the entire lifecycle, including end-of-life and recycled content. The related draft Delegated Act concerning recycled content is under scrutiny, seeking a balance between ambitious targets and methodology.

For end-of-life PV panels (EoL PV), a large quantity of material is expected in the coming years. The main challenge is not so much the quantity of material to manage (as this will improve the profitability), but the purification of recovered materials. Purification is key for Recycling and recycling contributes to EU independence. Shredding technology is widely used and capable of handling large quantities, with profitability within reach.

Other technologies like delamination, for example, that of the PHOTORAMA project which uses water jets and chemical treatments, are not yet as mature as shredding. Still, these are certainly very promising, as they allow for recovery of high-quality and high purity secondary raw materials (e.g. Si, Ag) which was recognised by the EUSEW Innovation Award 2024, commented Manfred Spiesberger. Back on purification, Pierre Fiasse noted that glass in Chinese PV panels contains antimony which requires a special treatment. A list of materials to be in ecodesign could help in recycling.

For batteries, collection and cross-border shipments inside the EU represent a challenge, with administrative burdens, thus making more difficult to reach targets on recycled content. On this matter, it is important to prevent EV batteries from leaving the EU to be able to recover the materials within them.

Hamid Oubaha commented that valorizing end-of-life (EoL) products, such as photovoltaic (PV) panels and lithium-ion batteries (LIBs), is fundamental for establishing a domestic supply chain for strategic and critical raw materials. Integrating these recovered materials into new devices offers a promising and sustainable pathway for upcycling and reducing reliance on imported materials. He explained that the RESiLEX Project, is focusing on the recovery and recycling of silicon as strategic material for the photovoltaic (PV) sector. In other hand, silicon is viewed as a valuable resource to substitute graphite anode materials in lithium-ion batteries (LIBs). Hamid OUBAHA provides details on how RESiLEX Project is integrating recycled Silicon from EoL PV Panels into a LIBs as anode active materials.

Finally, He raised the question of the increasing interest in Lithium Iron Phosphate (LFP), to reduce dependence on critical raw materials (CRMs) like cobalt and nickel. This shift could significantly impact the strategies of the LIBs recycling industry.

Main takeaways and recommendations

- **Dependence and Strategic Vulnerability:** Europe faces significant strategic vulnerability due to its near-total dependence on critical raw material (CRM) imports, which are indispensable for the green transition and have rapidly growing global demand.
- **Internal Supply Obstacles:** The main challenges to increasing internal European production (extraction, refining, recycling) are high energy costs and excessively long and complex permitting procedures.

- **The Crucial Importance of Circularity:** Keeping materials and waste within Europe through recycling is considered fundamental for independence and resilience, overcoming challenges related to purification and administrative burdens for collection.
- **Need for Rapid Policy Implementation:** Despite legislative acts like the CRMA and Battery Regulation being positive steps, the biggest challenge is their effective and rapid practical implementation, concretely accelerating permits and ensuring real investment to translate goals into reality and compete globally.
- **End-of-Life Value and Alternative Materials:** Strategies such as the use of alternative materials (e.g., LFP in batteries to reduce critical CRMs) and innovative recycling of end-of-life materials (e.g., PV silicon for battery anodes, RESiLEX project) are considered crucial for reducing dependence on imported CRMs.



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