

## Resilient supply chains in the green transition

The green transition will increase demand for critical minerals, high capacity batteries, and semiconductors. An electric vehicle requires six times more critical minerals than a conventional car, while an onshore wind power plant requires nine times more critical minerals than a comparable gas-fired plant. Likewise, the lithium-ion battery market is expected to become five to ten times larger by 2030 on account of demand for electric vehicles and stationary storage. Meanwhile, semiconductors underpin virtually every technology, giving them industrial and national security significance. Dependence on a few countries (e.g. China) for these critical inputs and technologies has sparked interest in policies to increase supply chain resilience, for instance through greater domestic production. As the EU and US face similar challenges, in June 2021 they agreed to establish the EU-US Trade and Technology Council, which will also address cooperation on supply chains.

### Background: Supply chain challenges in the green transition

The supply chains for critical minerals and high capacity batteries are highly concentrated. China dominates critical mineral supply chains through its leading position in the refining and processing stage, meaning many raw materials are sent to China after they are mined. As such, Chile and Australia may have the world's largest lithium reserves at 44 % and 22 % of global supply respectively but, after extraction, lithium is sent to China where 50 to 60 % of global lithium processing takes place. Likewise, the Democratic Republic of Congo (DRC) produces 70 % of the world's cobalt, but much of it is then sent to China where 72 % of global cobalt processing takes place. China's dominance extends into lithium-ion battery production, where it has [77 % of global capacity](#). The current pipeline for lithium-ion battery cell plants also suggests that by 2030, China will have 148 plants, Europe will have 21, and North America will have 11. The green transition has also raised concerns over bottlenecks around semiconductors. The manufacturing of leading-edge chips has become more complex and costly, [resulting in consolidation](#) among leading-edge chip manufacturers. In 2020, only Taiwan (TSMC) and South Korea (Samsung) were manufacturing 5 nanometre (nm) chips. In the US, Intel's 7 nm chips have been delayed until 2022, underscoring the complexity of the manufacturing process. Europe produces no chips under 22 nm. While semiconductor production has previously been highly globalised with cross-border design and manufacturing, China's pursuit of a domestic, vertically-integrated semiconductor industry has raised [concerns](#) over future supply chain concentration.

### European Union promotes industry alliances and strategic investment

In recent years, the European Commission has forged industry alliances to strengthen strategic supply chains. In 2017, the Commission launched the [European Battery Alliance \(EBA\)](#) to mobilise public and private investment by bringing together industry, interested Member States, and the European Investment Bank. After consultations with the EBA, the Commission released the [strategic action plan on batteries](#) to build up the entire battery value chain. The Commission has since approved two 'important projects for the common European interest' on batteries, mobilising combined public and private investment funding of [€8.2](#) and [€11.9](#) billion each. Similarly, in 2020 the [European Raw Materials Alliance \(ERMA\)](#) was announced as part of the [action plan on critical raw materials](#), which aims to reduce dependency on third countries, diversify primary and secondary sources, and improve responsible sourcing, resource efficiency, and circularity. As part of the EU's vision to create a circular economy, the plan calls for increased research and development (R&D) into waste processing, advanced materials, and substitution using Horizon Europe, the European Regional Development Fund, and national research and investment (R&I) programmes. The circular economy vision also drives the upcoming [circular electronics initiative](#), which promotes durability, circular design, and reparability, as well as the [proposal for a new batteries regulation](#), which promotes circularity throughout the battery lifecycle. Furthermore, the EU uses its trade policy tools to protect access for strategic supply chains. Given the difficulties of producing critical raw materials in the EU, they have been the focus in the [negotiation of free trade agreements](#). Finally, recent EU initiatives have focused on semiconductors. In December 2020, 22 EU Member States signed a [declaration](#) to promote EU

semiconductor value chains and to create synergies among national R&I initiatives. In May 2021, the Commission announced preparations for an [alliance on processors and semiconductors](#). Moreover, at least 20 % of the €672.5 billion EU Recovery and Resilience Facility will be directed towards the digital transition, including semiconductors.

## European Parliament pushes for greater sustainability and transparency

The European Parliament has pushed for greater supply chain sustainability and transparency. On sustainability, the February 2021 [resolution on the circular economy action plan](#) called for the Commission to propose binding targets to reduce material consumption within planetary boundaries, provide harmonised circularity indicators to measure resource consumption, and expand the Ecodesign Directive with standards such as for recycled content, recyclability, and efficiency. On transparency, the July 2020 [resolution on energy storage](#) expressed concern over dependence on raw materials for battery production from sources causing environmental degradation, violating labour standards, and exacerbating local conflicts. For instance, the EU's dependence on the DRC for [68 % of its cobalt](#) for battery production is cause for concern given that [20 % of cobalt](#) in the DRC comes from artisanal mines with documented child labour and human rights issues. In March 2021, Parliament adopted a [legislative initiative report](#) calling on the Commission to propose a directive on corporate due diligence and accountability, with the aim of improving environmental, human rights, and governance issues. The Commission plans to release a legislative proposal later this year.

## United States explores policy options and promotes domestic investment

With [Executive Order 14017](#), President Joe Biden commissioned an investigation into supply chains for critical products, including semiconductors, high capacity batteries, and critical minerals. The resulting [100-Day Supply Chain Review](#) includes recommendations for strengthening resilience, such as analysing how the Defence Production Act, which was essential for producing supplies to combat Covid-19, could be used to strengthen supply chains. Additionally, the Department of Energy (DOE), working with the Departments of State, Commerce, and Defence, has released a [national strategy to develop domestic battery supply chains](#). It provides objectives for the next nine years, including discovering and developing alternatives to various critical minerals, building up material processing capacity, investing in R&D, STEM (science, technology, engineering, and mathematics) education, and workforce training, as well as identifying where the US can extract minerals responsibly. The DOE is also running a variety of domestic investment programmes. The [DOE Loan Programs Office](#) offers US\$20 billion in investment for projects to enhance supply chain security for critical minerals and batteries. To promote domestic manufacturing, the DOE [announced](#) in June 2021 that it would require innovations developed through DOE science and energy programmes to be substantially manufactured in the US.

## US Congress controls critical tax incentives and funding

Because interest in supply chain resilience is fairly recent, many of the proposed bills directly addressing it establish new offices, databases or commissions to gather information. For example, the proposed [National Manufacturing Guard Act of 2021](#) would create the Office of Supply Chain Readiness within the Department of Commerce and create a supply chain data exchange on critical resource availability. Congress also plays an important role for supply chain resilience through taxes. Growing interest in supporting the battery industry has been manifested in bills to create an investment tax credit for energy storage, as in the proposed, bipartisan [Energy Storage and Tax Incentive and Deployment Act](#). Congress also has exclusive competence over appropriations laws that fund federal agencies. The 100-Day Supply Chain Review highlights the need to fully fund the research provisions in the Energy Act of 2020, which authorised the DOE to expand critical material R&D efforts to include demonstration and commercialisation. Supply chain policies have also gained momentum when cast in terms of competition with China. In June 2021, the Senate passed the [United States Innovation and Competition Act](#) (USICA), a US\$250 billion proposal aimed at countering China's influence, with US\$52 billion directed toward domestic semiconductor research, design, and manufacturing. Next, the bill must pass the House. Finally, the 100-Day Supply Chain Review argues in favour of investing in infrastructure, because it would increase US demand for semiconductors through key semiconductor-using industries such as power generation, clean energy, broadband, and electric vehicles.

